THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, ETC.

VOL. CXII.

OCTOBER TO DECEMBER 1910.

LONDON:

WALTER KING,

11 BOLT COURT, FLEET STREET, E.C.

1910.

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Register of Patents, Correspondence, and Parliamentary and Legal Intelligence.

REGISTER OF PATENTS.

[*The names printed in italics are those of persons by whom patents have been communicated.*]

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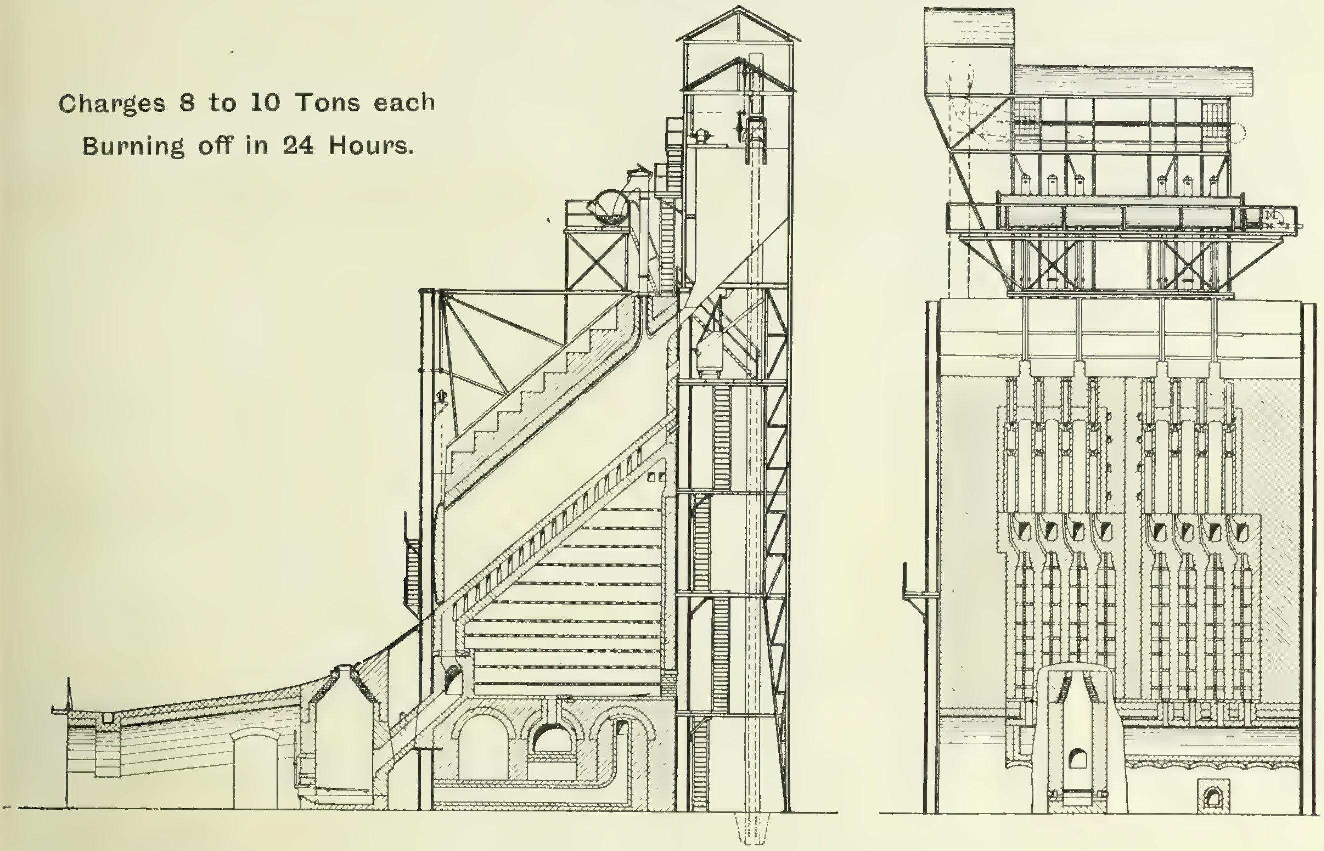

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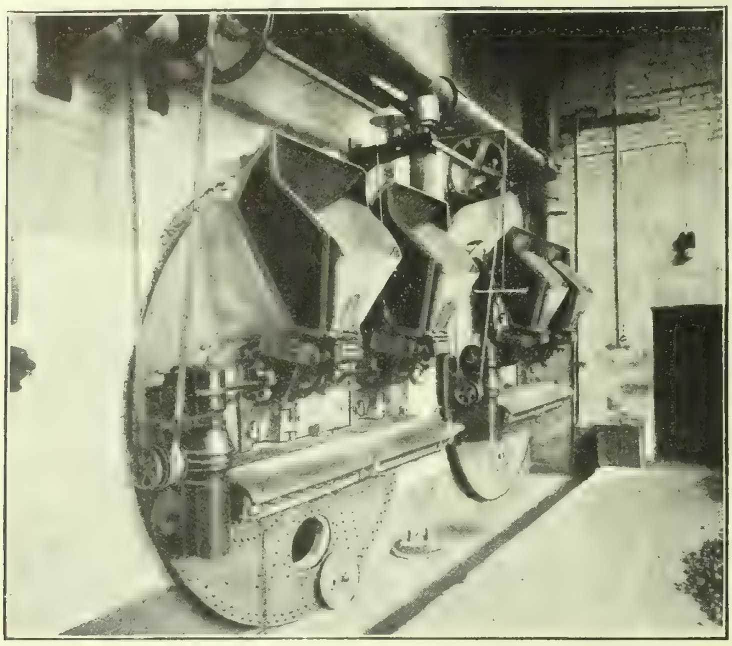

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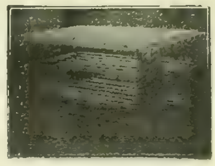
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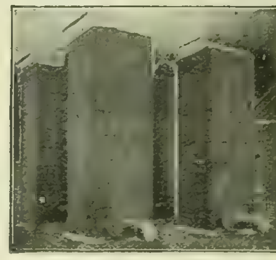
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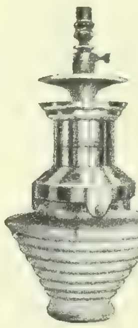

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2473.——TUESDAY, OCTOBER 4, 1910.

EDITORIAL NOTES—GAS, &c.

Legislation and Economy.

A FACT that obtrudes itself prominently in the thoughts of those who, during the greater part of their active existence, are engaged in and upon the affairs of the gas industry is that practically all the operations of the industry have undergone within memory a vast change; and there is satisfaction that the industry has shown vitality and innate ability sufficient to keep pace with the demands made upon it. And this despite the fact that its feet are still clogged by unnecessary restriction, though there has been some relief. Great as has been the development of the industry in usefulness in the service of the community, and in fostering the economies of our daily life, the expansion in both directions would be more active if the industry had still more freedom. The industry has now to obey the laws of competition and supply and demand, says Mr. J. H. Canning, in the thoughtful and inspiring address that he delivered to the members of the Welsh District Institution last Wednesday. That is true; and the laws of competition and of supply and demand are, within limits, a sufficient protection of the interests of communities in relation to gas. But we have to look at this matter from the point of view not only of the idealist who claims complete liberty for the gas industry, but from that also of the actualist who deals—confessedly sometimes in too rigid a manner—with the real and practical. The gas industry is one that cannot brook the most open competition if it would carry out its functions in the most economical manner. It is not as other commercial undertakings that can carry on their operations without special accommodation. Therefore, it needs a certain amount of protection and the concession of certain privileges; and for this there must be an amount of countervailing obligation, which can only be realized through the imposition of conditions. If the gas industry had perfect freedom, no undertaking could claim the right of individual protection and privileges. And that full freedom would, in the nature of things, have to be accompanied by an exposure to free competition in gas supply, which would produce the old conditions of public inconvenience, uneconomy, and waste, and even insolvency on the part of those concerns that, being in some way the weaker, had to go to the wall. Such conditions would not be to the benefit of industrial or public economy.

We do not understand Mr. Canning to claim the complete stripping of the industry of restriction and obligation, and the conferment of the fullest freedom; but his words give the opportunity for pointing out that, under the conditions of gas supply (or electricity supply for the matter of that) liberty undefined would not be, in the general interests, politic or desirable. But there is a difference between a sufficient obligation and the inflexible or onerous restriction that imperils economical service under the prevailing circumstances. And it is against the latter that there has to be war; for anything that imperils economical service is superfluous, and a hindrance to progress, and the sharper its removal the better. Of the restrictions still in force, "there are many," says Mr. Canning, "whose careful revision would be most decidedly to the public advantage; and united action on the part of gas undertakings to procure such a revision of the General Acts applying to an industry would at the same time both enable competition to be better encountered, and benefit the consumer." Agreed. But this brings us to an important point. It has long been felt that nothing but united and persistent action on the part of gas undertakings will bring about the revision of the General Gas Acts that is so desirable, and the revision that has been so long overdue. The question at once faces us, Where is the body fitted and qualified to bring about this united action? And there we have a subject on which the President of the Welsh Institution might have had something to say that, judging from the remainder of the address, would have been very much to the point, and would have supplemented the lines of thought in the address delivered by Mr. J. W. Helps as President of the Institution of Gas Engineers. The General Gas Acts are much out of sympathy with the circumstances of the times. They want to be consolidated, after undergoing a thorough treatment, involving extermination of decree contemporaneously inconsonant, emendation, and supplement. The fighting in Parliament during the last ten years, started and led from gain to gain by Sir George Livesey—the greatest of the gas industry's legislators—has left the impression upon Parliament that some of the general laws applying to the gas industry are not in harmony with current requirement. For example, such an acute observer of events (and assessor of their import) as Sir Henry Kimber, who presided over the House of Commons Committee on the Standard Burner Bills this session, was convinced that the proceedings on these Bills had brought us nearer still to the revision of gas legislation. The matter is ripe; the time is opportune. But there is the question, who is to assume the lead?

There must be some competent body to take the initial step; and such a body can only be one that is representative of all the various interests of the industry. The narrowness of the representation of the Institution of Gas Engineers puts that organization out of court for leading the way in any legislative reform. As constituted, it is a professional body pure and simple; and its pecuniary means and machinery generally are not equal to such a necessary piece of work in the interests of the gas industry. Nothing really effective could be done by it in this connection. If the gas industry, as such, had an organization (with influential representation and a respectable money backing) that could speak and act in the name of the whole industry, and not of its technical officers only, that organization could appoint a Committee—comprising technical, commercial, financial, and legal gas experts—to prepare a draft Bill with useless laws repealed, and new and suggested ones inserted, and so show the Board of Trade and parliamentary authorities what were the well-considered views of the gas industry on this matter. The making of industrial laws is not work for the legal element only. Here we are, however, a big and influential industry, with nobody in a position to take initial action in this legislative cause on behalf of the whole industry. Most things are left to individual effort; but here is something that is too large for any but a fully representative body to handle. It is all very well to go to the Board of Trade, and say "We should like the General Gas Acts revised, if you please;" it would be much better to go to the Board, and say the same thing, and illustrate there and then, in tangible manner, the way in which the industry would like to see the work performed, or, in other words, the character of the revision. Neither the Board nor the parliamentary authorities are above suggestion being put into practical form.

A few words in the address has induced us to run away from its lines. We were on the point of the removal of superfluous restriction; and Parliament has to be shown the *raison d'être* for the claim. The economy to the community and the convenience of the service provided by the gas industry are among the reasons that can be advanced. There was much being professorially said recently as to the waste of the domestic coal fire. Mr. Canning gives, in association with the subject, a good illustration of how the gas industry has promoted national economy, when he says that most articles of popular consumption—among others coal—has increased in price, but simultaneously, generally speaking, gas has decreased in price. Of course, the President does not intend the foolish interpretation of his words, that the dearer the raw material, the cheaper the supply of gas. His meaning is that the economies achieved by the gas industry have been such that while the normal level of coal prices has ascended, the normal level of gas prices, through these economies, has descended. That is an important point in favour of the claims of the industry; and

it can be accentuated by the economies and sanitary improvements that the extended use of gas produces in our daily and urban life. But besides the legislative aid to economy by the reduction of regulating stringency, much can still be done within the industry to promote and realize economical service, on the best possible lines. In this direction, Mr. Canning found subject-matter, more especially in relation to the commercial department, that formed not the least interesting portion of his address. He associates himself, too, with the current co-operative and educational efforts; and he closes his address with an optimism regarding the future that, being possessed by the industry's workers generally, carries them along in the excellent work of doing a part individually to make the industry, in some degree, and in some respect, greater day by day.

Thermal and Thermo-Dynamic Efficiency of Gas in Practice.

Review of the present position of things in any direction, together with deduction from what is found, is always a good educational exercise; but the deduction must ever be safeguarded by remembering that it is only made on the knowledge as it exists at the time. The things of yesterday are often not the things of to-day or of the morrow. Mr. Thomas Canning, in the paper he, at considerable labour, prepared for the meeting of the Welsh Association, on the subject forming the above title, brought into comparatively narrow compass some of the main matters comprised in that vast field of interesting research and practical application in which so many workers and investigators have dwelt. It is a very useful work that he has performed in this connection; and in the small amount of deduction that he makes from accumulated knowledge, he does not dogmatize. We rather think that Mr. Canning is one of those who believe that the gas-engine has about reached the end of its possibilities in respect of thermal efficiency. If so, he may be right; but we cannot help thinking that, in connection with the gas-engine, knowledge is in somewhat too chaotic a condition for any asseveration on the subject. As he points out, many people to-day do not know to what degree of efficiency the gas-engine has arrived. The development of the efficiency has been so rapid, and there are so many old type and consequently less efficient engines still in use, that the general character of the gas-engine suffers lamentably; and so the preservation of the ancient types acts both detrimentally to the machine and to gas, and in favour of the electric motor. Say, an old gas-engine, extravagant in its fuel consumption, breaks down through sheer old age. The electrical man hears of it, rushes in with an electric motor, and shows a saving on the effete old engine; and the wonderful performance and relative costs are blazoned forth in the electrical press and advertising literature as a fair sample of comparative merit. The user, too, circulates his views.

The fact, however, as previously remarked, is that the gas-engine has made distinct strides in efficiency during comparatively recent years. Mr. Canning quotes some figures from the report of the Institution of Civil Engineers Committee of 1906, in which the thermal efficiency of a 5-horse-power engine, running at full load, is given as 29 per cent., a 25-horse power engine as 35 per cent., and a 50-horse power engine as 31·8 per cent. There is a notable difference between the 25-horse power and the 50-horse power engines in respect of the figures; but good as that 25-horse power engine was—35 per cent.—in the thermal efficiency, Mr. Dugald Clerk in 1909 was talking, before the British Association, of further actual progress—to 36·8 per cent. This is gratifying; and though there must be limits to the thermal efficiencies of gas-engines, we are not going to admit that these limits have yet been reached. It may be that they have been on the old lines; and that to make further progress, there will have to be some vast change in the actual thermal cycle used. But if there was any general definite feeling among the highest experts and students that the boundary line had without doubt been already attained, we hardly think that the British Association Committee on Gaseous Explosions would be spending so much time over the internal combustion engine as they have been and are doing. They are surely hoping for some effective results to accrue from their labours. Judgment may well therefore be suspended.

Though Mr. Canning is impressed from his investigation that we are approaching the realization of the ideal efficiency in the case of gas-engines, he looks hopefully to a higher thermal efficiency being achieved in the case of gas-fires. He draws upon the last report of the Gas-Heating Research Committee of the Institution of Gas Engineers. In connection with that report, we were recently showing that certain makers have already exceeded the radiation efficiency disclosed by it, by reaching the figure of 50 per cent. He thinks that the essential elementary conditions in the case of a gas-fire are comparatively high pressures and a wide surface—not a deep bed—of "glow-fuel." It is for the gas supplier to give the one, and the makers of gas-fires the other. These are not at all difficult matters, though there must be limits to the pressures used in connection with gas-fires, if unpleasant roaring is to be avoided. Extremely high pressures can be the vogue in industrial heating work, and the efficiency can be increased in connection with certain operations, but that is quite a different matter from domestic heating. It is interesting to note the use by Mr. Canning of the term "glow-fuel," in contrast with the plain term "fuel," or the one suggested at the last meeting of the Institution of Gas Engineers—"radiants." Regarding both gas-engines and gas-fires, Mr. Canning gives some wise and homely advice that all engaged in the commercial work of gas undertakings would do well to thoroughly consider; and we think that, for the most part, all will be prepared, if not doing so already, to follow the counsel.

In the Distribution Department.

At the meetings of the Institution of Gas Engineers and of the District Gas Associations, the subjects introduced for consideration appear to have obtained, by custom, a sort of monopoly. Therefore, proper though the ambition be of gas engineers and managers to make progress in the more imposing technical and commercial aspects of the gas business, it is refreshing to break away for a time from their contemplation and discussion, and to be reminded that underlying them there are questions, involving managerial method, that are contributive to the making or the marring of economy. Mr. John Lewis, the Chief Distributing Engineer of the Newcastle and Gateshead Gas Company, so reminds us in the Presidential Address that he delivered to the North of England Gas Managers' Association last Saturday, by dealing with affairs that come within his own special province. And this also reminds us that, great and important as the distribution department of a gas undertaking (including the commercial work) has become, this is the first time a gentleman whose official position is purely that of Distributing Engineer has occupied the presidential chair of one of the industry's technical organizations; and the North of England Association are deserving of thanks for righting an apparent neglect caused by habit and by oversight of one change among the numerous modern changes in the conditions of gas supply.

Of late years, it has become a stereotyped remark, by chairmen at meetings of gas shareholders, that the distribution department has come much to the front, and that the department now represents year by year a greater proportion of the expenditure of gas undertakings than it did formerly. Without explanation beyond the fact, the statement seems to be censorious, and saddles the distribution department with a sort of stigma over its increasing prodigality; while the truth is that honour in the success of a gas undertaking is to-day (readers must not here be hypercritical in the matter of quantitative definition) about equally divided between the manufacturing and the distributing departments. However successful the manufacturing work of a gas undertaking may be, unless the distribution and commercial department is well organized, and managed with spirit, acumen, and circumspection, it may sadly negative all the financial economies that the manufacturing department may yield. And transposing the departments in the statement, the truth of the assertion still stands. It is upon the co-efficiency of the two departments that financial success relies more than ever to-day. And the technical knowledge required in, and the commercial responsibility of, the distribution department of a large undertaking are so extensive, that perforce the duties must be detached from the pure engineering and general management of the concern if they are to receive the due attention that is imperative for the best and for enduring success. To accentuate this, the eye need only glance at the remarkable comparative figures, appearing early in Mr. Lewis's address, referring to a decade's growth in the volume of business done by the

Newcastle Gas Company. Statistics are often impressive; and these certainly are.

With the distribution department taking such an important place in the success of a concern, it devolves upon those who are entrusted with the responsibilities of chief departmental officer to see that the organization is of the very best, and that materials and costs are under adequate and systematic control. This is the principal message, the outstanding piece of counsel, in the presidential address before us. In one direction in which the organization of the distribution department of the Newcastle Gas Company has been improved from previous condition, has been by the institution (through the instrumentality of the Secretary, Mr. Thomas Waddom) of a "job cost system." The result justifies the devised means. To this system the address is chiefly directed; and the President enters into it with zest and in full detail—in just such a manner, in fact, that the heads of the distribution departments of other gas undertakings can make step-by-step comparison in this regard of the Newcastle methods with their own. The address will be most useful and suggestive to those who are *au fait* with the detail of routine in the same connection; and, to some good purpose, they may consider and discuss it. The opportunity is given by the reproduction in our columns of the address *in extenso*, with illustrations of the cards and sheets used in the progress of the system from its initial stage to the end. Suggestion may be found that will inure to the improvement of the systems adopted by other undertakings; and, on the other hand, the distribution expert outside Newcastle may be able to suggest improvement in the methods that Mr. Lewis has submitted to critical judgment. There is one thing certain; it is that the objects of the system—expedition in the execution of work, prevention of waste, and the accurate allocation of expenditure—are all secured, or the system would not continue to form part and parcel of the administrative practices of the distribution department at Newcastle. But to adopt the words of the President, "this, like many other systems in business, "merely provides information; and it is by the intelligent "use of such that the benefits are to be derived."

In the concluding part of the address, Mr. Lewis treats of a number of miscellaneous subjects which we will only touch slightly here to indicate their nature, and to direct to them the attention they deserve as bearing upon the economies, immediate and prospective, of the work of the distribution department. There is condemnation of the policy of purchasers always trying to run down prices of materials and goods. This, with competitive price-cutting, can only result in well-known and positive evil effects. Cheapness ground down to its finest point does not indicate a sound policy in reference to the future, nor a due regard for encouragement or for that ethical principle (too often grossly abused) of "live and let live." In the cause of economy, Mr. Lewis revives an idea that has had expression before regarding the establishment of a central testing-place for new gas-consuming appliances, so that the contributors to the support of such a place might have the reports on the results of tests for their private information and guidance. The idea is good; but there are difficulties. Among other considerations, the examiners would have to be men of the highest rectitude and reliability, as the temptations would be many, and an error in manipulation or judgment might work an untold injury. Finally, there is in the address an amount of encouraging information as to the large trials in the area of the Company with mechanical street lighting and extinguishing devices. The result of the experience may be summed up in the President's own words: "In my "opinion, the feasibility of pressure lighting has been estab-"lished. But under certain conditions, it is not desirable "to operate apparatus over large areas where district "governing does not exist, or where the cost of its installa-"tion is prohibitive. In such cases, the difficult portions "of the area can be operated by the clockwork system." There Mr. Lewis shows his disinterestedness, by defining a field of usefulness for both the pressure and the clockwork lighting and extinguishing devices.

Rebates for Gas for Heating Purposes.

Most gas undertakings are now looking for business extension in the large field offered them by domestic heating. In the old lines of business, the annual rates of increase, in new connections and volumes of business per connection, are on the decline. This must be so the nearer the line of accrued business in any direction approaches the saturation level, and as building development in a district proceeds at a more modest pace. Under these conditions, new methods of "business-getting" have to be adopted; and in opening up a new line of business, it may be that terms that applied to pre-existing lines of business may not be the most suitable. The old proneness of the gas industry to be conservative, and to be faithful to the ancient ways, has been largely expelled; and the spirit of freedom in commercial transaction now almost generally pervades the industry. Where it does not, then all the worse for the undertakings concerned. Those are the undertakings with administrations out of gear with the times, and administrations who have not grasped the elementary truth that opportunism, legitimately practised, is not a trait to be despised in trading.

Now it has to be confessed that, for a large development of the heating business—the branch to which the eyes of the industry are turned for future lucrative expansion—the price of gas in many broad areas is too high for any extensive placing of gas-fires; and there is another consideration, that numerous householders require something more than the inducements of cleanliness, convenience, labour-saving, and so forth, to prevail upon them to give up that idol of domestic veneration, the coal fire. What people suffer, and what they put up with, in defence of the old occupant of their hearth, and in defiance of the dictates of the spirit of greater refinement that permeates current conditions of life, supply a testimonial to the tenacity of human nature to tradition and custom when it has set itself to be obstinate as against reform. There is, under the circumstances, a necessity for it to be weaned; and something seductive has to be offered. Human nature has, in trading, a fondness for rebates or, to use the more popular expression, discounts; and, as we were saying last week, the discount system for gas consumed for heating purposes has (without dual piping and meters) been used with beneficial effect in developing this line of business. Very kindly, Mr. R. W. Edwards, of Aldershot, has complied with a suggestion made by us that he should, for the benefit of the gas industry at large, relate the experiences of his Company in this development of their "business-getting" methods. New concrete experiences of this sort are what are wanted; and they are welcome. And we undertake to say that this article, in these days of a wide-awake commercialism, will be read near and far, and with more than ordinary interest.

The Aldershot experience with the discount system has been in the development in the outer district of the use of gas for cooking and heating. In these out-districts, the ordinary price of gas is higher than in the home district; and therefore it was more difficult there to create new business in cooking and heating. A modest all-round reduction applying to all classes of consumption would not have given any special fillip to the employment of gas as fuel; but a sixpenny rebate put a different complexion on the matter in the eyes of the householder. And quite a considerable number of householders have been found ready and willing on the offer of the rebate to pay a rent of 6d. a quarter per discount meter fixed (or as Mr. Edwards prefers to call them, "rebate indicators") and to bind themselves to pay their accounts, as a further condition entitling to rebate, by or before the last day of the month succeeding the quarter to which the accounts apply. This inducement to prompt payment is a secondary advantage to the primary one that induced the inauguration of the system, although the condition is not enforced in any arbitrary or unreasonable spirit. The consumers appreciate the new plan; and it is now an inherent part of the Company's commercial system, gaining what they required where the higher prices ruled—substantial increases of gas consumption, as is shown by Mr. Edwards in the examples of accounts that he cites.

The experience of the system at Aldershot can be summed up in few words: It is an effective system; and it pays. It helps to broaden the basis of the gas business; and a broadened basis, composed of a good diversity of business, is what is needed in resisting the attacks of competitors that were never so strong as they are to-day.

Improved Working Results in Dublin.

It must have been with considerable satisfaction that Alderman W. F. Cotton, the Chairman of the Alliance and Dublin Consumers' Gas Company, rose, at the half-yearly meeting of shareholders last Friday, to move the adoption of the report and

accounts for the six months ended the 30th of June, inasmuch as they furnished evidence of successful working under new conditions which it might have been expected would not have conduced to this result. The Company were in Parliament last year; and, in order to meet the views of the Municipality of Dublin, they consented to make a considerable reduction in the price of gas, which would cause a difference of nearly £25,000 a year in the revenue from this source. Yet the result of the half-year's working was a profit, with the addition of a small amount carried forward, of £40,903, which allowed of the payment of a dividend at the rate of 5 per cent. per annum, with £4369 to the good, whereas in the corresponding period of last year the reserve fund had to be drawn upon almost to this amount to pay the same dividend. How was it done? Alderman Cotton furnished the explanation in his address, which is reported elsewhere. First of all by improved working in the retort-house, where, according to the old axiom, dividends are made. Not only had the production of gas per ton of coal carbonized been greater, but the yield of residuals had increased; and while these brought in £19,367 in the half year ended June 30, 1909, in the past six months they realized £24,373. A large number of additional automatic installations were put in during the half year; but, as Alderman Cotton pointed out, there is room for an extended use of gas for other than lighting purposes in Dublin. Under the Company's new Act, the illuminating power of the gas is 14 candles; and the change gave rise to some complaints of "bad light." But, as usual, the fault, in most of the cases, lay with the burner; and therefore Alderman Cotton did well to condemn the continued use of wasteful flat-flame burners when the consumers can avail themselves of the more economical system of incandescent lighting, especially as, under the new conditions, facilities have been afforded for doing so. Twelve months ago, no one would have anticipated so favourable a result of the forthcoming year's working as that which the Directors have been able to present; and they and the officials well deserved the thanks accorded to them by the shareholders.

Exit the Hythe Coalite Plant.

Can it be true? Over the telephone the other day came the words: "You said in an article on 'The Coalite Position' this week, 'the Hythe plant, it is believed, has not been restarted yet.'" The words were remembered. Then came this startling statement: "Well, I have heard, on very good authority, that an old iron dealer has purchased the plant for £200. He estimates there are about 300 tons of old iron in it; but in view of the cost of getting it away, he could not afford to pay more for it." This plant from beginning to end must have cost a few thousand pounds; and is this really the termination of an existence that was trumpeted so loud and trumpeted so long as offering to gas-works generally an example worthy of their emulation? Those "Times" advertisement articles, florid and costly; those platform speeches, bold and flattering; those demonstrations, convincing to a few smoke-wearied ones—how they all shrink before the announcement that this young incorporation in a gas-works has, so soon in its career, passed into the hands of an old-iron dealer. If the answer to our opening question is in the affirmative, we hope the friends of Professor H. E. Armstrong will keep the sad tidings from him.

Wireless Electric Ignition and Extinguishing of Gas-Lamps.

Some time ago we heard of an inventor who in his own town was doing great things in the electric ignition and extinguishing of the gas-lamps. By a small electrical contrivance fitted on to the incandescent burners of the public lamps, and an electrical transmitting arrangement on his motor car, he could flit through the streets, and, by touching a button on the electrical contrivance on the car, light up the whole of the lamps. No wires and no connection of any kind, beyond those mysterious waves through space which enable Marconi to confer so much advantage on mankind. The inventor, it was said, could also stand at the end of a street and light up or extinguish the lamps in it one after the other. In his own house, when friends were assembled, he would go (the story ran) to the bottom of his garden, and astonish the visitors by lighting up the lamps in the rooms where they were sitting. The absence of all signs of human agency must have been weird. When we heard of this, we refrained from publishing the statements, in the hope that something more definite would come to hand; but there is a reminder of the story in a message, headed "Wireless Lighting," from the Copenhagen correspondent of the "Daily Telegraph." We reproduce the message without further comment: "The well-known Danish inventor, M. Valdemar Poulsen, who has for a long time made a special study of wireless lighting, carried out a successful experiment to-day [Friday]. While his assistant stood in one room holding two incandescent lamps, the inventor went to another room and placed his transmitting apparatus in position. On pressing the two contacts, the lamps were lighted and extinguished. There was no connection of any kind between the apparatus and the lamps."

Automatic Lighting and Extinguishing of Gas.

In another part of the "Journal," there appears a "Communicated Article" on this subject—the contribution mirroring the results of a studious examination, on the part of the writer, of the various automatic ignition and extinguishing devices for street-lamps now inviting favour. The article is critical in its character; and we can imagine that the advocates of both pressure and clockwork devices will have something to say on the criticisms as to the limitations of their respective systems, and possibly there will be a controverting of some points raised. An article of this kind does no harm; it offers a base for discussion. Certain of the points in it have, we know, been present in the minds of engineers who have contemplated the recommending for adoption of some means of dispensing with the cumbrous mode of hand labour in lighting and extinguishing street-lamps. They at all events would welcome discussion by the experts in this matter.

Inauguration of the Manchester University Lectures on Gas.

Mr. Franklin Thorp, the President of the Manchester and District Junior Gas Association, was quite justified in characterizing last Saturday as a "day of days" to be remembered by the gas profession, inasmuch as on it they witnessed the realization of ambitions long hoped for, and the beginning of a relationship of the members with the University which would be fraught with great advantage. His remarks were made at the inauguration of the series of lectures on the "Science of Gas Manufacture and Combustion," which, as mentioned in the "Journal" last week, have been arranged by the Manchester Junior and Senior Gas Associations in co-operation with the authorities of the University. The scheme, which is the outcome of a suggestion by Mr. Thorp in his Inaugural Address early in the year, has had the hearty support of Professor Harold B. Dixon, the head of the Department of Chemistry of the University; and he gave it a good send-off by delivering the first lecture, an abstract of which appears elsewhere. The movement also has the cordial approval of the Vice-Chancellor (Sir Alfred Hopkinson), who expressed his regret at being unable to be present on what he regarded as an "auspicious occasion." In his introductory remarks, Professor Dixon welcomed the beginning of what he hoped would be a lasting connection between the University and the gas industry of the Manchester district. At the same time, he took the opportunity of congratulating the gas profession and the University of Leeds on the founding of the Livesey Professorship of Fuel and Gas Engineering; and he said that in Manchester they desired in a more humble way to connect their department with the gas engineers of the district "for their mutual advantage." The interest shown in the lectures, which are free, was evidenced by the large attendance on Saturday; and we sincerely trust that there will be no falling-off, but rather an increase, in the numbers on the five succeeding occasions. These are opportunities for the acquisition of knowledge which should certainly not be missed.

The Gas Engineering and Fuel Lectures at Leeds University.—In another part of the "Journal" will be found the principal features of the prospectus of these lectures for the session 1910-11. The teaching staff consists of Dr. W. A. Bone, F.R.S., Livesey Professor of Applied Chemistry (Coal Gas and Fuel Industries), with Mr. Harold H. Gray, B.Sc., as Demonstrator, and Dr. H. G. Colman and Mr. Ernest Bury, M.Sc., as Special Lecturers. The courses have been arranged to meet the requirements of students who are preparing for responsible positions either as gas engineers or in the fuel and metallurgical industries; and their attention is specially directed to the particulars furnished elsewhere.

THE VISIT OF MEMBERS OF THE GERMAN GAS AND WATER ASSOCIATION.

THERE are people whom it is always a delight to welcome as visitors; there are others whom the less one sees of them, the better. Among those whom—professionally and in the true bonds of friendship—it is always a pleasure to see are the members of that influential technical and industrial organization of the great German Empire, the German Association of Gas and Water Engineers. Therefore it was a real happiness that the unfortunate national bereavement at home of a few months ago only meant the postponement of a reciprocation on British soil of the kindness and hospitality that were showered upon members of the Institution of Gas Engineers when they paid their memorable visit to Germany, and chiefly to Berlin, in 1908—the year of the Presidency of Mr. W. Doig Gibb. It seems hardly possible that two-and-a-quarter years have spent themselves since then; but inexorable Time will not permit us to lose sight of one of the main facts of life. The memories, however, of that brilliant time are verdant in the minds of those who were privileged to receive the honours of welcomed guests on that occasion.

Nearly six years have elapsed since the Earl's Court Exhibition; and it was in the course of that display of the position of gas progress that the last formal reception of our German friends was recorded. Then the gathering was of international character; France, Belgium, Holland, and other countries sending their professional gas representatives with fraternal greetings, and to learn what Great Britain had accomplished in the interests of the gas industry. Vast and important have been the changes of the intervening time, in all departments of the industry. But what was shown our visitors then were the advances in the means of most profitably using the gas sent from the gas-works into the distribution systems of the United Kingdom. The exhibits of the time have been largely left behind by the further developments of knowledge and by the activity of inventive genius. What is being shown the visitors on this occasion are the large embodiments of advance in representative works (the names of which are industrially world-famed) all tending to the realization of the ambitions of the gas technician—greater economy in the manufacture of the staple commodity of the industry. There is one point that should be here mentioned, as serving as a link between the Earl's Court Exhibition of 1904 and the present visit; and it is that, in 1904, Mr. James W. Helps occupied the prominent position in connection with the exhibition of Chairman of the Advisory Committee; and had the visit this year of our German friends been at the prearranged time, he would have had the honour of receiving them as President of the Institution of Gas Engineers. But unavoidable circumstance delaying the visit, the eminent position of chief representative of the hosts is in the worthy hands of his successor in the presidency, Mr. Alexander Wilson, at whose right-hand side in this visit stands Mr. Helps sharing the pleasures of a happy responsibility.

"Old Sol" did his best on Sunday to add to the heartiness of the welcome accorded the visitors by shedding over land and sea during the morning and early afternoon the brilliance of his rays. But the effort was too great for him to sustain; and the sky was somewhat overcast as the travelling party sped by train from the landing-place on our shores—Dover—to Charing Cross station, during which journey they were able to see something of the beautiful south-eastern portion of the country in its autumn garb. The train conveying the visitors reached its destination about 5.20 o'clock; but some time before, some members of the Institution Reception Committee assembled at the station. There was the President of the Institution (Mr. Alexander Wilson), who had travelled up from Glasgow specially in time to be present at the incoming of the guests; there was the ex-President (Mr. J. W. Helps), the Hon. Secretary (Mr. S. Y. Shoubridge) was present, and other members of the Committee were: Mr. H. F. Andressen, Dr. Harold G. Colman, and Dr. Rudolf Lessing. The Secretary of the Institution (Mr. Walter T. Dunn) was also in attendance. Several of these, the visitors knew well, through the Berlin visit, and individual trips paid between Germany and this country, and *vice versa*. It is convenient to interpose here a full list of the names of the gentlemen constituting the Reception Committee. They are: Mr. H. F. Andressen (Imperial Continental Gas Association, London), Mr. J. Ferguson Bell, Dr. Harold G. Colman, Mr. Thomas Goulden, Mr. R. S. Gardiner, Mr. W. Doig Gibb, Mr. Thomas Glover (Norwich), Mr. W. R. Herring, Mr. Charles Hunt, Mr. J. W. Helps, Mr. H. E. Jones, Mr. Stanley Jones, Dr. R. Lessing, Mr. F. D. Marshall, Mr. S. Y. Shoubridge, Mr. R. G. Shadbolt, Mr. Alexander Wilson (*President*), Mr. A. F. P. Hayman (Imperial Continental Gas Association, Berlin).

The train arrived; and soon the representatives of the Council of the German Association were seen in hearty greeting with the President of the Institution, among them Dr. Karl Bunte, the General Secretary of the Association, whose father, revered throughout the gas industry of the world, was unable (to the general regret) to undertake the journey. There was a mingling then in mutual greeting, accompanied by expressions of the warmest welcome. From the station the visitors were driven in motors to the Westminster Palace Hotel, which will be their headquarters during the visit. The President of the German Association (Herr H. Prenger) was unable to make the journey with the general body of members; but so anxious was he to be with them on Sunday that he made the journey direct from Rome, and reached the hotel at ten p.m.

The list of members who intimated their ability to accept the invitation to participate in the visit is as follows:

COUNCIL—

Herr H. PRENGER (*President*), of Cologne.
„ F. KORDT, of Dusseldorf.
Dr. K. BUNTE (*General Secretary*), of Carlsruhe.
Herr K. HEIDENREICH, of Berlin.

MEMBERS—

Herr Burgermeister ACHILLES, of Sagan.
„ A. ASSMANN, of Homburg.
„ BALLUF, of Wittenberge.
„ O. BENNINGHOFF, of Dortmund.
„ J. BERNAUER, of Budapest.
„ Max. BESSIN, of Berlin.
„ Eugen BLASS, of Mülheim.
„ Richard BLUM, of Berlin.
„ Paul BOTTGER, of Lörrach (Baden).
„ Shirk BOYER, of Charlottenburg.
„ A. BRODMARKEL, of Hof i. Bayern.
„ W. BUEB, of Berlin.
„ H. DANIELS, of Dusseldorf.
„ P. DRORY, of Stettin.
„ Johannes ELSTER, of Berlin.
„ FANAS, of Berlin.
„ A. VON FEILITZSCH, of Braunschweig.
„ E. FISCHER, of Esslingen a N.
„ W. FORTMANN, of Oldenbourg.
„ Karl FRANCKE, of Bremen.
„ F. FRANKE, of Hagen (Westfalen).
„ E. FROITZHEIM, of Cöln-Deutz.
„ H. GERDES, of Berlin.
„ F. GÖHRUM, of Stuttgart.
„ M. HASE, of Lübeck.
„ M. HEMPEL, of Berlin.
„ HILGENSTOCK, of Hanover.
„ O. HUBER, of Berlin.
„ W. JANSEN, of Düren.
„ M. KLÖNNE, of Dortmund.
Dr. O. KNUBLAUCH, of Cöln-Ehrenfeld.
Herr E. KOBBERT, of Königsberg.
„ E. KOHLER, of Metz.
„ H. KOPPERS, of Essen-Ruhr.
„ P. LABRYN, of Wormerveer.
Dr. L. LANG, of Potsdam.
Herr LICHTHEIM, of Altona.
„ B. LOH, of Mülheim a Rh.
Dr. C. LOMSCHÉ, of Iserlohn.
Herr LUTZ, of Hamborn a Rhein.
„ Friedrich LUX, of Ludwigshafen.
„ G. MARTIN, of Erfurt.
„ H. MENZEL, of Berlin.
„ R. MESTEL, of Breslau.
„ E. MEYSTRE, of Vevey (Schweiz).
„ A. MIEHR, of Augsberg.
„ H. MOHR, of Altenburg, Sa.
„ G. MÖLLERS, of Cologne.
„ A. MÜLLER, of Dessau.
„ K. OBERTHÜR, of Kaiserslautern.
„ A. PETERS, of Cologne.
„ K. PFUDEL, of Charlottenburg.
„ H. PIPERSBERG, of Lüttringhausen (Rheinland).
„ R. PIPPIG, of Kiel.
„ H. POHMER, of Mariendorf, Berlin.
„ Otto RAUSCHENBACH, of Stralsund.
„ F. RAUSER, of Berlin.
„ K. REINHARD, of Leipzig.
„ K. RIEMANN, of Rixdorf, Berlin.
„ J. VAN ROSSUM DU CHATTEL, of Amsterdam.
„ VON SANTEN, of Cöln-Ehrenfeld.
„ B. SARTORIUS, of Wittenberg.
„ K. SCHILLING, of Braunschweig.
Dr. E. SCHIRRMEISTER, of Berlin.
Herr W. SCHMIDT, of Dahlhausen (Ruhr).
„ K. SCHNABEL-KÜHN, of Höchst a M.
„ W. SCHNELL, of Freiburg i. B.
Dr. H. SCHÜTTE, of Bremen.
„ W. STAUSS, of Dresden.
Herr E. URFEY, of Wiesbaden.
„ W. VAIGL, of Pilsen.
„ W. WAGNER, of Vegesack.

Herr K. Weiland, of Ohligs (Rheinland).
Dr. Wein, of Budapest.
Herr E. Weiss, of Rahnsdorf bei Berlin.
„ Werner, of Konigsberg.
„ Wirtz, of Breslau.
„ H. Zollikofer, of St. Gallen.

It will be seen from the list that there were originally 82 acceptances; and it must be counted as fortunate that only four were prevented finally from making the journey.

The formal programme of the week's arrangements was entered upon at an early hour yesterday morning. There is much to do, and much to see, during the week; and the programme informs us that everywhere that visits are to be paid there is a desire to show hospitality in right true British fashion. But the bountiful provision of pleasure and interest has to be faced; and it was faced at nine o'clock yesterday morning with a good deal of happy anticipation on the part of all, and a little silent supplication for the continuance of bright weather through the space of six consecutive days at least. Fortunately, the weather was kind at the start; and this was a good augury.

The first objective was Beckton. The journey was made by motors; and, seeing that we numbered nearly a hundred persons, the procession made a brave show in London streets. It was noticed that the members generally had armed themselves with a booklet—provided by the Institution Reception Committee, prepared by Dr. Rudolf Lessing, and printed in German—giving information regarding the works to be visited; and the works to come under survey yesterday were Beckton, Kensal Green, and Fulham. Therefore, during this round of inspection, the Gaslight and Coke Company were the hosts. We will not spoil the day's story by any hasty survey; but leave the telling of it until next week.

Arriving at Westminster in the early evening, there was not much time to spare to prepare for the evening engagement. This was a banquet, at the Hotel Cecil, by invitation of the Institution of Gas Engineers.

The itinerary for the remainder of the week will show the full character of the programme provided:

Tuesday, Oct. 4.

A.M.
9.30. Motor-cars leave Westminster Palace Hotel.
10.15. Arrive at the East Greenwich Works of the South Metropolitan Gas Company. Inspection of the Works.
P.M.
1. 0 Luncheon, by invitation of the Company.
2.15 Motor-cars leave the Works.
3.15 Arrive at the Works of the Croydon Gas Company. Inspection of the Works.
4.30 Tea, by invitation of the Company.
5.30 Motor-cars leave the Works.
6.15 Arrive Westminster Palace Hotel.

Wednesday, Oct. 5.

P.M.
11.35 Special train leaves Euston.

Thursday, Oct. 6.

A.M.
7.55 Special train arrives Edinburgh (Princes Street). Breakfast on arrival at Station.
9.40 Special train leaves Caledonian Railway Station (Princes Street).
9.55 Arrive at the Granton Works of the Edinburgh and Leith Corporations' Gas Commissioners. Inspection of the Works.
P.M.
12.30 Luncheon, at the invitation of the Gas Commissioners, in the Technical Office—the Right Hon. the Lord Provost of Edinburgh in the Chair.
2. 0 Motor chars-à-bancs leave Granton Works for Forth Bridge.
5. 0 Arrive back at Caledonian Railway Station (Princes Street).
5 10 Special Train leaves Edinburgh.
6.15 Arrives Glasgow (Central Station).
7.30 Banquet at the invitation of the Gas Committee of the Glasgow Corporation, in the City Chambers—the Rt. Hon. the Lord Provost of Glasgow in the Chair.

Friday, Oct. 7.

A.M.
9.30 Motor-cars leave Central Hotel.
10. 0 Arrive at the Tradeston Works of the Gas Committee of the Glasgow Corporation. Inspection of the Works.
11. 0 Motor-cars leave Tradeston Works.
11.20 Arrive at the Provan Works. Inspection of the Works.
P.M.
1.15 Motor-cars leave the Works.
1.35 Arrive Central Railway Station.
2.10 Special Train leaves Central Station. (Luncheon and Dinner will be served *en route*.)
10.55 Arrive Euston. Motor-cars will meet the train.
11.30 Arrive Westminster Palace Hotel.

Saturday, Oct. 8.

P.M.
1. 0 for 1.30. Luncheon at the Garden Club of the Japan-British Exhibition, by invitation of the Institution of Gas Engineers.

ECONOMICAL ASPECT OF STREET-LAMP IGNITION AND EXTINCTION BY PRESSURE.

A recent number of the "Journal für Gasbeleuchtung" contains some short communications on this subject. The first is by Herr Göhrum, the Manager of the Stuttgart Gas-Works. He points out that a general conversion from hand lighting and extinction to the use of lighting and extinguishing appliances operated by increase of gas pressure can only be made after exhaustive trial of the latter appliances. An indirect advantage, however, of lighting by increase of pressure is that it draws attention to mains which are of insufficient size for the needs of the consumers; and it is to the financial interest of a gas undertaking to enlarge the distributing system to meet the increase in the demands of consumers. For instance, the author found that a consumer, before the main from which he was supplied was enlarged, paid a gas account of about 43s. per annum. After the distributing system had been overhauled and the pressure increased from 15-10ths to 22-10ths, his gas account amounted to 56s. to 58s. per annum. The unaccounted-for gas at the same time fell off, because the distributing pressure at the gas-works was reduced from 35-10ths to 18-10ths. A further advantage of the wave of increased pressure is that it calls attention to blocked or badly governed burners, and almost compels the adoption of properly-regulated burners. This brings with it an improvement in the conditions of lighting, and acts favourably to gas in its competition with electric lighting. Considerable economy may generally be shown by calculation to be likely to ensue on the introduction of pressure ignition of street-lamps; but it should further be considered, before attempting it, whether it is practicable from the technical standpoint. The distributing conditions must be favourable, and the waves of pressure must not affect the contents of the gasholder unfavourably. After reconsideration of estimates which he had previously made, in consequence of objections raised to them by Herr Buhe, of the Dessau Gas Works, Herr Göhrum comes to the final conclusion that the adoption of pressure ignition effects an economy of about 10s. per lamp per annum.

The next communication is by Herr H. Dobert, the Manager of the Geestemünde Gas-Works. He points out that only a few tenths pressure are requisite to operate the "Bamag" pressure igniting apparatus, and that the maximum pressure increase required to ensure satisfactory working is from 8-10ths to 12-10ths. A previous report by Herr Buhe, to the effect that a pressure of 53-10ths was required at Breslau, indicates that the maximum evening gas pressure there must amount to 40-10ths, even when no pressure igniting apparatus is employed. Probably this means that the gas-works at Breslau are at a great distance from the chief area of gas supply, and that the pressure will have fallen to the normal in the course of the transmission of the gas through the long mains from the gas-works to the district. Objections to pressure ignition, on the ground that the high pressure is detrimental to the operation of inverted burners, are generally due to the impression that the increase of pressure requisite is considerable. In the case reported, where the maximum pressure in parts of the town may already be 40-10ths, a wave of increased pressure bringing the maximum pressure up to about 53-10ths means an increase of pressure of only about one-third, which will not cause any serious disturbance of consumers' burners if they have been properly regulated. Other objections raised by Herr Buhe to pressure ignition are: (1) That the risk of explosion where wet meters are used is greater; and (2) that the gasholder accommodation is not fully utilized. These points cannot be dealt with except with reference to the local conditions in the case referred to by Herr Buhe; and he has not given sufficient details in regard to them. Herr Dobert does not consider it necessary to discuss the question of interest and depreciation charges on the capital outlay on pressure ignition, because he finds that the economy in wages and gas effected by the adoption of the system wipes out the expenditure thereon in a space of about three years. The system of pressure ignition has now been adopted in so many towns in Germany that its advantages may be regarded as sufficiently established. Not the least of them is the means it affords for igniting and extinguishing street-lamps at the proper time, and thereby enabling gas to compete more effectively with electricity for public lighting.

The third communication is by Herr Buhe, the Manager of the Dessau Gas-Works, and is written by way of comment on the foregoing communications. Herr Buhe emphasizes the point that his investigation of the conditions at Breslau showed that pressure ignition was not satisfactory. He expressly limits his unfavourable conclusions to this particular case, and does not contest the view that in favourable local conditions pressure ignition may prove remunerative to a gas undertaking. He thinks, however, that in towns of the size of Breslau, and even in many smaller towns, the conditions of the works and distributing system are not favourable to the employment of pressure lighting devices, and that the latter may give rise to considerable difficulties. He believes that many gas men have formed the same somewhat unfavourable opinion as himself with regard to the general adoption of such a system of lighting street-lamps. In conclusion, he says that pressure ignition does not present advantages for all towns, and that before introducing it, the local conditions must always be thoroughly investigated.

GAS ACTS FOR 1910.

[SECOND ARTICLE.]

THE Bills promoted by gas companies already in possession of statutory powers were few this session. Excluding the three Standard Burner Bills, there were only seven; and one of these, the Ammanford, was abandoned. The Standard Burner Bills still await third reading and Royal Assent.

The further powers sought by the Brighton and Hove Gas Company have been obtained. They have been empowered to sell and lease lands belonging to them which may not at the time be required for the purposes of their undertaking; and the entering into agreements with the proprietors of navigations, &c., has also been allowed. Protective powers for local authorities and the Railway Company have found entrance into the measure. The new auction clauses have been granted, as have also been powers to create reserve and special purposes funds. The terms of the capital redemption fund have been somewhat altered from those in the original draft of the Bill ("JOURNAL," Jan. 18, p. 156); and we reproduce from the Act the clause as it now stands:

Whereas under the provisions of Sections 50 and 51 of the Brighton and Hove Gas Act, 1881, the Company were required to cease to manufacture gas or residual products at the Black Rock works of the Company, or, after a period of ten years, at any place within the parish of Hove, and have accordingly abandoned such works, and ceased to manufacture at their then existing works in the said parish of Hove. And in consequence thereof, capital to the extent of £57,000, or thereabouts, of capital expended in the works so abandoned has become unproductive; and it is expedient that the Company should cancel such unproductive capital, it is hereby provided as follows:—

(1) The Directors of the Company may, if they think fit, in any half year appropriate out of the revenue of the Company, as part of the expenditure on revenue account, any sum not exceeding £1800 to a fund to be called the "Capital Redemption Fund."

(2) Every sum credited to the said fund shall be applied by the Directors from time to time, and in each case as soon as is reasonably practicable after such sum has been credited to the said fund under the provisions of this section, in purchasing ordinary or preference stock of the Company; and all stock so purchased shall immediately after the purchase thereof be cancelled, and shall thenceforth be, and be taken to be, extinguished; and the Directors shall cause the same to be duly noted as so cancelled and extinguished in the books of the Company. Provided always that all stock so purchased otherwise than in the open market shall be purchased at a price not exceeding the middle price of the then current official quotation for the same on the London Stock Exchange, or at the price (as recorded in the Company's books) at which the last transaction in the same class of stock has taken place, whichever of these prices shall be the lower.

(3) This section shall cease to operate so soon as the Company shall have appropriated and applied as aforesaid sums amounting in the aggregate to £57,000.

(4) The Company shall not re-issue any stock which shall have been cancelled under the provisions of this section.

Section 17 of the Company's Act of 1881, relating to the Directors fees, has been amended, so that it reads, and has effect, as if the sum of £2250 had been inserted in the section instead of £1500 There is provision for the reduction of the number of auditors to two in the event of any of the present auditors ceasing to hold office; and no one will in future be newly elected to the office who is not a professional auditor. This, however, will not affect the appointment of a Special Auditor by the Brighton Corporation under Section 21 of the Company's Act of 1866. A variation is made in the prescribed times of holding the half-yearly meetings, by the naming of the months of February or March and August or September. The standard price of 3s. 3d. proposed in the Bill, it will be remembered, was, under the special circumstances of the powers granted to the Company, brought down by 1d. Therefore, in Brighton, Hove, Preston, and Aldrington (comprising the inner area), the standard price will be 3s. 2d., with the sliding-scale operating half yearly. The proposed additional charges in the outer area have been reduced; and now it is decreed that, in the parishes named, the price for the time being charged by the Company in the inner area is not to be exceeded by more than the following amounts: In Portslade-by-Sea, New Shoreham, and specified parts of Southwick, Kingston-by-Sea, and Old Shoreham by 3d. per 1000 cubic feet; in other described parts of Portslade, Patcham, Southwick, and Kingston-by-Sea, and part of Rottingdean, 6d.; in Lancing and Overdean and the remainder of Old Shoreham and Rottingdean, 1s.; and in any other parish or place within the outer area, 1s. 3d. Lower prices may be charged, providing they are not less than those ruling in the inner area. The prepayment clause appears; but the variation in the Bill, as to the charge for the hire of a prepayment meter, without fittings, not exceeding the rate of 17½ per cent. per annum on the cost of the meter and its fixing, has been brought to the ordinary form of 10 per cent. per annum on the cost of the meter. The standard illuminating power of the gas is proposed at 15 candles, as tested by the "Metropolitan" No. 2 burner. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

By their new Act, the Bristol Gas Company are authorized to raise additional capital not exceeding in the whole £400,000 by the creation and issue of further nominal amounts of capital stock, with a dividend limited to 5 per cent. per annum; the issues to be subject to the new auction clauses. The amount the Company may raise on mortgage, and in respect of which they may create and issue debenture stock in accordance with the provisions of the Acts of 1891 and 1899, is increased by one-fourth part of the amount of the additional capital which at the time of borrowing has been raised under the provisions of this Act. The Company are given power to redeem or purchase, by agreement, any debenture stock issued under the powers of their Act of 1873; and to the extent of the nominal amount of any such redemption or purchase, their powers in regard to the creation and issue of debenture stock are to be deemed to be increased. The clause in the Act of 1873 relating to sulphur in the gas other than sulphuretted hydrogen is repealed. The Company have been granted a standard illuminating power of 14 candles, using the "Metropolitan" No. 2 burner. The conditions attaching to the testing have been somewhat modified since the Bill was noticed on Jan. 18 (p. 156). In reference to penalties, the results are confined to one day instead of three, in these terms: The illuminating power of the gas supplied by the Company on any one day shall be ascertained by taking the average of three consecutive testings of gas made on such day at intervals of not less than one hour; and the Company shall not be liable to any penalty or forfeiture unless such average illuminating power shall be less than the prescribed illuminating power. The limits of the Company are extended to the places specified in the Act. The clause as to the appointment of a Managing-Director as set out in the review of the Bill has been preserved in the Act. The Directors also take power to themselves to determine the salary of the Secretary. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The East Grinstead Gas and Water Company's Act (being mainly devoted to water supply) will be dealt with later among the water measures. It may be stated here, however, that the Company have procured the right to raise £40,000 additional capital, which is to be entitled to 7 per cent. dividend on the part issued as ordinary, and 6 per cent. on the preference. The new auction clauses will apply to the issue. Borrowing powers are allowed to the old extent of one-fourth. The Company are ordered to keep separate accounts as between the gas and water undertakings. A new testing place is to be provided in the offices of, or at a convenient place provided by, the District Council—this being in substitution of the testing-place defined in the Act of 1878. The Council are to provide at their own cost the building for the testing apparatus, and pay £50 towards the expense of the latter. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Exmouth Gas Company have secured the right to extend their limits of supply so as to include Lympstone and Woodbury. Additional lands are scheduled for manufacturing purposes. Provision has been made for the conversion and consolidation of all the existing preference shares into one class of preference stock to the amount of £12,200, and bearing a uniform interest of 5 per cent. per annum. The existing ordinary shares are also to be transformed into consolidated ordinary stock to the amount of £17,000, bearing 5 per cent. interest. Additional capital powers are granted to the extent of £24,000, of which not more than £16,000 may be raised as preference stock. The new auction clauses are to apply. Borrowing powers on the ordinary lines of one-third are allowed. With the change on conversion of capital in the standard rate of dividend, the sliding-scale provisions have undergone the usual modification. A special purposes fund has been arranged for. The standard illuminating power of the gas is to be 14 candles, tested by the "Metropolitan" No. 2 burner. The Company have secured a stand-by clause. The ordinary prepayment clauses appear. It is also provided that the Company are not to be liable to either penalty or forfeiture by reason of the presence in the gas supplied by them of sulphur compounds other than sulphuretted hydrogen. [*Parliamentary Agents: Messrs. Torr and Co.*]

Artificial Lighting of Rooms.—At a recent meeting of the Royal Society of South Africa, the subject of the influence of uniformity and contrast on the amount of light required for the illumination of apartments was brought forward by Mr. H. Bohle. According to an abstract of his paper in "Nature," the author dealt first with the adaptation of the human eye to various daylight illuminations, and gave a fresh definition of "glare." When the eye looks at an illuminant of great intrinsic brilliancy in front of a dark background, it tries to do two things at once—to open wide for the dark background, and to close up for the intrinsic brilliancy. The author then considered the physiological effects of radiation, explained overheating of the eyes due to excess light absorption, and considered the effects of the ultra-violet rays of modern illuminants and of solar radiation. In addition, he dealt with the destructive action of rays when applied excessively, and finally the effect which uniformity and the avoidance of contrast in artificial lighting have on the amount of light required. He came to the conclusion that in a room with black walls an illumination of 35 to 40 candle-metres is required; whereas in a place with white ceilings and light walls the amount of light can be reduced to 30 candle-metres. For perfect uniformity in such places, as obtained with inverted lamps, 20 candle-metres give, in the opinion of the author, complete satisfaction. The effects of various lampshades on the uniformity of illumination were also shown.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 55.)

THINGS on the Stock Exchange moved irregularly last week, but without any violent fluctuations. Adverse factors were the tightening of money, labour troubles, and the drop out in the Rubber Market, which occasioned anxiety regarding the settlement. The opening day was dull; the rise in the German Bank rate being the first warning note of possible trouble. Consols fell $\frac{1}{4}$; and all the chief markets were lower except the American. Tuesday was brighter. The beginning of the settlement gave fair promise of smoothness. Consols recovered $\frac{1}{8}$; and the rest were not much changed except some of the old favourites in the speculative line. Wednesday was very quiet, and the general tendency was duller, in view of the monetary aspect. On Thursday, there was no increase of activity in business, but the tone was decidedly better; apprehension as to difficulties arising out of the settlement being pretty well allayed. Government Stocks were firm, Rails were quite strong with rising prices, and even the lines which had been showing persistent weakness cheered up. The improved feeling continued through Friday; and prices advanced moderately in almost every leading department. Saturday was very quiet; and the general tendency was hardly modified at all, though Rails were a little perturbed by the non-settlement in the labour market. In the Money Market, there was a good demand for the Stock Exchange and the turn of the quarter. Following the German lead, the Bank raised its rate of discount to 4 per cent. from the 3 per cent. rate fixed on the 9th of June. Business in the Gas Market was about on a level with that of the previous week in point of volume and of general strength; and several further advances in quotations were marked on both the London and the Provincial Exchanges. In Gaslight and Coke issues, the ordinary stock showed increased strength, with transactions ranging between $106\frac{1}{4}$ and 107—a rise of $\frac{1}{2}$. The secured issues were rather active; the maximum realizing from $87\frac{1}{2}$ to $88\frac{1}{4}$, the preference $103\frac{3}{4}$ and $104\frac{3}{4}$, and the debenture $81\frac{1}{4}$ and $81\frac{3}{4}$. South Metropolitan was very quiet and firm at from $121\frac{3}{4}$ to $122\frac{1}{2}$. In Commercials, the 4 per cent. was steady at $107\frac{3}{4}$; but the debenture gave way a point at 79. Among the Suburban and Provincial groups, Alliance and Dublin marked $86\frac{1}{2}$ (a rise of $3\frac{1}{2}$), Brentford debenture 100, Ilford debenture $98\frac{3}{4}$ and $99\frac{1}{4}$, and South Suburban $121\frac{1}{2}$. On the local Exchange, Liverpool "A" was done at 220 and ditto "B" at 163—a rise of $\frac{1}{2}$. In the Continental companies, Imperial was stronger, changing hands at from $187\frac{1}{4}$ to $188\frac{1}{4}$ (a rise of 1), Union was done at 97 (a fall of 1), European fully-paid at from $23\frac{3}{4}$ to 24, ditto part-paid at 18, and Tuscan at $9\frac{5}{8}$. Among the undertakings of the remoter world, Buenos Ayres debenture was dealt in at $97\frac{1}{2}$, Oriental at 139, Primitiva at from $7\frac{1}{4}$ to $7\frac{3}{8}$, ditto preference at $5\frac{5}{32}$ to $5\frac{5}{16}$, and ditto debenture at $97\frac{1}{2}$.

ELECTRICITY SUPPLY MEMORANDA.

Principles and Charges—The Honesty of the "Electrician"—More Arithmetical Evolution—Rival Claims—A Link with the Past—All through the Metallic Filament—Olympia Again.

A FORTNIGHT since, an article appeared in our editorial columns on "The Relations of Municipal Gas and Electricity Departments," in which special reference was made to Manchester. For Mr. Pearce, the Chief Engineer of the Manchester Corporation Electricity Department, we have the greatest respect and admiration; and therefore the more heartily do we welcome the letter that appears from him in our "Correspondence" column, as to the general principles governing—or said to govern—charges for electricity supply. The statement of these principles as submitted by our correspondent has been encountered by us times out of number through a somewhat natural inclination of interest in the affairs of the electricity industry. But though we try, in quest of knowledge and in the desire to be just, to divest our minds of bias in examining these principles, they always appear, the further penetration goes, to be usefully employed in covering a multitude of sins—in other words, the principles are often found to be as much honoured in their breach as in their observance, and to be subordinated to the exigencies of a business open to the keenest of competition. We quite agree that the chief expenses of an electricity undertaking are due to the necessity of being in readiness to supply, and also that the total costs are bound to vary according as the hours of demand are long or short; and we also admit the usefulness of a diversity of demand on an undertaking. Thus Mr. Pearce will see that, on the question of general principles, there is no real difference between us.

But now applying these principles, we have never seen, so far as remembered, an analysis offered by a station engineer of actual charges to prove that justification bridges the prices from the two extremes. The extent of the variation is our trouble, and not the principle of differential charges for different purposes and for volume and duration of demand. It is not readily seen that "there is ample warrant for the wide disparity between the charges for electric lighting and electric power supplies, or, to write more correctly, between short-hour and long-hour consumers." We will not take the extreme Manchester price of 0·7d. per unit for power, but the top power price of 1·5d. We submit that, if Mr. Pearce now searches his accounts, he will probably find several power patrons paying this price whose consumption, quantitatively and measured by hours of demand, has correspondence with that of many of the lighting consumers who are paying on the flat-rate of 3·75d. What we want to know is why, in the circumstance of equality, there should be this great difference of 2·25d. between two consumers. Again the use of electricity for cooking is a short-hour use; and we should like to be informed, applying the principles named by Mr. Pearce, of any justification there is for charging (we are not sure the figure is correct) $1\frac{1}{4}$d. per unit for this short-hour custom as compared with the longer hours of the lighting consumer paying $3\frac{3}{4}$d. Mr. Pearce has perhaps studied the curves of gas undertakings in largely residential localities; and, if so, he will know that, during the short period of a couple of hours on Sunday while preparations are proceeding for dinner, the demand on the gas-works takes a flight upwards and downwards in a most precipitate fashion. That would come under the category of a short-hour demand, and per consumer it is a very small demand. Supposing this load were placed on the electricity undertaking, what justification would there be, under the principles stated by Mr. Pearce, for charging the current used at (say) $1\frac{1}{4}$d. per unit, while the same consumer may be using electricity for lighting for several hours constantly night after night at $3\frac{3}{4}$d.? In other words, he is called upon to pay three times more for his long-hour lighting load than for his short-hour cooking load. We are not disputing principles, but are merely marvelling at the flexibility shown in electricity charges by the application of the principles, or, would it be more correct to say, want of application? Of course, it is quite agreed that the power of storage possessed by gas undertakings is something over which central station electricity engineers have cause for envy.

Stimulated by the article that appeared in the "JOURNAL" as far back as Sept. 6, headed "A False Foundation," the "Electrician," after obviously spending many laborious hours, with the aid of a number of hypotheses, published on Sept. 23 an article purporting to give the last word on the question of the Gaslight Company's costs in relation to the Westminster public lighting contract. In our previous article, we corrected certain figures put forward by our contemporary and Mr. E. W. Seale regarding the gas consumption of the new high-pressure inverted lamps, as well as their absurd estimates as to the price the Gaslight and Coke Company are charging for the gas consumed by these lamps. The "Electrician," save in one respect, is as delighted as a child with a new plaything over the figures published in our article. We are pleased. "At last our gas friends have forsaken some of their vagueness, and have actually descended into figures." But we have never "descended" so low into figures that at any time we have reached $5\frac{1}{2}$d. per 1000 cubic feet as the figure at which the Gaslight Company are charging out the gas consumption of the Westminster high-pressure lamps. It was a stupid calculation and there was no excuse for anyone making it who possessed even an elementary knowledge (perhaps our contemporary does no[t] do so) of gas affairs, and was not behind the times respecting the progress of gas lighting. But after the error was pointed out, our contemporary coolly reiterated it; and we called this dishonest on their part. The "Electrician" also took the efficiency of the old vertical burner high-pressure lamp in forming a foundation for its computations, instead of the new high-pressure inverted burner lamp. Its attention was called to the error—i[f] so it can be termed, seeing the amount of publicity that had been given to the remarkable efficiency achieved by new invention i[n] high-pressure lamps. But our contemporary repeated the statement. That we called dishonest. And the "Electrician" feel[s] aggrieved over the epithet—suggesting that it was scarcely necessary for us to use such a term. We do not withdraw it, but emphatically reassert that the repetition of statements of the kind, unless done in ignorance, is not honest, and, if ignorance on the part of an electrical writer is at the bottom of such a performance, then it is inexcusable.

Our contemporary is still burning to show that the Gaslight and Coke Company have entered upon an unprofitable business in this Westminster street lighting. It takes the figure wit[h] which we presented it as to the consumption of a 3000-candl[e] high-pressure gas-lamp. But the figure is not quite what th[e] "Electrician" wanted; and so (we do not know why, unless it is to swell the costs), it feeds each of the lamps with 10 pe[r] cent. more gas than it requires—the declared reason being tha[t] this extra supply will be necessary to comply with the cond[i]tions of the contract. Who on earth has been putting that quee[r] notion into the head of our electrical contemporary? The Con[m]pany will see that the pressure at which the gas is supplied will i[n] all parts of the district prevail upon the lamps to give their full effi[]ciency. The writer of the article, too, has at length grasped som[e] idea as to the net manufacturing cost of gas into the holders pe[r] 1000 cubic feet (including 3·87d. charged for renewals and repair[s] over the whole of the manufacturing plant, it works out to rathe[r] less than 1s. per 1000 cubic feet); but he jumps about in a mo[st] sprightly fashion in the attempt to fix upon some figure that he ca[n] take hold of in his anxiety to show that the Gas Company are no[t] making a profit on the transaction. Then he goes on to take vario[us] other hypothetical figures to make up a total, which gives his uneas[y] mind "at least just cause for suspicion that the margin of prof[it] is negligibly small, if not negative." This is somewhat differe[nt] from the former conclusion; and so we may let our friend re[st] in the happiness of his suspicion. To say the least, it is not ve[ry] profitable to indulge in arithmetical evolutions of this kind. O[ur]

contemporary has already been impaled through its penchant for such exercises. There is, however, pleasure on our part that two or three authoritative figures have now convinced it that the Gaslight Company are not quite so foolish as the first calculations endeavoured to make out.

It ought perhaps to be also mentioned that the "Electrician" desire their view to be known that their gas friends have "no right to claim, as a result of these contracts, that street lighting by gas is cheaper than electricity." Of course, it does not know of any electricity undertaking in London charging pence per unit to the private consumers for electricity for lighting, and only 1d., or about 1d., per unit for current consumed in the street lamps. Naturally, not being of a very combative temperament, we do not desire to make much of this. But what we do wish to emphasize is that our contemporary has no right to claim, as a result of this, that lighting by electricity is cheaper than lighting by gas. Does it not see that if for street lighting it is necessary to come down to such a fine price for electricity in order to compete with the inverted gas-lamp, then the private electricity consumer who has to pay 4d., 5d., or 6d. per unit must be paying very heavily for illumination? Sorry. There is one more point. Will our contemporary favour us by reading the first three paragraphs of the "Memoranda" in the "JOURNAL" for Sept. 13. It will prevent a repetition notice here as to Marylebone public lighting "savings."

"George Offor!" The name recalls the early days of electricity supply in this country. This gentleman was mixed up with the infantile years of certain concerns. The name now serves as a sort of link with the past. George Offor, electrically speaking, still lives in the past; and he apparently requires a lot of modernizing to put him on a level with things as they are. We have before remarked that the "Electrical Review" loves the antique even in electric lighting testimonials. It loves George Offor, and has allowed him to indulge himself to the extent of a couple of columns, mostly devoted to the reproduction of testimonials which must have required a good deal of dusting before the reminiscent Mr. Offor could send them to the editors for publication. The testimonials are expressive of the satisfaction of electric lighting users with the favourable charges compared with gas. They are dated 1884, 1894, 1902. These dates are enough to make the old flat-flame burner rise up in dignified protest over this reminder of its inefficiency. We wonder whether George Offor has heard of inverted incandescent gas-burners giving up to 30 candles per cubic foot of gas consumed at ordinary district pressures, and 60 candles at high pressures. The columns of a technical paper might be filled with something possessing a little more freshness about it than is supplied by this survivor of the mediæval times of artificial lighting.

There has been surprise and protest over the decision of the Metropolitan Electric Supply Company to increase the flat-rate for current from 5½d. to 6d. per unit; the lessened consumption of consumers using the metallic filament lamps being blamed for the necessity for taking the step. The Company's administration are charged with walking backwards. The act at any rate shows this, that the Company have not been able by new lighting business to pick up the losses occasioned by the metallic filament lamp, though no doubt they have made a struggle to do so, seeing that the metallic filament lamp has been with us some time, and this increase has only just been determined upon. But the Company are at the same time adopting the "telephone" system of charging—a fixed quarterly payment, with a specified number of units charged at 2d., and all consumed after (during the quarter) at 1d. Between the two systems, perhaps the Company will have less ground for fear. Naturally, we wish them well.

It has generally been the electricity industry that in exhibition work has followed the gas industry. But it is determined to be first with the next big display in London; and there will therefore, we understand, be occupation of Olympia by electricity during September, 1911.

THE BURKHEISER PURIFYING PROCESS.

In the "JOURNAL" for the 2nd of November last (p. 311), a description appeared of the principal features of the Burkheiser process of purifying gases; and in the same number of the "JOURNAL" (p. 326) an abstract was given of the specification of the patent by which the process is protected. A detailed description of the process is communicated by Dr. W. Bertelsmann to the "Chemiker-Zeitung" of the 20th ult.; and as it appears therefrom that some modifications have been introduced with a view to improve the process since the description of it was given in our pages, a few further details may be quoted with advantage from Dr. Bertelsmann's article.

It is first pointed out that in the dry distillation of coal, from 10 to 50 per cent. and upwards of the sulphur contained in the coal, amounting to 0·5 to 4 per cent. of the latter, goes into the volatile products. Consequently, the crude gas may contain as much as 3·12 lbs. of sulphur per 1000 cubic feet of gas, or nearly 2200 grains of sulphur per 100 cubic feet. Of this sulphur, from 94 to 97 per cent. is in the form of sulphuretted hydrogen, and the remainder in the forms of carbon bisulphide or aliphatic and aromatic sulphur compounds. During the condensation and washing of the gas, about 25 per cent. of the sulphur is taken out; and, where cyanogen is recovered by washing with solution of sulphate of iron, a further 5 per cent. is removed. The condensed and washed gas may therefore contain 70 per cent. of the sulphur in the crude gas, or at the most, about 2·18 lbs. per 1000 cubic feet. This sulphur, so far as it is in the form of sulphuretted hydrogen, is ordinarily removed from the gas by treating it with moist ferric hydrate. The action of sulphuretted hydrogen on ferric hydrate, according to the equation

$$Fe_2(OH)_6 + 3H_2S = 2FeS + S + 6H_2O$$

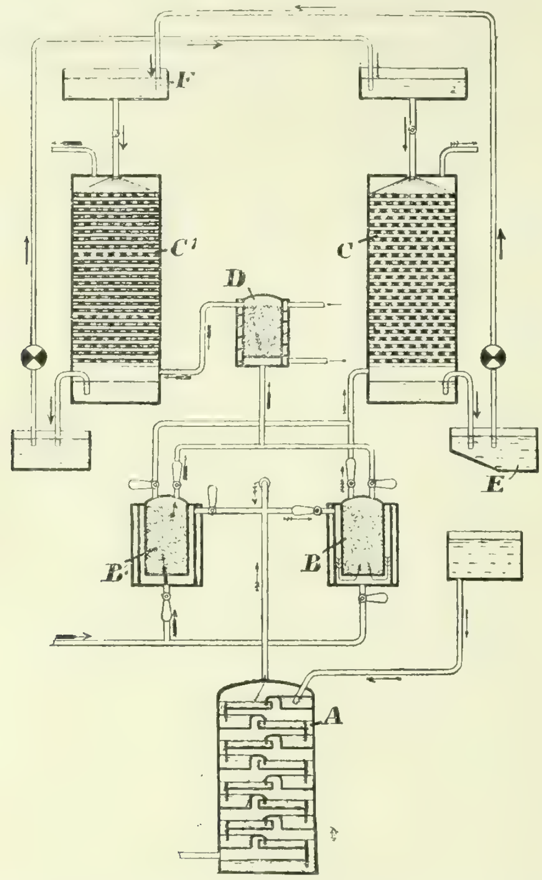
is attended by the evolution of 25 B.Th.U. per cubic foot of sulphuretted hydrogen. The oxidation of the moist sulphide of iron by the air liberates 243 B.Th.U. for the quantity of sulphide of iron corresponding to 1 cubic foot of sulphuretted hydrogen. The oxidized or revivified material is again available for the absorption of sulphuretted hydrogen; and ordinarily the absorption and revivification go on together by the addition of about 1½ per cent. of air to the gas which is to be purified.

Dr. Bertelsmann points out that the ordinary process of purification of gas by means of oxide, as described, requires the use of iron vessels of large area, and generally of large concrete revivifying floors. He states that the spent oxide containing about 50 per cent. of sulphur is almost valueless as a raw material for the manufacture of sulphur or sulphuric acid, and is valuable only on account of the cyanogen which it contains. Hence the removal of sulphur from gas does not afford a valuable bye-product, but entails considerable expenditure. He mentions some previous attempts to combine the sulphur in a convenient manner, so as to make it of value, but passes them over because so far it has not been reported that good results have been obtained from them. He then refers to the Burkheiser process as described in the "JOURNAL," pointing out that the process embodies the following series of operations: (1) The absorption of sulphuretted hydrogen by means of purifying material; (2) the revivification of the fouled purifying material, with formation of sulphur dioxide; (3) the formation of ammonium bisulphite from the sulphur dioxide and a solution of ammonium sulphite; (4) the formation of ammonium sulphite by the taking up of ammonia by the solution of ammonium bisulphite; and (5) the oxidation of the ammonium sulphite to ammonium sulphate. As stated in the previous article, the absorption of the sulphuretted hydrogen is accomplished by means of artificial or natural ferric hydrate; but Burkheiser heats this material to a temperature above 100° C., whereby it loses a part of its water by hydration, and passes into a lower hydrate—probably Fe_2O_3,H_2O. Any organic material present is at the same time burnt, and the prepared material is of a deep red colour and very porous. It is used in purifiers in a dry state to a depth of 6 to 10 feet, and is said to be capable of purifying 20,000 times its volume of gas before requiring revivification. The absorption is facilitated by previous warming of the gas by means of waste heat; and the deposition of any water in the purifying material is thereby avoided. The fouled material is revivified in the purifying vessel by means of a blast of air, but in such a manner that the oxidation takes place so vigorously that sulphur dioxide is formed at once, and passes out of the vessel with the nitrogen of the air. The heat thus liberated is partly utilized for the preliminary warming of the crude gas. The sulphuric acid and sulphates of iron produced are removed at the close by washing the purifying material, which is subsequently dried in a current of air, and thus rendered fit for use again.

The ammonia in the gas is extracted by washing, and the resulting liquor is used for washing the air containing sulphur dioxide, which is thereby combined to form ammonium sulphite and ammonium bisulphite. The solution of ammonium bisulphite then serves for washing the gas; and, by taking up ammonia, it is converted into the neutral solution. The solution thus makes a continuous circuit—passing from neutral to acid and from the latter to the neutral state again. The salt with which it gradually becomes strongly impregnated is precipitated. It consists, owing to oxidation, of about 60 per cent. of sulphate and only 40 per cent. of sulphite; and, while in this state it would be quite suitable for manurial purposes, it is, in order to meet the views of purchasers, completely converted by oxidation into sulphate through sublimation of the sulphite and oxidation of the sublimed material. It is easy, by oxidation in the air, to convert about two-thirds of the sulphite to sulphate, and hence by sublimation and oxidation a sulphate free from sulphite is produced.

Dr. Bertelsmann next describes the apparatus for the practical carrying out of Burkheiser's process. It is substantially identical with that described and illustrated in the "JOURNAL" for the 2nd of November last. He refers also to a special apparatus or oven with a continuous conveying screw for the treatment of the oxidized fouled oxide for the extraction therefrom of the sulphate and sulphite; but it appears from a later statement that the use of this apparatus is discarded under an improvement of the process which Herr Burkheiser has since made. An attempt to recover the cyanogen in the gas along with the ammonia, by converting it into ammonia, through the intermediate formation of ammonium sulphocyanide, has not yet attained practical success. So far Burkheiser's process has only been successfully adopted in large experimental installations, and final judgment on it must be withheld until it has been tried for a sufficiently long time on a large working scale. Its objects are to economize the space required for purifying plant, and to cheapen the cost of that plant while effecting economies in purifying material, wages, and sulphuric acid.

A modification of the process, which is also protected in Germany by a patent, aims at producing sulphate directly and exclusively. The sulphur dioxide formed according to the original process is passed, along with excess of air, over heated contact material, whereby it is oxidized to sulphur trioxide. Thus the modification combines Burkheiser's original process with the contact process for the manufacture of sulphuric acid. The original apparatus is supplemented by the provision of a contact chamber which takes the place of the oven with conveying screw already referred to. The gas freed from tar mixes with ammonia evolved from a distilling column A, and passes with it into a heated purifier B, from which the gas thereby freed from sulphuretted hydrogen goes on to a washer C in which it is freed from ammonia. Air is



meantime blown into another purifier B^1, already fouled with sulphur, and oxidizes the sulphide of iron with formation of sulphur dioxide. The latter passes into the chamber D, which contains platinized asbestos, ferric oxide, or other contact material, and is heated by superheated steam or waste gases to the necessary temperature for the reaction, which, with ferric oxide, is about 600° C. The sulphur dioxide is thus converted into sulphuric anhydride, which is washed out from the residual nitrogen in a washer C^1. The solution thus produced is used to wash the gas for the extraction of ammonia, and the sulphate formed is removed from the vessel E as the liquid becomes saturated with it, while the neutral mother-liquor is pumped to the tank F, and again used in the tower C^1 for the absorption of sulphuric acid.

Herr Burkheiser proposes by another patented process to convert in the ordinary way one-third of the sulphuretted hydrogen of the gas into sulphur dioxide, and cause this to react with the rest of the sulphuretted hydrogen, according to the equation—

$$2H_2S + SO_2 = 2H_2O + 3S.$$

This proposal, however, does not provide for the utilization of the sulphur, and does not combine ammonia recovery with sulphur purification.

PERSONAL.

Mr. John F. West, formerly Manager of the Stockport Corporation Gas Department, has, out of 67 applicants, been appointed Outside Superintendent of the Department.

Mr. F. H. Brunt, Engineering Assistant to the Manchester Corporation, has, out of 91 applicants, been appointed Manager of the Rochdale Corporation Water-Works, in succession to Mr. W. Tomlinson, who is retiring after 40 years' service. Mr. Brunt, who is 37 years of age, was educated at the Manchester Municipal School of Technology, where he is now Lecturer on land and engineering surveying. The commencing salary of his new post is £250 per annum, rising to £350.

Mr. John Phillips, who has been for half-a-century in the service of the Bristol Gas Company, and has for many years held the post of Secretary, has been elected to a seat on the Board. He will, however, retain the secretaryship by virtue of the special provision in the Company's last Act of Parliament to which attention is called to-day in our second article (p. 21) dealing with the Gas Acts of the present session. We heartily congratulate Mr. Phillips on this recognition of his long and devoted service to the Company.

Many of our readers, especially those who have had business transactions with the Phœnix Iron-Works at Stroud, will be interested to learn that Mr. and Mrs. George Waller celebrated their golden wedding on Monday last week. Besides the family gathering, they were invited to meet the employees at the works, when Mrs. Waller was presented with a gold and diamond brooch, Mr. Waller with a gold-mounted walking-stick, and jointly with a silver rose-bowl, suitably inscribed. On Wednesday, Mr. Waller entertained the workmen, staff, and representatives at supper, which was followed by a musical evening.

OBITUARY.

Mr. William Lister, J.P., and Mayor of Stockport in 1902, who died last Tuesday, aged 65, was elected a member of the Town Council in 1889, was made an alderman in 1901, and for some time was Chairman of the Gas Committee.

It is reported that Hofrat Dr. Heinrich Caro, a member of the Board of Directors of, and formerly Manager of, the Badische Anilin und Soda Fabrik, at Ludwigshafen-on-the-Rhine, died at Mannheim on Sept. 11. He had attained his seventy-seventh year. He was one of the pioneers of the coal-tar colour industry, of which he gained his early experience in England, and on returning to Germany was recognized for upwards of fifty years as a leader in this branch of applied chemistry. He took an active part, also, in formulating the German patent laws. His services to industry were acknowledged by his being made the recipient of many honorary degrees and distinctions, among which may be mentioned honorary membership of the Association of German Engineers and of the Association of German Chemists.

We regret to learn that the Directors of the Colonial Gas Association have lately lost an esteemed colleague in the person of Mr. A. Godwin Hammack. The name of Hammack has been on the roll of the Association since it was started in 1888; the father of the deceased having been the first Chairman. In October, 1894, he was succeeded on the Board by his son. Shortly after the last annual meeting in November, Mr. Godwin Hammack had a paralytic seizure, in consequence of which he was unable to follow his profession as a Solicitor or attend any meetings of the Board. A few months ago, some hope was entertained of his recovery; but he had a relapse, to which he succumbed at his residence at Littlehampton. He was also one of the Directors of Messrs. William Sugg and Co., Limited, in which position he succeeded his father.

HOW TO TRADE SUCCESSFULLY.

By R. W. Edwards, of Aldershot.

About two-and-a-half years ago the question of rebates presented itself, owing to the difficulty in attracting consumers in our out-districts to adopt gas more extensively for cooking and heating. In the home district the question did not apply so acutely, because the ordinary price was a flat-rate of 2s. 6d., then sufficiently attractive to bring a steady flow of orders for cookers and fires in their respective seasons.

It should be pointed out that the Company's area covers nearly 100,000 acres, embracing twenty-eight parishes. The prices in the various groups are not identical, but are governed by Acts in which the principle is followed of graduating the rate according to the distance from our home district. Though not so worded, it was intended that in the first set of out-districts the price charged should never be more than so much above the home rate; and it was stipulated that for a period of years the excess price under this arrangement should not be less than so much—the latter point being designed to protect the home area. Subsequent powers fixed a higher maximum difference, with a fixed minimum again for a series of years; and this was on the presumption that the first batch of out-districts was nearer to the works than the area added later. Hence the higher maximum difference. The actual figures are purposely omitted, principally because they are but incidental to the question under review, and the reference is only intended to enable readers to appreciate why one thought of differential rates. There was no getting away from the fact that our higher rates in the outside areas (although lower than, or quite as low as, the general prices charged by other Southern companies) did not tend to develop our sales in the direction of consumption for fuel, &c.

After realizing the fact that differential prices would go a long way to solve the problem, the next difficulty which presented itself was that of registration. It was practically impossible to suggest the use of separate meters for each fire or cooker, or the separation of pipes in existing houses. Experiments were then made over several months with a few hundred rotary meters—utilizing them only for arriving at the amount of rebate, and not as a basis of account. "Rebate Indicator" is our name attached to these little instruments; and each is carefully tested on arrival from the makers, and before being issued for fixing in the various districts.

Ultimately, it was demonstrated that the principle of offering a rebate was a right one; and about two years ago the system was generally adopted in the out-districts.

In offering the rebate (6d. per 1000 cubic feet) off gas registered separately for cooking and heating, the consumer taking advantage of it was invited to enter into a short agreement embodying the following:—

The total consumption of gas will, as hitherto, be registered by the meter, and of that the quantity used for cooking and heating will be ascertained by the Company by means of an indicator (about the size of a very small clock) which will be fixed by and at such point or points of the consumer's internal pipes as the Company select.

A small rental of 6d. per quarter will be charged to the consumer in respect of each indicator, in addition to the usual meter-rent, which, of course, varies with the capacity of the meter. And the rebate will be subject to the following further conditions:—

1. Punctual payment of accounts—that is, payment of the whole of the last quarter's account due to the Company must be made on or before the last day of the month subsequent to that in which falls the quarter-day ending the period of consumption to which the account refers—viz., on or before Jan. 31 for the quarter ended Christmas; on or before April 30 for the quarter ended Lady-day; on or before July 31 for the quarter ended Midsummer-day; and on or before Oct. 31 for the quarter ended Michaelmas.
2. Should payment of the whole of the amount due to the Company in respect of any quarter not be made strictly in accordance with the conditions laid down in the preceding clause (clause 1) the price to be paid by the consumer for gas consumed for cooking, heating, or motive power purposes will be the net price, and the rebate will not be allowed.
3. The Company reserves the right to discontinue allowing the rebate at any time, on giving the consumer one quarter's notice.

The agreement renders an important service, as it stipulates as a *sine quâ non*, the settlement of the account by a given date; otherwise the rebate is forfeited. The stipulation is not harsh; and although occasional instances happen of consumers overlooking the date, where such omission is of an isolated nature in a particular case, and a reasonable explanation is forthcoming, the rebate is allowed. If the system was inelastic, some irritation would be caused and more harm than good done by the arrangement. Tact and reasonable consideration in matters of this kind must dominate in all business—that is if one wishes to cultivate the consumers' good-will, and advance the interests of the undertaking.

After two years or so, what was commenced as an experiment, in spite of many warnings from well-meaning friends, is now a successful and established arrangement. Our consumers thoroughly appreciate the system which enables them to utilize gas for purposes other than lighting, at a reduced cost.

Briefly, the following are some instances taken at random from our ordinary rentals, showing the comparative consumptions before and after the operation of the rebate. Consumers' names are not given.

Annual Consumption.

Consumer A.—Four gas-fires.	
Year before rebate operated	31,800
,, after ,, ,,	79,700
Increase	47,900
At rate of (per cent.).	150·6
Consumer B.—Three gas-fires.	
Year before rebate operated	50,000
,, after ,, ,,	77,900
Increase	27,900
At rate of (per cent.).	55·8
Consumer C.—Three gas-fires.	
Year before rebate operated	42,100
,, after ,, ,,	96,400
Increase	54,300
At rate of (per cent.).	128·9
Consumer D.—One fire.	
Year before rebate operated	92,400
,, after ,, ,,	131,700
Increase	39,300
At rate of (per cent.).	42·5
Consumer E.—One cooker (small hotel).	
Year before rebate operated	16,800
,, after ,, ,,	57,800
Increase	41,000
At rate of (per cent.).	244
Consumer F.—Fourteen fires.	
Year before rebate operated	399,200
,, after ,, ,,	495,600
Increase	96,400
At rate of (per cent.).	24·1

Annual Consumption.

Consumer G.—One cooker.	
Year before rebate operated	135,300
,, after ,, ,,	184,300
Increase	49,000
At rate of (per cent.).	36·2
Consumer H.—One cooker.	
Year before rebate operated	20,100
,, after ,, ,,	35,400
Increase	15,300
At rate of (per cent.).	76·1
Consumer I.—Two fires.	
Year before rebate operated	46,500
,, after ,, ,,	76,700
Increase	30,200
At rate of (per cent.).	64·9
Consumer J.—One cooker.	
Year before rebate operated	27,000
,, after ,, ,,	51,000
Increase	24,000
At rate of (per cent.).	88·8
Consumer K.—Two fires.	
Year before rebate operated	54,400
,, after ,, ,,	73,500
Increase	19,100
At rate of (per cent.).	35·1
Consumer L.—Two fires.	
Year before rebate operated	38,000
,, after ,, ,,	57,500
Increase	19,500
At rate of (per cent.).	51·3

Excepting E, all are private consumers, of a class difficult to approach; and unless one has something really attractive to negotiate with, there is little hope of a canvasser even getting an interview.

One cannot yet claim to have passed the experimental stage; and it is questionable if one ever does. Nowadays, it is imperative that consumers should have an ever-varying attraction; otherwise they are unlikely to even notice one's claim, however honest and worthy it be. The general results reflected in the consumptions of the twelve ordinary consumers must appeal to all, and demonstrate what business still remains to be obtained—showing, apart from the cooker field (which is becoming saturated in many towns), what a vast territory there is yet to be developed by pushing the sale of gas for heating. Where electrical competition is fierce, they indicate how much lost ground can be recovered by a proper method of selling.

In these days of political discussion of the principles of how to trade, one can take a profitable lesson by learning the true meaning of "negotiate." I have in my mind schemes for the future which I trust will equal the rebate system outlined in this article; but the introduction must be governed by circumstances. The slot consumer has not been neglected. The system has been extended in the same districts to that class of customers. The difference is that we find the slot consumer has, so far, not taken up the gas-fire to the same extent as has the ordinary consumer. The following are some random cases:—

Annual Consumption.

Consumer A.—One cooker (private house).	
Year before rebate operated	21,200
,, after ,, ,,	39,000
Increase	17,800
At rate of (per cent.).	83·9
Consumer B.—One cooker (let apartments).	
Year before rebate operated	57,100
,, after ,, ,,	69,800
Increase	12,800
At rate of (per cent.).	22·4
Consumer C.—One fire (private house).	
Year before rebate operated	12,200
,, after ,, ,,	17,200
Increase	5,000
At rate of (per cent.).	40·9
Consumer D.—One cooker (let apartments).	
Year before rebate operated	80,300
,, after ,, ,,	88,000
Increase	7,700
At rate of (per cent.).	9·5
Consumer E.—One cooker and three fires (private house).	
Year before rebate operated	41,900
,, after ,, ,,	118,200
Increase	76,300
At rate of (per cent.).	182·1
Consumer F.—One cooker (let apartments).	
Year before rebate operated	16,600
,, after ,, ,,	24,100
Increase	7,500
At rate of (per cent.).	45·1
Consumer G.—One cooker (fish frying shop).	
Year before rebate operated	65,300
,, after ,, ,,	76,900
Increase	11,600
At rate of (per cent.).	17·7

Annual Consumption.

Consumer H.—One cooker (private house).	
Year before rebate operated	21,900
,, after ,, ,,	25,600
Increase	3,700
At rate of (per cent.).	16·8
Consumer I.—One cooker (butcher).	
Year before rebate operated	17,300
,, after ,, ,,	20,700
Increase	3,400
At rate of (per cent.).	19·6
Consumer J.—One cooker (private house).	
Year before rebate operated	14,300
,, after ,, ,,	28,800
Increase	14,500
At rate of (per cent.).	101·3
Consumer K.—One cooker (private house).	
Year before rebate operated	17,400
,, after ,, ,,	32,000
Increase	14,600
At rate of (per cent.).	83·9
Consumer L.—One cooker (private house).	
Year before rebate operated	19,900
,, after ,, ,,	28,000
Increase	8,100
At rate of (per cent.).	40·7
Consumer M.—One cooker (private house).	
Year before rebate operated	6,500
,, after ,, ,,	7,300
Increase	800
At rate of (per cent.).	12·3

The slot consumer's average consumption can be improved considerably by offering him a lower figure for cooking and heating. Though we allow a large free cooker to each slot consumer, the rebate only applies when the consumer desires a still larger (double-cased) cooker, for which a low nominal rent is charged. The consumer realizes that at the end of a quarter, if he uses gas for cooking or heating, there is something to come back. Not only has he no difficulty in paying the small rental for the special hire cooker, but he has something in hand.

It would serve no good purpose to take up space by dilating further on this system of differential rates. It is proved by our short experience that the idea is a perfectly sound one, and capable of being widely extended, to the advantage of the consumer and the gas authority.

The ordinary consumer, at present offers the widest scope for the fire; and I am quite sure that if those companies who are working under a sliding-scale will look at the question unselfishly, it will be found that, instead of reducing the general price without getting anything like a reasonable response in increased consumption, it would be better to give rebates to encourage

consumption in those fields that are yet scarcely developed. Meanwhile, it may not result in increased dividends; but it enables one to broaden the base of business, and in the long run so develop the sales as to bring about general economy by virtue of greater all-round use of plant and mains—ultimately securing a more all-day, all-the-year-round gas consumption, which, while keeping our competitors off this untouched and practically virgin heating field, will prepare our industry to better combat perhaps in times of more stringent competition, the claims for lighting. At present, a reasonable price for lighting holds its own trebly—at least as against electricity at 3d. But in time to come, when the metallic filament lamp has become more popular and cheaper, when electric stations have recovered from the set-back due to loss of consumption following the use of economical lamps, then the price for current will undoubtedly be cheapened; and when that time arrives the gas industry must be ready, and more than ready, with all the resources at its command, to successfully defend itself and attack its competitors. But unless one has a sound, well-constructed undertaking, on a broad basis, cheap in capital, economical and efficient at works, enterprising and up-to-date outside, with a business not confined to one or two channels, one cannot "play the game" successfully.

AUTOMATICALLY LIGHTING STREET-LAMPS.

[Communicated.]

For a great number of years past, the automatic lighting of street-lamps has been a problem that has occupied the attention of inventive minds in the gas industry. The problem would be much less complex than it is if the pressure conditions of one gas-works were the same as those of all others; but it may be safely said that no two gas-works have entirely the same conditions in this respect. Some attempts have been made to solve the problem by the use of electricity, by running an electric cable from lamp-post to lamp-post, whereby an electric current would operate certain mechanism to turn on the gas and give the necessary spark to light it. But the capital outlay for this process was prohibitive. Then, again, separate mains have even been thought of, and, as the writer thinks, tried. But here also the cost was prohibitive; and the result, apart from the cost, was a failure. The greater number of inventions have used the gas pressure itself as the motive power; but these have hitherto been so limited in their action that gas engineers have turned in despair to clock controllers. So that inventions for lighting street gas-lamps have ranged themselves into two classes: The pressure lamp-lighter and the clock controller.

The Clock Controller.

Taking the latter class first, it may be said that the inventions have not been entirely successful. The difficulty has been to get the controllers to keep correct time on account of using the time-keeping mechanism to turn the plug of a tap, which is sometimes stiffer than at others, and thus makes correct time-keeping impossible. It is a serious disadvantage that one lamp should be lit half-an-hour, or even longer, before the next one. The saving of gas in such case becomes a negligible quantity. Then the apparatus has to be wound every week, and the time for operating altered; and though it may be said that this can be done by the lamp cleaner on his rounds, still it requires doing, and the task of winding and regulating a thousand clocks 52 times a year is no light one. Besides, a lamp cleaner is not always qualified to handle delicate clock mechanism; hence the number of repairs. More than one make of clock controller regulates itself, automatically altering the times for lighting and extinguishing every four or five days; but the writer must confess that he does not see very much advantage in this, when the clock has to be wound every week. It might as well be adjusted at the same time as the winding. In one gas-controller, it took so long to turn on the gas that it frequently lit-back in the bunsen. In most other controllers, the other extreme is reached—the gas being turned on instantaneously. But this necessitates a permanent pilot flame.

Pilot Flames.

By "permanent" is meant one burning 24 hours a day. This is a very important matter, and one that does not receive the attention it deserves from those interested in public street lighting. Theoretically it is supposed that a pilot flame need not burn more than one-tenth of a cubic foot of gas per hour. This may be so, when the pilots are properly adjusted; but how often is this the case in actual practice? Under existing service conditions, it will be found that from one-fourth to one-third of a cubic foot of gas is consumed by the pilot per hour—in the one case 8 and in the other 6 cubic feet per day, or respectively 2920 and 2190 cubic feet per lamp per annum. In the use of an alternate pilot flame, which is extinguished when the burner flame is lit, nearly one-half of these quantities is saved. Taking the mean of the figures and the average number of hours for lighting, upwards of 1170 cubic feet are saved per lamp per annum.

Torch Lighting.

Some gas engineers, appreciating this saving, have adopted torch lighting; but the drawback is that in winter time the atmosphere in the lantern during the day is cold and damp, which seriously affects and shortens the life of the mantles. Again, the permanent pilot flame is apt to blacken the mantles with a deposition of carbon, because when the pilot is inside the mantle, the burner flame causes it to impinge on the surface. To overcome this trouble, a bunsen pilot flame has been invented. But surely the best remedy is to turn this flame out when the burner flame is lit. Here, again, trouble arises, because usually, in almost every lamp controller, the gas is turned on or off practically instantaneously. What happens is this: When the burner gas is turned on and the pilot gas turned off in the process of lighting, during the hours the burner gas is lit the gas contained in the pilot tube, between the tap or valve and the tip of the tube, being lighter than air, escapes, and its place is taken probably by the products of combustion, which are heavier than air. Hence, when the gas is turned off quickly there is no time allowed for the hydrocarbon gas to expel the other gas, and reach the tip in time to light up; and the wind gets blamed for the trouble. Another way of getting over the difficulty has been proposed, but, so far as the writer is aware, not tried in actual practice, and that is to use a battery to produce a spark to light a temporary pilot. This, however, would probably cost more than the saving in gas, besides damaging the mantles as in the case of the torch. Moreover, in cold and damp weather the battery rapidly fails, and one never knows when it is going to fail—thus imparting an element of doubt as to its operations.

Limitation of the Clock Controller.

Another limitation of the clock controller, which, however, does not arise to any extent in this country, is the practice of not lighting the street gas-lamps during moonlight nights; and in the case of fog coming on, the lamps must remain unlit, unless they are lit by hand. At the same time, there are many conditions under which a clock controller only may be used—where, for instance, a municipality do their own lighting and extinguishing, buying their gas from the local gas company. Naturally the municipality do not care to ask the gas engineer to alter his pressure to operate the lighters belonging to the municipality, when by so doing he materially reduces his output of gas.

Pressure Lamplighters.

Compared with clock controllers, pressure lamplighters possess many advantages. The lamps may be lit or extinguished at any, and not at only a pre-determined, time during the 24 hours, which is of advantage in the case of fog or early darkness. Again, they need not be lit on moonlight nights; and they can be simultaneously and instantaneously lit. On the other hand, most of those on the market are subject to many limitations and disadvantages which do not apply to clock controllers. In almost every case of pressure lamplighters, the motive power used is the gas pressure. In some cases the whole of it is employed; while in others only a portion is required, as will be explained later on. In the former case, the difficulty is that the pressure to be relied upon is a very variable quantity in some works, especially on the Continent, where low maximum pressures are used, whereas in others high pressures are employed. Taking, for example, 4 inches of pressure and a 4-inch bell on which the pressure acts, the force of the pressure is the weight of a cubic inch of water for each inch of pressure and each square inch of surface of bell; so that where a gas-plug has to be turned, the gross force available in the above example is $26\frac{1}{2}$ oz., less the weight of the bell and of any mechanism attached to it that has to be lifted—which may be 8 oz.—leaving a net force of $18\frac{1}{2}$ oz. to turn the tap. Supposing the pressure available is only 2 inches, giving a gross force of $13\frac{1}{4}$ oz., or a net force of $5\frac{3}{4}$ oz., this is not sufficient for the purpose; and the apparatus is therefore useless with low pressures.

Mercury Seals.

Many pressure lamplighters use mercury seals; water seals being apt to freeze, and requiring deeper seals and larger mechanism. The trouble of a mercury seal, however, is twofold. In the first place, its great affinity for most other metals limits the choice of metal of which to make the apparatus; and, secondly, the oily exudations of the gas act on the mercury, and mechanically decompose it into minute globules having the appearance of the dross that forms on the surface of molten lead. Consequently, in time the mercury ceases to be a seal; and if a light be applied a flicker of flame will be seen passing over the surface. This trouble may be overcome by removing the mercury, washing it in a strong alkaline solution, and then squeezing it through chamois leather. But this is costly when it has to be done on a large number of lighters. The mercury also becomes adherent in patches on the side of the bell, increasing the weight to be lifted; so that, though adjusted to operate at 4 inches, it does not do so until perhaps 42-10ths or 43-10ths is reached. Sometimes the pressure is raised much higher than is required to operate the lighter, with the result that the gas blows through the seal, and squirts particles of mercury on to the leaden weights, this making them still heavier; while sometimes with the high pressure the mercury reaches the bottom weight, and dissolves part of it, reducing the weight carried, and allowing the apparatus to operate at 37-10ths or 38-10ths.

Leather Diaphragms.

As an alternative to a liquid seal, a leather diaphragm is used in some lighters. It is, however, a very curious thing that it gets dry and hard much sooner than the same leather does in gas-meters. Even if a horizontal diaphragm has an extra dose of oil given to it *in situ*, the oil rapidly percolates through the pores of the leather, which becomes dry. The reason possibly is that the meter leather diaphragms are so much larger in surface than the

lamplighter diaphragms, so that the former act like a sponge that keeps it moist longer. In other cases, oiled silk is used instead of leather. This, after being in use a year, shows no perceptible sign of deterioration. It has also been tested under great heat, which has not affected its efficiency.

GAS ATMOSPHERE.

In many pressure lighters the mechanism used for opening the valves works in a gas atmosphere. This forms a scale on the mechanism, which soon reduces its efficiency, and increases the friction, necessitating in time its removal for cleaning purposes. The expense of doing this discounts the value of the lighter by adding to the cost of maintenance. The gas seems to have a selective action on the metal employed in the manufacture of a lighter. Brass is affected slightly, aluminium is hardly touched, German silver is considerably affected, and gun metal most of all. On the other hand, the last-named material is best for contact with a leather diaphragm, being least affected by the oil and acid of the leather. A green verdigris is set up with brass.

ORDINARY PRESSURE LIGHTER.

The ordinary pressure lighter consists of a base, containing an annular well, in which is placed an inverted cup or bell sealed in mercury; thus forming a gas-chamber in which are two valves—one to control the burner gas, and the other the pilot gas. Then attached to the bell is certain mechanism, which when the bell rises opens one and closes the other valve alternately. The aim of the inventor is to make the operation of this mechanism as free from friction as possible. Suppose the friction requires a force of 1800 grains to neutralize it, this translated into pressure acting on a 3-inch bell means an inch of pressure; but friction is an inconstant quantity, because vibration also in part neutralizes it. Now the 3-inch bell itself, with the mechanism attached to it, may weigh 3 oz. or 4 oz., which also equals an inch of pressure; so that to raise the bell so as to operate the mechanism a pressure of 2 inches is required—an inch to balance the bell and mechanism, and another to overcome the friction. It is very clear that the pressure must be dropped before it can be raised again for the next operation; and it is equally clear that the bell will not drop until some pressure is reached below that which is required to balance the bell—*i.e.*, 1 inch. This point may be called the engaging-point, and the other (2 inches) the operating-point; and the difference between the two is called the "range."

FRICTION AND VIBRATION.

It will be observed that in this class of pressure lighter only a portion of the pressure is used to operate the mechanism—that is, the quantity required to overcome the friction. This class of lighter is adjusted to suit the different street levels and different pressures by placing leaden weights on the bell; thus preventing the apparatus from operating until a higher pressure—for example, 4 inches—is reached. The engaging-point in this case would be 3 inches. An element of uncertainty, however, now comes in—viz., vibration, caused by the street traffic and the wind—with the result that when the pressure has been raised to 3½ inches the friction is neutralized, and the bell rises and turns on the gas, possibly some hours before the proper time. And this range cannot be mechanically altered. For instance, to engage at 2 inches and operate at 4 inches, it is always 1 inch (except when affected by vibration) above the engaging-point. The operation of opening and closing the valves is performed practically instantaneously, giving rise to pilot troubles as before described.

OPERATING PRESSURE.

In order to work this lighter with anything like safety, it is necessary to permit it to engage at the maximum working pressure, and then raise the pressure 1½ inches to operate it—*i.e.*, 1 inch for the range and ½ inch for a safety margin; so that only in the case of gas-works having an abundant reserve of pressure can the ordinary pressure lighter be used with any degree of reliability. Such gas-works are few and far between. The holder pressure of a gas company varies considerably according to the quantity of gas stored. Suppose, for example, it is 8 inches maximum and 4 inches minimum, and the maximum working pressure is fixed at 4 inches, under ordinary conditions it is quite easy to give the extra 1½ inches required to operate the lighter. But the time comes—perhaps once in a hundred times—when there is only the minimum holder pressure of 4 inches; and the lamps cannot be lit. Consequently, if, in order to get over this trouble, they are set to light at 4 instead of 5 inches, they may frequently light in the afternoon, when 3½ inches is reached, and a subsequent drop to 3 inches may take place. Then when lighting-up time comes, the pressure is raised to 4½ inches, and those lamps that are lit are extinguished. Supposing the gas company have a large cooking-stove consumption at luncheon-time, and raise their pressure to 4½ inches to meet it, the lamps would be lit up. Or supposing the minimum holder pressure is 6 instead of 4 inches, the other pressures remaining the same, and the mains in some portion of the district happen to be small, and the consumption, when once it starts, causes a drop of 2 inches. In such case the lamps would have to be lit half-an-hour or an hour before their time; thus doing away with any saving in gas, and probably causing a loss on the lighting contract. Even if the lamp is lit before the consumption starts, this takes the pressure down below the engaging-point. Then when the consumption ceases, the pressure rises, perhaps at 10 or 11 p.m., and puts the light out; and if it is not relit by hand, the rise in the pressure in the morning to extinguish the lamps will relight those that went out during the night. It will thus be seen that the conditions must be made to suit this class of lighter (and this, in nine cases out of ten, is, in the writer's opinion, impossible) or it will not give satisfaction. Almost without exception, pressure lamplighters will only meet one set of pressure conditions; so that if conditions cannot be altered, the only alternative is a clock controller or else manual lighting.

ENTIRELY SATISFACTORY PRESSURE LAMPLIGHTER.

Assuming the use of an entirely satisfactory pressure lamplighter, the saving to be effected by it, is in labour and gas. But it does not follow that the whole of the saving goes to the gas company, as this depends on the conditions of the contract with the local authority. The saving in labour varies indefinitely. The wages paid are usually 25s. per week, with perhaps 1s. or 2s. less to improvers. This appears at first sight a very low figure, especially when it is remembered that the work is done largely during the night. But against this the number of hours worked per week is small compared with those in other branches of labour. They vary from 40 to 50 hours, and average about 45 hours, which gives 6⅔d. per hour.

The time allowed for lighting and extinguishing varies. With some companies it is 1¼ hours and with others 1½ hours for each operation; there are cases where 2 hours are allowed. Then, again, the number of lamps in a man's round varies. In large towns, where the lamps are close together, the number may be 100; in the suburbs, where they are farther apart, from 60 to 80; and in the distant suburbs, where they are few and far between, perhaps only 40. Taking the minimum time, and the maximum number of lamps (they generally go together), it works out as follows: 2½ hours per day is 912 hours per year, and at 6⅔d. per hour this comes to 4s. 11¼d. per lamp per annum. If the number be 70 and the time 1½ hours, the result is 8s. 4½d. Taking the maximum time at 2 hours, with the minimum number, the result is 19s. 9d. It will, however, be found in practice that the average saving in labour is about 8s. per lamp per annum. As regards the saving in gas, this also varies largely according to conditions. If the ordinary pilot burner is used, 1170 cubic feet may be saved in the pilot alone. If the torch is used, it means a debit of 1380 cubic feet against the automatic lighter. It must, however, be remembered that to effect this saving by the torch considerable capital outlay is required.

There is another saving of gas effected by the lighter by lighting the lamps simultaneously at dusk instead of starting from one to two hours before that time. The average for each operation being half the time allowed, or from 1¼ to 2 hours per day at 4 cubic feet per hour, this equals 1825 to 2920 cubic feet per lamp per annum, so that even in torch-lit lamps there is a saving of from 450 to 1540 cubic feet, while, on the other hand, the maximum saving may be 4090 cubic feet. If we average the price of gas at 2s. 6d. per 1000 cubic feet, the money saving would be from 1s. 3d. to 10s. Taking the minimum savings in gas and labour, the sum is 6s. 5¼d., while the maximum is 29s. 9d. per lamp per annum. A safe average would be 10s. to 15s. per lamp per annum.

CLUSTER BURNERS.

Where two burners are employed in one lantern, with the use of a special tap, one may be extinguished by hand at midnight, at a cost of 8s. per lamp per annum. The saving in gas being averaged at 5½ hours per day, at 4 cubic feet per hour, equals 22 cubic feet, or 8030 cubic feet a year, which, at 2s. 6d. per 1000 feet, comes to £1. The lighter therefore saves this or the man's labour *plus* the cost of a special tap. There is also a certain saving of from 10 to 50 per cent. in mantles and chimneys by the use of the automatic lighter. These figures are on the assumption that a perfect lamplighter is used. Where the lighter is not satisfactory, they will have to be discounted to the extent of the cost of the maintenance of the lighter.

Gas Publicity.—Three examples of gas publicity which came under notice last week deserve brief mention. In the "Daily Mail" on Friday, there was a page headed "Home Lighting and Heating for Winter," in which gas came in for attention, and an advertisement of the Gaslight and Coke Company had a prominent place. The Company also had a very effective page in the first Woman's Supplement to "The Times," which appeared on Saturday. A page of the "Manchester Courier" last Thursday was devoted to the Glasgow Exhibition, of which a general view was given, as well of Messrs. Fletcher, Russell, and Co.'s stand. Advertisements of the firm and of other exhibitors associated with the gas industry occupy the outside columns.

Production of Carbon Dioxide from Scrubber Water.—A French patent has been taken out by M. Fillunger for the production of pure carbon dioxide from the water coming from the scrubbers in the process of manufacturing coal or coke-oven gas. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the patentee points out that the gases obtained in distilling gas liquor for the recovery of the ammonia consist, after the absorption of the ammonia by acid, of carbon dioxide, water vapour, sulphuretted hydrogen, cyanogen compounds, as well as traces of sulphur dioxide and of hydrocarbons. These impurities are removed by bringing the gases into contact with lyes containing metallic salts—for example, liquor obtained in extracting copper from burnt pyrites. The gases are further purified by passing them over red-hot copper oxide, or by absorbing them in potash so as to form potassium bicarbonate, and then decomposing the bicarbonate by heat.

A NEW PROCESS FOR THE RAPID ESTIMATION OF SULPHUR AND SULPHURETTED HYDROGEN IN ILLUMINATING GAS.

By C. Winthrope Somerville, of the South Metropolitan Gas-Works, Bankside.

The daily increasing refinements in gas manufacture demand a corresponding use of efficient instruments for analysis and general testing; and in the matter of purification especially, rough and ready methods have been too long in existence.

The absence of better processes for controlling the working of purifiers is, perhaps, a valid excuse for using an indifferent one for something like forty years; but the author is under the impression that more energy has been expended in trying to improve a poor process than in seeking a better one.

Those controlling the purifiers are naturally desirous of obtaining the greatest possible duty from their material; and to be able to ascertain with accuracy, in the space of a few minutes, the precise conditions of a purifier with regard to its sulphur or sulphuretted hydrogen content, is both necessary and desirable. To this end, the author has been carrying out some investigations into possible processes to supersede the inefficient ones of the present time, with the result that he has designed one in which the reactions are indicated by a colour disappearance of such sharpness as to leave no doubt in the mind of the operator.

Hitherto the Harcourt test has, almost universally, served the purpose of making rapid estimations of CS_2 and H_2S; but the process has its limits as regards accuracy and the purposes for which it is employed.

The whole of the sulphur content of the gas is not recorded by it; it is unreliable with small quantities of either impurity; and the exact temperature at which to work for the determination of CS_2 has never been agreed upon. This, in conjunction with the difficulty of colour matching, leads different operators to get different results when testing on the same gas over a similar period of time.

The necessity for different standards for testing by daylight, flat-flame and incandescent gas-lights, and the deterioration of these standards, militate considerably against the usefulness and the efficiency of a process. The author would also like to suggest that it is more convenient to have the results of determinations of sulphuretted hydrogen given in terms of that impurity instead of in terms of sulphur.

In determining the form the new test should take, there was very little room for choice—a colour test, if possible to obtain, being eminently the most suitable. The author originally confined his investigations to a process for estimating total sulphur, and experimented in the direction of passing the products of combustion from burning gas into a solution of standard alkali coloured with various indicators. But the colour change was too indefinite, especially when hydrogen peroxide was used to ensure the oxidation of the sulphurous acid into sulphuric.

Finally, advantage was taken of the well-known reaction between iodine and sulphur dioxide, in which the free iodine is indicated with starch, giving the intense blue coloration; and this colour was found to disappear instantly when the sulphur dioxide in the products of combustion became in excess of that which was required to absorb a definite weight of iodine contained in the reaction bottle.

It has been found that no other constituent of the products of combustion reacts with the iodine to interfere in any way with the test.

The new process for the estimation of total sulphur is based on the following reaction:—

$$SO_2 + 2I + 2H_2O = H_2SO_4 + 2HI.$$

The gas is passed through a meter and burned. The products of combustion, after being cooled slightly, are carried through a solution containing 100 c.c. of N/1000 iodine in a total volume of about 450 c.c., made up with either distilled or tap water, and to which is added starch indicator. The weight of iodine in this solution is 0·01268 gram. It will be seen from the equation that 253·72 parts of iodine are equivalent to 64·06 parts of SO_2; consequently 0·01268 gram of iodine is equivalent to 0·0016 gram of sulphur, or 0·024688 grain.

When sufficient gas, containing in the products of combustion the equivalent quantity of sulphur to the above weight of iodine, has passed, there occurs an instantaneous decoloration of the blue solution to colourless water; the sharpness of the reaction depending on the amount of sulphur in the gas. Thus with gas containing 40 grains of sulphur per 100 cubic feet the reaction takes place over a period equal to the passage of 1-2000th of a cubic foot of gas; while with gas containing 20 grains per 100 cubic feet the reaction takes place over a period of 1-1000th of a cubic foot.

Upon the decoloration of the solution, the consumption is noted; a simple calculation giving the grains of total sulphur per 100 cubic feet.

A smaller or larger volume of the iodine solution may be used, if desired, thereby reducing or increasing the duration of the test. Using 50 c.c. of iodine, with gas containing about 30 grains of sulphur, the time occupied is from two to three minutes.

The process has been checked against the Gas Referees' and standard gravimetric methods at various parts of the gas-works plant, giving comparative results in all cases, a few of which are noted below —

	Standard $BaSO_4$ Test.		Somerville Test.
1.	28·6	..	28·3
2.	36·8	..	36·6
3.	44·3	..	44·8
4.	18·7	..	18·9
5.	21·7	..	22·0

A cubic foot of district gas was collected in a bottle, and the gas delivered to the meter by displacement with water. A series of nine estimations were made on this sample to test the concordance of the results.

1.	27·6
2.	27·6
3.	27·4
4.	27·4
5.	27·2
6.	27·1
7.	26·9
8.	27·0
9.	26·8

Note.—The gradual decrease is probably due to the absorption of CS_2 by the water.

In testing, the gas is burned in a bunsen burner at the rate of ½ cubic foot per hour; and a simple form of water-jet vacuum pump is used to support the combustion of the flame and carry the products through the reaction bottle.

In designing the apparatus, the chief points considered were: Temperature of products entering the iodine solution; volatility of iodine; sufficient seal for complete absorption of SO_2; speed of gas; splitting-up the gas for effective washing; visibility of reaction; sharpness of reaction; portability; simplicity.

With regard to the use of iodine as the reagent. Many works on volumetric analysis solemnly warn the chemist as to the liability of a solution of iodine to lose its strength with keeping; and the author started his investigations with fear in his heart as to whether, on this account, it was worth while doing anything with it. After eighteen months continual experience with it, however, he is glad to be able to regard the warning as something in the nature of a "bogey." A decinormal solution of iodine, made up in the ordinary way with potassium iodide, and kept in a dark cupboard, has maintained its strength (to within 1 per cent.) for nine months; also another solution, made up with 50 per cent. of glycerine as an experiment, has lost nothing in six months.

Estimation of Sulphuretted Hydrogen.

In applying the principle to the estimation of H_2S the author encountered rather more difficulties than was anticipated. Gas containing H_2S passed direct into a solution of iodine and starch, does not give an indication of the amount of impurity according to the equation.

$$H_2S + 2I = 2HI + S.$$

First, unless the gas be passed exceedingly slowly, and through an impossible depth of solution, the H_2S is not completely oxidized. Secondly, the presence of any hydrocyanic acid helps to discharge the colour.

It was found that the solution, apart from the iodine, must be capable of retaining the H_2S; also that the usual precautions recommended in the volumetric estimation of H_2S in solution by iodine must be carefully observed. These and several other chemical details had to be overcome; and when finally embraced in a specially prepared and carefully adjusted starch solution, exact results were obtained.

In the gas used by the author, it was found that hydrocyanic acid was the only other constituent that helped to discharge the colour or interfere with the test, and the volume of this varies from *nil* to a few grains.

During the passage of the gas through the reaction vessel, the whole of the HCN is not extracted, but only a definite proportion—dependent upon the depth of seal. But this proportion seems to be constant, with considerable variation in the speed of the gas.

Since every effort to extract the HCN previous to entering the reaction vessel, without also extracting the H_2S, was unsuccessful, it was arranged to make duplicate tests, in the second of which the H_2S is extracted by lead carbonate, which has no effect on HCN. By deducting the second result from the first, the H_2S is obtained.

It was then found that in testing gas containing more than 75 grains of H_2S per 100 cubic feet, the volume of gas required was so small as to make the HCN recorded a negligible quantity. It was also found that, owing to the speed and certainty with which the test could be carried out, even on comparatively clean gas, three duplicate sets of estimations could be made in the time required to make one estimation by the Harcourt test on the same gas. In practice, it will be found that these duplicate tests are very rarely, if ever, required.

With any gas containing a constituent, other than HCN, which helps to decolorise the solution, the H_2S would, of course, be estimated in the same way, providing the lead carbonate was unaffected—thus rendering the process available for all gases.

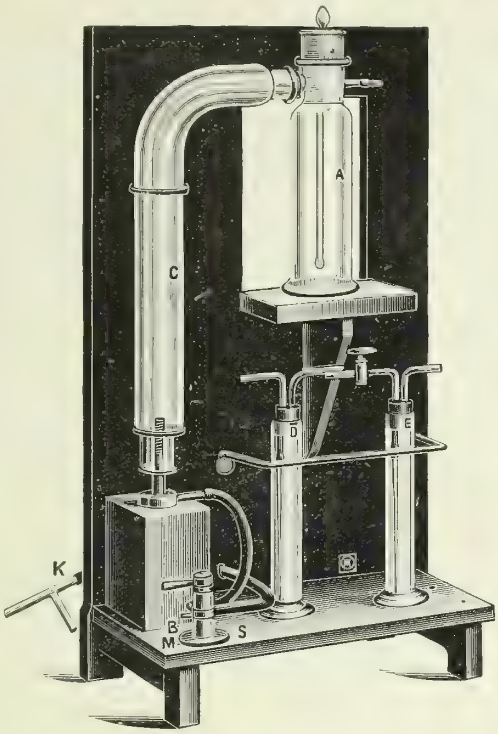
In testing, the gas is passed direct into a reaction vessel of about 100 c.c. capacity; the inlet tube having a bore not greater

than 0·5 mm. diameter. The outlet is connected to an aspirator; and the speed is regulated according to the amount of H_2S that is present. The time occupied by a test varies from five seconds to two minutes.

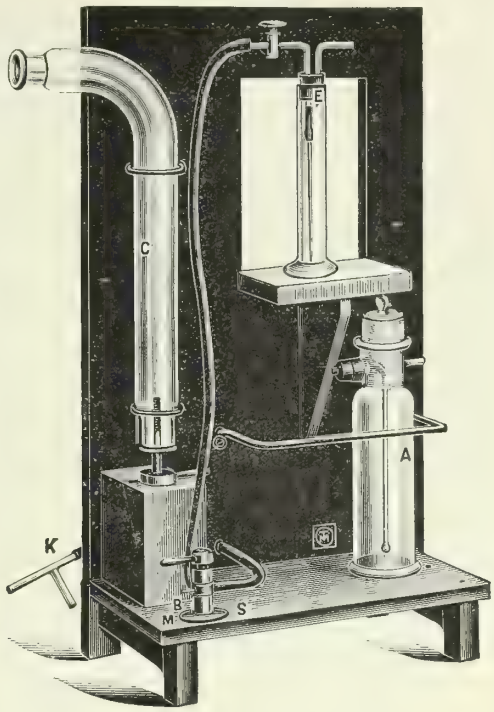
There are used 10 c.c. of N/1000 iodine (with 10 c.c. of starch); being equivalent to 0·0026231 grain of H_2S. The water from the aspirator measures, in cubic centimetres, the volume of gas that is used.

The decoloration with gas containing only 5 grains of H_2S occurs over a period of about 3 c.c., in which case 20 c.c. make a difference of 1 grain of H_2S. With gas containing above 50 grains per 100 cubic feet, the decoloration is instantaneous.

By means of the process, it is possible to estimate from one to thousands of grains per 100 cubic feet.



Sulphur Test.



Sulphuretted Hydrogen Test.

The Starch Solution.

The accuracy of both processes is dependent on two things—the correct weight of iodine in the reaction vessels, and the starch solution.

For the estimation of total sulphur, an ordinary starch solution as recommended by the test-books may be used—*i.e.*, 1 gram of starch per 100 c.c. But here a word of warning! The author has found that starch which has been purchased in powder form and kept for some time, is liable to be a source of error; for whatever precautions be taken in the making, there is a tendency for particles to granulate and retain the starch iodide, and thus prevent the decoloration of the solution.

Starch, such as Colman's, should be purchased in lump form; put in a stoppered bottle; and ground just before using.

The keeping qualities of a starch solution are very poor; and it was found that, after a few days, a good blue colour could not be obtained. This may be remedied by including in the solution about 2 per cent. of alcohol, and rendering it just alkaline by sodium hydrate, when it will keep, and give a good colour, for at least a month.

In the estimation of H_2S the starch is a special preparation adjusted to the weight of the iodine; and a measured quantity has to be used. From the formula supplied to the manufacturers of the apparatus (Messrs. Townson and Mercer) the starch is sent out in sealed bottles of 1 oz. capacity, and when made up according to the instructions the solution will keep, it is believed, indefinitely—always giving an intense blue colour. It may be used for the sulphur estimation in quantities of 3 to 7 or 8 c.c.; but for the estimation of H_2S, not less than 9 c.c. and not more than 11 c.c. should be used with the given volume of iodine solution.

Iodine Solutions.

For checking iodine solutions, the author recommends weighing out accurately the required weight of previously ground and pressed pure sodium thiosulphate, and titrating the solution of iodine into the thiosulphate solution.

For the solution of iodine in daily use, the author recommends glass reservoirs with taps, the top fitted with a rubber cork pierced with a short thistle funnel containing soda lime as an air purifier. The reservoir should be painted black.

Illustrations are given showing the test ready for estimating both impurities, but the purifier D is incorrectly shown, the correct shape being that of a calcium chloride drying tower. Fig. 1 shows the apparatus ready for estimating total sulphur; fig. 2 shows the apparatus ready for estimating sulphuretted hydrogen.

To Use the Apparatus.

Sulphur Test.—The gas is connected from the service to the inlet arm of the T-piece K. One outlet arm of this goes to the meter inlet; the other to the inlet S of the three-way cock. The outlet of the meter is connected to the inlet M of the cock; and the outlet B of the cock is connected to the burner under the combustion tube C. When the decoloration of the solution occurs, the three-way cock is switched from M to S—thus stopping the meter, and allowing the gas to remain burning. The air to support the combustion of the gas and the products of combustion are carried through the reaction bottle A by means of a rubber-tube connection from the water jet vacuum-pump P. When the test is finished, A is disconnected from C, and the gas switched back from S to M—thus allowing it to pass through the meter again in readiness for the next estimation.

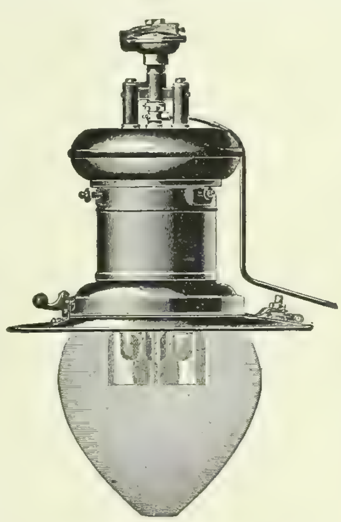
Sulphuretted Hydrogen Test.—Here an aspirator is used for measuring the gas. The inlet arm S of the three-way cock is connected to the service, and the outlet arm B to the reaction vessel E. The outlet of E is connected to an aspirator. When estimating traces of H_2S in the presence of HCN, a lead carbonate purifier D (wrongly shown in fig. 1) is placed between B and the vessel E, and a test made. A second test is then made with B connected directly on to E. The difference of the two results, in grains per 100 cubic feet, gives the H_2S.

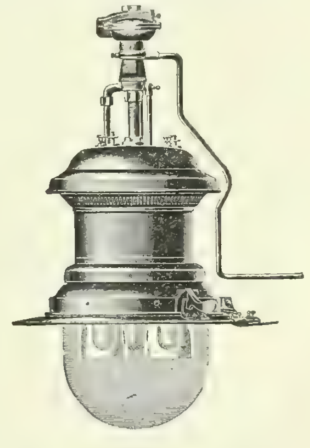
In conclusion, the author would point out the advantage of being able to vary the volume of iodine solution used in either test, for the purpose of increasing or decreasing its duration and the volume of gas used.

LOW-PRESSURE "GRAETZIN" LAMPS

For Outdoor Lighting.

In the accompanying illustrations are shown two high-power "Graetzin" lamps, working at low pressure, suitable for outdoor lighting, to which our attention has been called by Messrs. J. & W. B. Smith, Ltd., of Farringdon Road, E.C. Both lamps are black enamelled; and the larger one is fitted with an automatic gas-regulator at the top, air adjusters at the side of the casing, and a flash bye-pass. There are three burners, each of which has a separate control. A side lever movement, with all-night attachment, enables the lamp to be used with all the burners alight or





with one on and two off. The lamp measures 31 inches over all, and it is stated to give a light of 1000-candle power with a consumption of about $23\frac{1}{2}$ cubic feet of gas per hour. The smaller lamp, which, like the other, is fitted with an automatic gas-regulator, side lever movement, flash bye-pass, and separate control to each burner, measures 26 inches over all; and it is claimed for it that with a consumption of 14 cubic feet of gas per hour it will give a light of 600-candle power. The lamps are very suitable for lighting large areas.

Vertical Retorts for Amsterdam.—We learn that the Dessau Vertical Retort Company have just received a large order from the Amsterdam Municipality for the erection of vertical retorts on the Dessau system at the new Southern Works. The installation is to comprise thirty beds of eighteen retorts—540 retorts in all.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Newcastle.

The Sixty-Seventh Half-Yearly Meeting of the North of England Gas Managers' Association was held at Newcastle on Saturday. There was a very large attendance. The company assembled at the North of England Institute of Mining and Mechanical Engineers, Neville Street, whence they drove in special cars to the Elswick Ordnance Works of Messrs. Armstrong, Whitworth, and Co., Limited. There an hour was spent under guidance, walking through the vast works, in which were seen numerous big guns in course of construction, as well as the turrets and other interior fittings for the warship "Hercules," recently launched in the Tyne. Among other processes which were looked at with interest was the cutting of steel plates by the oxy-acetylene blow-pipe, which was considered very smart work. Returning to the Mining Institute, the meeting was constituted by Mr. J. Lewis, of Newcastle, taking the chair.

New Members.

On the motion of the Hon. Secretary—Mr. H. Lees, of Hexham, seconded by Mr. Matt. Dunn, of Stockton, the following were admitted to the Association:—

Members.—Messrs. Bertie Culvert, of Northallerton, John W. Ford, of Hessle-on-Hull, Theodore Nicholson, of Willington, Co. Durham, and Charles Wood, of Bradford.

Associates.—Messrs. Fred D. Hinchcliffe, of Hexham, Frank L. Scaife, of Stockton-on-Tees, and Wm. Thirlaway, of Newcastle.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I am not aware that a Distributing Engineer has occupied the presidential chair of any other Association of Gas Engineers and Managers in the United Kingdom. But certainly, by virtue of your kindness, I am the first to be elected to the chair of the North of England Gas Managers' Association; and it is an honour which I greatly appreciate.

The distributing department of a gas undertaking has, of recent years, come rapidly to the front; and the reason is readily comprehended when the many advances in, and the widened range of, the application of gas is taken into consideration.

Practically the whole of the consumption was, not many years ago, under conditions now entirely out of date, and by apparatus which could not be compared with that of the present day in regard to either scientific construction or multiplicity. As a natural consequence, the technical knowledge which then sufficed for the carrying on of the department is incomparable to that which necessity now exacts. Competition and the demands of the public have brought about this change, with the result that one-time independent and sometimes unobliging suppliers of a public commodity are now transformed into enterprising tradesmen. It is now necessary to be cognizant of apparatus to suit all requirements, the true value of the various appliances, the continuous improvements in them, and their correct adaptation; to see that the whole of the work is thoroughly organized and administered; and, among other things, to exhibit a strong desire to do everything possible to satisfactorily anticipate the wants of consumers and develop the use of gas.

As indicating the growth of distribution departments, I give you the following figures relating to the Company I have the honour to serve, which will be proportionately representative of other undertakings.

	Jan. 1, 1900.	Dec. 31, 1909.	Increase.
Consumers—			
Ordinary	38,934	49,809	10,875
Prepayment	—	59,467	59,467
Cookers on Hire—			
Ordinary	2,420	9,395	6,975
Prepayment	—	53,450	53,450
Grillers on Hire	—	6,002	6,002
Fires on hire	—	3,639	3,639
Public lamps	10,090	14,754	4,664
Private incandescent burners maintained	—	17,046	17,046
Miles of main	485	752	267
Consumers per mile of main	80	145	65
Employees	440	750	310
Weekly pay bill	£560	£930	£370

The carrying out of this increased volume of work has, of course, resulted (in addition to the capital expenditure) in a gradually increasing annual expenditure on distribution in the revenue account; and as from time to time the services which it may be deemed desirable to render to consumers multiply, so may the distribution account be expected to increase. But the fact that a great change has taken place in the work of the department furnishes a reason—the best of reasons—for looking around to see that one's methods of ascertaining what things cost, checking waste in both time and material, keeping pace with the change in the work, and satisfying oneself that, although higher total costs may be expected, they are not higher than they ought to be.

A JOB COSTING SYSTEM.

This Company, with a view to making the methods fit the altered circumstances in an up-to-date manner, about two years ago (upon the initiation of their worthy Secretary, Mr. Waddom) decided to introduce in the Distribution Department that which is now becoming general in large manufactories managed on modern lines—viz., a job costing system. The introduction necessitated many changes in the then existing methods; but the work involved has been amply justified.

As I am a believer in presidential addresses containing rather full information on one subject, which, of course, means brief reference to any other, and as I think the working of a job costing system in a distribution department will be of interest, I propose to devote the major portion of my address to this subject, and in doing so shall endeavour to make the same as plain as possible, though this is not easy.

I shall first divide the system into the following main headings, and then consider *seriatim* the details under each.

1. *Orders.*—Those received at the chief offices are sent to a "Central Order Receiving and Reports Office" at the workshops, and from there distributed to foremen, who give each job a number and despatch workmen to attend to it. The workmen, on their return, report particulars of the work done to a reports clerk, who despatches the information to the department from which the order was received and also to the costs office.

2. *Time and Job Keeping.*—Workmen are paid from time cards, on which are recorded the times of commencing and finishing work each day; these being checked with the time spent on the various jobs as shown by job cards on which are recorded the times of commencing and finishing each job.

3. *Stores.*—The stores issued for jobs are charged against respective jobs, and these, with the stores in stock, are checked with the stores purchased.

4. *Assembling.*—The assembling of all charges against jobs shows on the weekly costing sheets the cost of each individual job (except those entailing very small costs), and each class of job, and the relationship of the costs accounts to the general accounts.

5. *Scrutiny.*—There is a scrutiny of the weekly costs sheets and utilization of same.

ORDERS.

As to orders, I may explain that there is a chief office in Newcastle and a branch office in Gateshead, where orders and complaints are received from consumers; and we have a central workshop in Newcastle where all classes of work (other than in connection with prepayments) are dealt with; a branch workshop in Gateshead, where most classes of work (other than prepayment work) are dealt with; and three workshops in different parts of our area, where only prepayment work is handled.

In describing the costing system, however, I shall confine my remarks, for the sake of lucidity, to the orders received at the chief office and executed by the central distribution workshops. The principles are the same with the branch office and workshops; but the details are slightly modified to meet the different circumstances.

Consumers' complaints and orders for new work—both of which I shall hereafter refer to as "orders"—received at the chief office, are there entered upon numbered triplicate forms. Different forms are used for each class of order, and one form used for each order. That shown in Illustration No. 1 is for laying

N. & G. Gas Co. Chief Office.	NEW METER AND SERVICE PIPE. Form No. 29. 249906/66	Office No.

Name | Workman's No.

Address

Fix Light Meter on Loan, or Sale

and lay Service Pipe | Charge

Note

Order Received.				Despatched to Workshop.	Despatched to Foreman.
Date.	Hour.	Min	By		
			Clerk.		

Illustration No. 1 - size 6½ inches by 4 inches.

a new service pipe and fixing a new meter. The two slips and card comprising these forms are gummed at the left-hand side. As much as possible of the general matter for each class of form is printed, in order to minimize time and labour in the office; and the matter which is to be added by hand, in filling up the

form, is made on three copies with one writing by the use of a two-faced carbon sheet placed between the second slip and the card—the transparent nature of the second slip permitting the impression on the back thereof to show through distinctly.

The two top copies of these orders are despatched at fixed times during the day to the workshops; the time and date of handing to the messenger being stamped thereon by the use of a time and dating stamp. The copy retained at the chief office is put into a table cabinet the top of which is divided into numerous well sections for the reception of different classes of orders; and there it remains until the receipt of a report from the workshops to the effect that the order has been completed. This affords a ready means of detecting any delay that may occur in completion, as each class of order is automatically arranged in chronological order of issue.

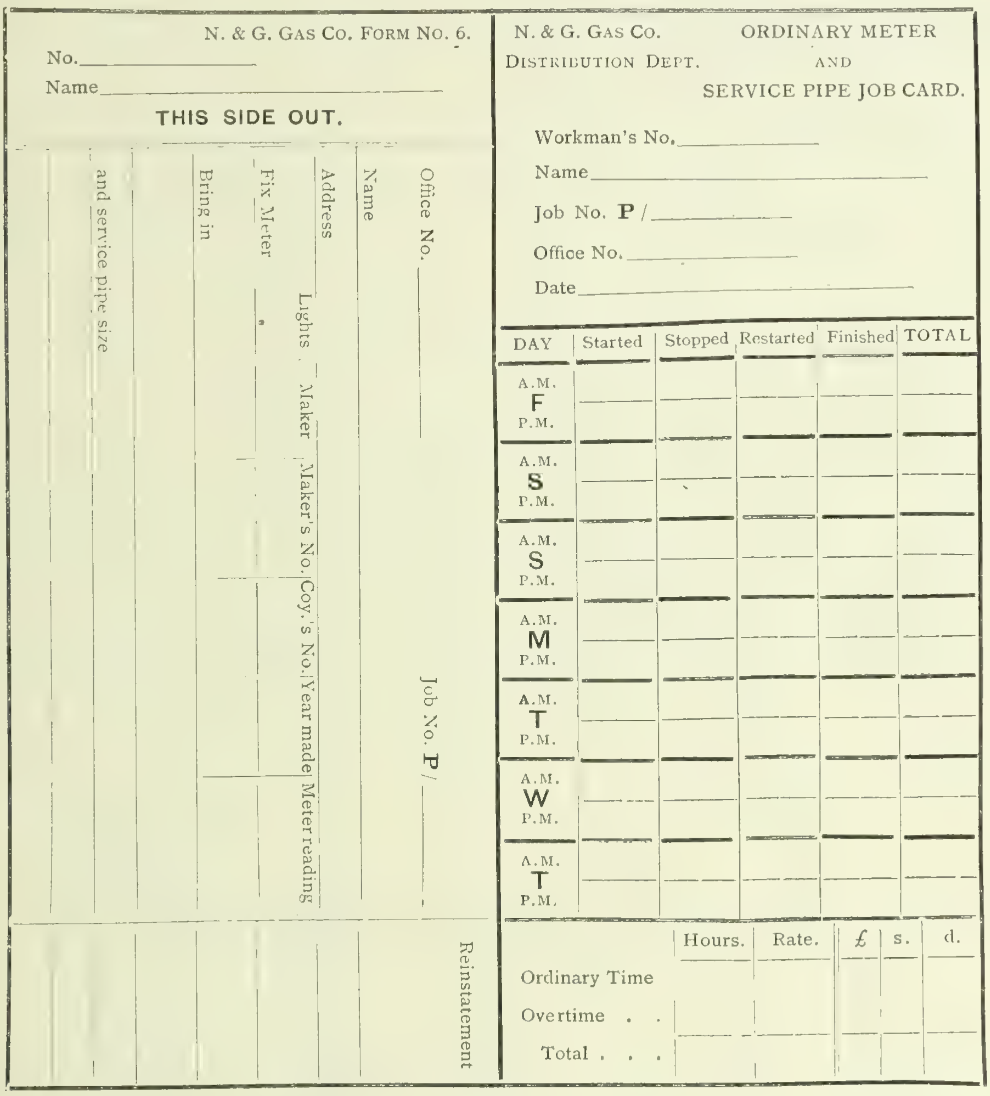
The two copies of the orders despatched to the workshops are received in the order receiving and reports office, where the orders clerk has a well table cabinet divided similarly to that just described. Into the correct section or compartment of this one copy is placed, and there remains until the completion of the work; the other copy being sent to the foreman in charge of the class of work to which the order refers—the time and date of the despatch to him being stamped thereon, so that any delay can be traced to the spot where it occurs.

It will be evident to you that by this table we can at once ascertain how many orders of each class we have in hand in the whole works; and, as here again they are automatically arranged in chronological order, we can see the length of time we have had them, and it is the duty of the orders clerk to report to the chief clerk any orders upon which there happens to be unnecessary delay.

This table has the further practical utility, that when (as you all know sometimes happens) an unusual number of orders of one class is received, and there is danger of delay in execution, and consequent irritation on the part of the consumers, we are able to deal promptly with the situation by transferring men from other classes of work where there may be a slackness, or by taking on extra hands if all departments are fully engaged.

But to follow the orders through—the foreman, having received copies of orders from the orders office, selects his men for the various jobs. Meanwhile, his clerk writes out a job card for the work which the man has to execute. As Illustration No. 1 is for laying a service pipe and fixing a new meter, we shall continue this order; and Illustration No. 2 shows the job card for the work.

Back of Card. Face of Card.



N. & G. Gas Co. Form No. 6.
No.
Name
THIS SIDE OUT.
Office No. | Name | Address | Fix Meter | Bring in | and service pipe size | Lights | Maker | Maker's No. | Coy.'s No. | Year made | Meter reading | Job No. P / | Reinstatement

N. & G. Gas Co. ORDINARY METER AND SERVICE PIPE JOB CARD.
Distribution Dept.
Workman's No.
Name
Job No. P /
Office No.
Date

DAY	Started	Stopped	Restarted	Finished	TOTAL
A.M. F P.M.					
A.M. S P.M.					
A.M. S P.M.					
A.M. M P.M.					
A.M. T P.M.					
A.M. W P.M.					
A.M. T P.M.					

	Hours.	Rate.	£	s.	d.
Ordinary Time					
Overtime . .					
Total . . .					

Illustration No. 2—size 7½ inches by 2¾ inches.

The illustration shows both sides of the card—the back is self-explanatory. The face shows the office order number, which is that of illustration No. 1, and also shows a job number which the work now receives and retains throughout.

For the job in question a plumber and labourer are required. The former takes the job card (Illustration No. 2), and the labourer is given a similar card, but without any particulars of the job being entered on the back. Upon receiving these job cards, the men immediately register the time in the spaces shown on the face of the card in the "Started" column, by means of a time-recording machine, to which I will refer later.

The assistant procures tools while the plumber proceeds to the stores for the material required for the job; and to the question of stores, I will also refer later.

The men then proceed to the address shown on the plumber's job card, execute the work, and return to the workshops. The plumber then reports to his foreman that the job is completed, and is handed the foreman's copy of the original order. (Illustration No. 1.)

The foreman takes this opportunity of asking questions upon any point regarding the work. If he considers it necessary, he inquires the reason of excessive time having been spent on the job; and if the explanation be unsatisfactory, the question is further investigated and dealt with accordingly.

The workmen then register the time on their job cards in the "Finished" column; and the plumber proceeds to the reports office, where he hands in the copy of the order just received from the foreman, and his job card (having first entered his report on the back), and verbally reports to the clerk any incidents out of the ordinary which may have arisen. The clerks have been trained to this work, and they know how to elicit all necessary information, and put the same concisely in writing.

The workman is then ready for his next job; but to follow the order right through, the reports clerk, from the job card, writes out on a triplicate form (Illustration No. 3) a report of the work done. Here, again, distinct forms are used for each class of work, printed to reduce to a minimum the writing required.

We shall now follow the disposal of the three copies of the report just written out, and of the two copies of the original order relating to the job (the copy which we saw put into its own section of the well table on receipt at the workshops, and the other just handed in by the workman).

N. & G. Gas Co., Distribution Dept. Forth Street.	NEW METER AND SERVICE PIPE. Form No. 30 249906/91	Office No.
Name		Job No.

Fixed Light Meter on Loan (or Sale) Maker Year made

Maker's No. Co.'s No. Meter Reading

Service Pipe

Work completed Reinstatement Yes No Reports Clerk

Received from Workshop.	Rental Dept.	Meter Reading Dept.
	District............ Rental No..........	Card No............
Consumers' Dept. (Gen.)	Clerk	Inspector

Illustration No. 3—size 6½ inches by 4 inches.

One copy of the report is sent to the office or department which issued the order; and when received, it is attached to their copy of the order, and both are then filed away for future reference. Another copy of the report and one copy of the order are now despatched to the costs department at the chief office, where all the charges against the various jobs are assembled.

On the report forms, it will be noticed, spaces are provided for stamping the dates and times of despatch and arrival; and thus any delays in transmission are quickly observed.

There still remain at the workshops one copy of the order and one of the report, which are now filed away in what we call the "Street Index Cabinet," consisting of several shallow drawers, each divided into sections running the length of the drawer. The orders and reports are filed in these drawers alphabetically, according to the names of the streets, which are indicated by guide-cards. A little rack divided into pigeon holes is used for sorting the forms into alphabetical order, preparatory to filing them away in the cabinet. The street index has been found to be extremely useful, as it affords a record of all work done in any street or on consumers' premises in that street. Information as to details of work done is quickly found; and from the job number quoted on the report, we are able to easily follow up details of time occupied, material used, and total cost.

The orders and reports having been disposed of, the job cards are examined in the orders and reports office, to see which jobs involve street reinstatement; and from these, orders are issued to the various local authorities, all of whom do the reinstating work within their respective areas for the Company.

The following diagram is intended to indicate the course of the orders and reports—the plain lines showing the issue and execution of the order, and the dotted lines, the reports of work done. (Illustration No. 4.)

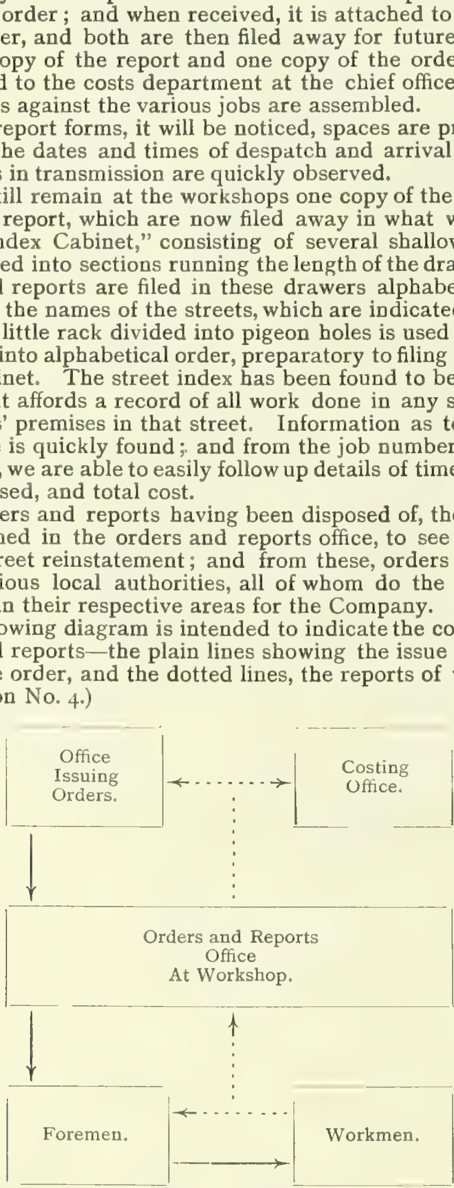


Illustration No. 4.

TIME.

The method of time-keeping is that each workman has his number, the same as with an ordinary time-board system; but instead of a time-board, he has a weekly card, which, at the beginning of the working week, is placed in the rack—marked A in the following illustration (No. 6)—containing slots numbered to correspond with the card numbers.

The man, as he enters, takes his card out of this rack, and records the time of entering on the card, which he then puts into the rack lettered B. When he leaves for the day, the reverse operation takes place—thus leaving the card in A ready for the next morning.

All cards left in rack A in the morning show at a glance the absentees; and the racks are locked immediately the men have finished recording their time. The cards are afterwards taken to the time office to have the previous day's time carried to the "total" column.

N. & G. Gas Co. Distribution Dept.

No.

Name

Week ending

DAY	IN	OUT	IN	OUT	TOTAL
A.M. F P.M.					
A.M. S P.M.					
A.M. S P.M.					
A.M. M P.M.					
A.M. T P.M.					
A.M. W P.M.					
A.M. T P.M.					

	Hours.	Rate.	£	s.	d.
Ordinary Time					
Overtime					
Total					

Illustration No. 5—size 7 inches by 2⅝ inches.

If a workman fails to register at night, owing to finishing late on an outdoor job, his card is placed in its proper slot in the first rack by the timekeeper. The workman, after registering his starting time next morning, instead of placing his card in the second rack, enters on it (in writing) his time of ceasing work the previous night, and takes it to his foreman to be initialled. The card is then given in to the timekeeper, who places it in its proper slot in the second rack.

The workmen have become accustomed to stamping their cards; and the operation is got through very quickly. All writing, save that of entering the names on the cards, is done away with; the dates being put on by a stamp and the numbers printed by a numbering machine. Thus, with less labour, we have a permanent record of each man's time, imprinted by his own agency, the accuracy of which he cannot afterwards dispute.

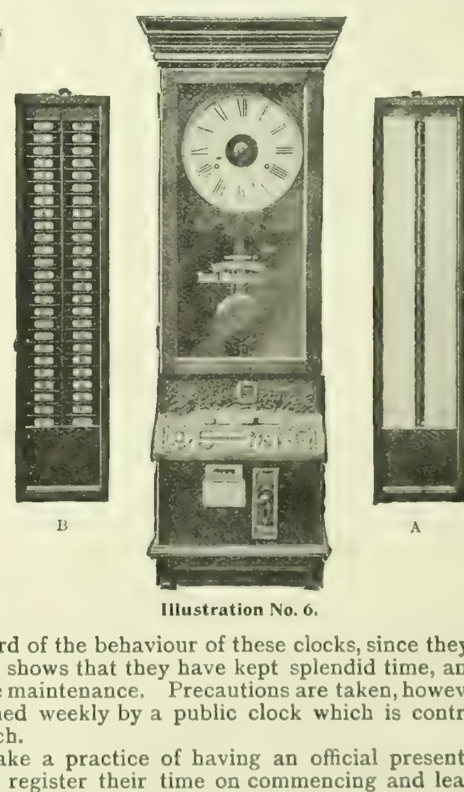


Illustration No. 6.

A record of the behaviour of these clocks, since they were first installed, shows that they have kept splendid time, and required very little maintenance. Precautions are taken, however, to have them timed weekly by a public clock which is controlled from Greenwich.

We make a practice of having an official present when the workmen register their time on commencing and leaving work, whose duty is to see that the workmen pass through without undue crowding likely to cause waste of time, &c.

At the end of the working week, all time cards are taken to the ne office; and the total time and wages are filled in at the foot each man's card. The total time and wages are then entered on pay sheets, a representation of which is given in Illustration No. 7. It will be observed that they are ruled for ur pays. The workmen's numbers, names, and rates of pay have thus only to be written out once a month, instead of every week as is usually the case when books are used—an arrangement which saves us several hours clerical labour each week.

We now want to ascertain that the wages to be paid are represented by work. Each workman gets a job card for each job he has to do (Illustration No. 2 shows that issued for a meter and

J2A

NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

DISTRIBUTION DEPT. No.

PAY SHEET.

Standard Hours per Week—53. V—3735

Workman's No.	NAME.	Standard Rate of Pay. Week.	Day.	Hour.	Pay No. Week ended Time.	Over-time (after 9 p.m.)	Amount.	Pay No. Week ended Time.	Over-time (after 9 p.m.)	Amount.	Pay No. Week ended Time.	Over-time (after 9 p.m.)	Amount.	Pay No. Week ended Time.	Over-time (after 9 p.m.)	Amount.	Workman's No.
	Brought forward																

Illustration No. 7—size 13 inches by 13 inches.

ervice pipe); and on these are registered, by time-recording achines placed near the foreman's office, the times of commencing and finishing each job. Men working on inside work, hile waiting for outside jobs, are generally employed on the ame kind of work during such intervals; and therefore one job ard for each class lasts the week. Regular jobs, such as loading nd unloading of stores, testing meters, making solder, cleaning rasswork for stock, estimating, &c., are each given a separate ut permanent job number, under which all work of this description is charged.

Very small outside jobs, the individual cost of which does not istify the labour of separate costing—such as attending naphhalene stoppages, turning on and off, cooker complaints, &c.—are lso charged under separate, but standing, job numbers. As all time orked is recorded on job cards, this, when priced-out, should gree with the wages to be paid. The job cards for completed ork, and those for jobs uncompleted on Thursdays (the end of ur working week) are sent, as received, to the time office, where hey are balanced with the money as shown by the time cards, hich reveals whether any man has lost an unnecessary amount f time between jobs.

The procedure here is that, as batches of cards arrive, the clerks alculate the number of hours recorded, and their cash equivalent. They enter these in the spaces provided at the foot of the cards, nd put the cards in racks similar to those previously described. There is one for each department—collectively having numbered lots for the cards of 900 men. The numbers are those already seen appearing on the time cards, pay sheets, job cards, and reports. Thus by the end of the week the whole of each man's job cards, which average about eight, are collected together. The cards are not only priced and balanced in this office, but also scrutinized as to excessive time on or between jobs.

The period between finishing one job and starting another is added to the former if not exceeding ten minutes. But if this time is exceeded, it is charged to a standing job number representing "Waiting for Jobs;" and the reason of the excess is inquired into.

Our works at Forth Street are divided into four chief subdepartments, each using several varieties of job cards suitable to the different classes of work dealt with. But no matter how numerous are the varieties of cards used in any one department, they are all of one distinctive colour. Thus the plumbing job cards are red; the mains department, blue; &c. This is to facilitate sorting operations preparatory to copying the time from the cards on to the wages abstract sheets.

The first step is to gather all the cards of each colour together; and this is where the utility of the device of having distinctive colours for the cards of each department shows itself—the sorting being done very quickly, and confusion between the departments prevented. The cards of each department are now arranged according to job numbers.

The next step in the process is to copy the time and wages from the job cards to the duplicate wages abstract sheets. (See Illustration No. 8.) Where two or more cards relate to the same job,

N. & G. GAS CO.

WAGES ABSTRACT.

DISTRIBUTION DEPT.

FORM No. 154. *Pay No.* *Week ended* *191* .

		7823		
25	6		4	3
150	6		3	0
	12		7	3
		7824		
56	5		3	6
65	7		5	0
171	6		3	0
190	5		2	3
	23		13	9
		7825		
5	7		5	0
15	5		3	6
136	7		3	0
191	5		2	3
	24		13	9

		7830		
16	25		17	9
131	25		10	6
21	17		12	0
157	17		7	2
332	7		3	2
341	7		3	0
	98	2	13	7
		7833		
7	5		3	6
176	5		2	3
	10		5	9
		7834		
56	53	1	17	6
171	53	1	5	0
	106	3	2	6

		7838		
1	17		12	0
157	17		7	2
168	9½		4	3
	43½	1	3	5
		78,0		
13	7		5	0
135	7		3	0
	14		8	0

7823	12		7	3
7824	23		13	9
7825	24		13	9
7826	7		5	0
7827	10		7	1
7828	2		1	0
7829	4		2	1
7830	98	2	13	7
7832	9		4	4
7833	10		5	9
7834	106	3	2	6
7835	7		3	2
7836	9		4	8
7837	7		3	2
7838	43½	1	3	5
7839	2		1	0
7840	14		8	0
		£10	19	6

Illustration No. 8—size 13 inches by 9 inches.

they are entered at the left side of the sheet, together with the workmen's numbers, hours, and wages. The hours and wages are then added together, and the total transferred to the right-hand column. Where there is only a single card for a job, the particulars are carried direct into the right-hand column.

A separate abstract sheet is made out for salaries, and also summaries showing the total wages for each department; and the grand total agrees with the amount of wages paid as shown by the pay sheets. The abstract sheets are (on completion) placed in binders; one set being sent to the costs department of the chief office, and the other retained at the workshop for reference.

For the disposal of the job cards, we have the time and costs office fitted with a number of deep drawers divided into longitudinal sections. In these, the cards are filed away according to their job numbers. Each department has its distinct drawer; and on the outside there are indicators showing the contents of the section. Arranged thus, the cards are very easy of access; and we readily obtain any information we require.

STORES.

I will now describe our system as applied to that important item, storekeeping. In this respect, we are at a great disadvantage from the fact that the whole stores cannot be centralized in one building, owing to lack of space. We had thus to adapt our system to rather difficult conditions, which we met to a great extent by organizing various sub-stores, and placing the whole in the charge of a chief storekeeper.

Stores are obtained by requisition to the chief office, on receipt of which an order in triplicate is made out—one copy being retained at the chief office, and another sent to the firm supplying the goods. This latter bears a request for the invoice to accompany the goods; and if the invoice has not arrived by the time of the receipt of the goods, a post-card reminder is sent. The remaining copy is despatched to the workshop to which the goods are to be delivered; and on it is provided a space for the use of the storekeeper. In it, when the goods arrive, he notes their receipt, date of arrival, and the condition in which they are received. The form is then sent to the accountant's department with the invoice.

Where only a portion of the goods ordered are delivered, their receipt is entered on what is termed a supplemental goods received form and sent to the chief office with the invoice. When the whole order has been executed, the copy of the order is returned. Goods, having been received, are recorded on the left-hand side of stock cards with the cost, as obtained from the invoice.

Illustration No. 9 shows one of the stock cards. We have a few different rulings to suit various classes of goods. The issues of stores are recorded on the right-hand side. A separate stock card is kept for each description of article stored; and we have in current use altogether 4800 of these cards, which are stored vertically in cabinets. Each branch-shop has its own set.

Our materials are all classified; and the cards relating to the various articles comprised in each class follow each other in sequence. The cards are also numbered consecutively for reference.

N. & G. GAS. CO.	Form No. 117.				251370							MAX. STOCK.		MIN. STOCK.	
RECEIVED INTO STOCK.						ISSUED FROM STOCK.									
Date.	From.	Order No.	Quantity.	Rate.	Amount.	Reqn. No.	Quantity.	Reqn. No.	Quantity.	Reqn. No.	Quantity.	Reqn. No.	Quantity.	Total Issued.	Balance.

Illustration No. 9—size 11 inches by 9½ inches.

As to the issue of goods, these are all handed out by the storekeepers; and no other person is allowed to handle them while in stock or to go behind the stores counter. Neither is anything allowed to be supplied to anyone on a verbal request. The man who requires material for his job must write out a requisition (see Illustration No. 10) on which he shows the job number and his own number. It is not found that there is any appreciable loss of time in the workmen having to do this small amount of writing; and it saves the time of the clerical staff.

N. & G. Gas Co., Distribution Dept. Forth Street.	STORES ORDER—METER FIXING. Form No. 120. 286494			No.
To the Storekeeper. Please supply me (Workman No.) with the following Meter and Materials:				Job No.
To be filled in by Storekeeper. Meter. / Maker.	Maker's No.	Co's. No.		Reserved for Office use
Year Made.	Meter Reading.			Rate / Amount.
Quantity.	Description.			
Date................		.... Storekeeper.		

This Card to be kept flat and clean.

Illustration No. 10—size 6½ inches by 4 inches.

The storekeeper, on the workman presenting his requisition, satisfies himself that the articles asked for are proper ones for the job. Having supplied them, he retains the requisition, from which the goods issued are posted to the issued side of the stock cards; and from the latter the cost is entered against the items on the requisition, and these are calculated and sent to the costing office daily.

Materials returned by workmen are shown on credit notes provided for the purpose; and these materials are entered on the received side of the stock cards without any price, and then dealt with in the same way as the requisitions. Old materials brought in from jobs are handed over to the storekeeper; a form for such being filled in and also dealt with in the costing office.

I may say that for prepayment installation stores we use, for convenience, the following requisition forms (Illustration No. 11) on which are shown the materials returned; and these, deducted from those issued, show the net. This saves credit-notes and consequent postings. This principle can be applied to requisitions for goods for other classes of work.

At the top of the stock card (Illustration No. 9) is a space for entering the maximum and minimum stock it is desirable to keep; and the storekeeper can easily tell how near he is approaching the minimum, and also what quantity should be ordered, as the state of the stock of any article can be ascertained from the cards. At the end of the half year, the received and issued columns of the stock cards are added up; the balance carried down; and the totals transferred to stock sheets. The actual stocks of stores, and the balances as shown by the stock cards, are entered on the same stock sheets and priced, and they should agree within narrow limits. If they do not, the matter is investigated.

Under this heading, I may mention two other items of charge against jobs; the first being cartage or motor traction. For this, way-bills are used—being made out to show the time occupied in delivering goods for the various jobs; the job number being quoted in each case. A copy of this is sent to the costing office for charging against the job; and a similar course is followed as to any expenses incurred which are chargeable against jobs.

ASSEMBLING OF COSTS.

We now arrive at the assembling of the costs of each job. We have seen the costings office supplied with the following particulars:—

1. A copy of the order and a report of the completion of each job.
2. A wages abstract, showing the wages chargeable against each job.
3. Priced requisitions as to goods issued and returned on each job, and from which an abstract is compiled similar to the wages abstract.
4. Charges for cartage or motor traction.
5. Chargeable expenses.
6. Notification on report of completion of job whether reinstatement of road is necessary.

As practically all reinstating is done by the local authorities, and we cannot get the charges in time to close-off the weekly sheets promptly, each reinstating charge is roughly estimated, and the whole account adjusted at the end of the half year.

From these particulars the following weekly sheets (Illustration No. 12) are made out in triplicate; a separate set being employed for each class of work shown. These are added up, and the totals of each carried to their respective accounts in the costing card ledger.

The cost account-keeping is on the double-entry principle, and closely related to the general accounts of the Company. For instance, the wages, as shown by the wages abstract (which it will be remembered is made up from job cards), are posted in the costs account to the debit of the respective jobs on the costing sheet just shown, and credited in one sum each week to a wages account. These, therefore, must balance; and they must also agree with the wages account in the general books, as obtained from the pay sheets made up from the time cards. The costing accounts supply the division of the items for the distribution headings in the general accounts.

It will be noticed that oncost is provided for in the weekly cost sheet. This is for indirect or establishment charges, but is only dealt with once a month.

Charges for work done are made up from these sheets. The Secretary, the Chief Engineer, and myself, are each furnished with one of the triplicate copies of the sheets.

SCRUTINY AND USES OF COSTS.

The objects of the system are to obtain expedition in carrying out work, to prevent waste, and to obtain an accurate method of allocation of expenditure. But this, like many other systems in business, merely provides the information, and it is by an intelligent use of such that the benefits are to be derived.

The weekly costing sheets show the cost of individual jobs, and the classified items of which the same is made up; and they are carefully examined. The costs of the several classes of jobs are averaged, and compared with those of the previous weeks; and the cause of any increase is inquired into.

A selection of jobs, the costs of which do not *primâ facie* appear unreasonable, is also made up; and these are gone into by way of additional scrutiny against waste, &c. The average cost of wages for prepayment installations is calculated each week; the

N. & G. GAS CO., Distribution Dept., Diana Street.

STORES ORDER.

Prepayment Installation—Fittings.

Form No. 180. 290,133 Job No.

Stock Card No.	Materials. Description.	Issued.	Retd.	Used.	Reserved for Office Use. Rate.	Amount.
	Meter Fixing—					
	Meter . . .					
	Padlock . .					
	Meter Cock .					
	Brass Ferrules . .					
	Lead Pipe .					
	Iron Tube .					
	,, Bends .					
	Cooker Parts—					

Stock Card No.	Materials. Description.	Issued.	Retd.	Used.	Reserved for Office Use. Rate.	Amount.
	Cooker or Griller Fixing—					
	Cooker . . .					
	Lever Cock . . .					
	,, Handle . .					
	Griller . . .					
	,, Plate . . .					
	,, Cock . . .					
	Brass Ferrules . .					
	Lead Pipe . . .					
	Iron Tube . . .					
	,, Bends . . .					
	Flue Pipe . . .					
	,, Tees . . .					
	,, Cones . . .					
	,, Elbows . .					
	,, Damper . .					
	Cement Slab. . .					
	Flooring Board . .					

Stock Card No.	Materials. Description.	Issued.	Retd.	Used.	Reserved for Office Use. Rate.	Amount.
	Internal Fittings—					
	Pendants . .					
	Brackets . .					
	Pattrices . .					
	Burners . .					
	Iron Tube .					
	Drop Screws .					
	Hooks. . .					
	Nails . . .					
	Screws . .					
	Fine Solder .					

N. & G. GAS CO. Distribution Dept., Diana Street.

STORES ORDER. Prepayment Installation—Fittings. Form No. 180.

Job No.

To the Storekeeper. Please supply me (Workman No.) with the following Materials for the above Job:

	Maker	Maker's No.	Co.'s No.	Year Made	Meter Reading
Meter					

	Maker	Number
Cooker		
Griller		

To be filled in by Storekeeper.

Date______ Storekeeper.

This Card to be kept flat and clean.

Illustration No. 11—size (when folded) 6 inches by 4 inches.

N. & G. GAS CO.

DISTRIBUTION DEPT.

Form No. 179.

x—38

Office No.	Job No.	ADDRESS.	LABOUR. Hours.	LABOUR. Amount.	MATERIALS.	MATERIALS. Stores.	MATERIALS. Show Room	Chargeable Expenses.	Re-instating Street.	Cartage.	Total.	On Cost.	Total.	Estimate.	Charge.	Capital.	Revenue.	Remarks.

Illustration No. 12—size 16 inches by 10½ inches.

figures for the different branch workshops being compared. The cost of each street-main is examined and compared with others of similar diameter. Manufacturing receives special attention; the cost of production for each article or lot being gone into and placed against previous results.

There is not the slightest doubt that the system has effected many economies. The men are more punctual, as they are aware the recorders show the exact minute of arrival; and punctuality with a large body of men means a great amount of time saved. There is less waste of time between finishing one job and commencing another, and less frequent delays in the execution of orders, as at three points—viz., the office issuing the order, the orders and reports office, and the foreman's office—are provided means of keeping watch upon uncompleted jobs.

The comparative value of workmen is shown, and also where specialization of men is an advantage. There is better supervision and check on the stores; less stocks are carried; and delays are avoided by having to wait for material through the stock having run out unnoticed.

The foremen are informed of the cost of work done in their departments, which stimulates them to increased efforts towards economy; and the fact that workmen are aware that their jobs are the subject of investigation acts as a strong deterrent against wrong-doing, and the whole *morale* of our men is improved. The men took kindly to the system, and gave it a fair chance from the commencement.

Distribution departments of gas undertakings are places where job costing systems are of greater advantage than in many factories, because so much of the work is outside and consists of work engaging one or two men away from constant supervision

and not in gangs in charge of foremen on the spot to avoid waste. We have inspectors who visit jobs; but their visits are necessarily brief, and not always after the completion of the work. Therefore, you want to know the ultimate result in money.

A job costing system generally means extra clerical labour; but I have not known of any works where one has been introduced and afterwards discarded. The advantages are too great. The introduction of our system resulted in increased clerical staff; but this has been more than compensated for by savings and efficiency.

I recognize that the system I have outlined is for a distribution department dealing with a greater volume of work than that falling to the lot of most of the undertakings in the North of England; but it can be easily modified to suit businesses of smaller dimensions and different conditions, and the units of separate costs can be made whatever is desired. To set down in writing the details of the system makes it appear rather formidable; but in reality it is simple and runs smoothly. If any of the members of the Association desire further information, an endeavour will be made to satisfy their desires.

SHORT-SIGHTED POLICY.

The question of obtaining the best value for money (as the subject to which I have been referring undoubtedly is) constrains me to make reference to another subject in the same category—viz., the use of articles of good quality. In these times of strenuous competition, the buyer is often tempted to purchase goods which at first sight appear to be cheap and to meet requirements. But this is, too frequently, a short-sighted policy to be strongly condemned from a distribution point of view. The cheap article may suggest a momentary attraction; but for the commodity with which we deal, a good article at a fair price should always be the standard of purchase.

The cutting of prices, which necessitates relative reduction in value of the material and workmanship, ought to be discouraged by gas undertakings, and rather should encouragement be given to the manufacturer of a good article which will not develop any latent defects, no matter what part it is intended to serve, from the main to the point of consumption. If a piece of work is worth doing, it is worth doing well; and as good material and apparatus are essential to a good job, anything "cheap and nasty" should be rigorously eschewed.

A CENTRAL TESTING STATION.

In order to keep abreast of the times, it is the practice with this Company, as with many others, to obtain particulars of everything that is new, and in many cases to obtain a sample for testing purposes. But it is to be regretted that too often the articles are found to be of little or no commercial value; and in other cases they are imitations—and poor ones at that—of something already on the market.

This testing costs each concern a good deal of money; and I have long thought that if some means could be devised whereby all new appliances passed through some recognized centre for testing purposes, and the results were supplied to the undertakings contributing to its cost, it would tend to prevent a lot of inefficient apparatus being placed on the market, and there would be a great savng to the individual subscribers.

I quite realize that many difficulties present themselves against such a scheme; but if the broadening of the basis of the Institution of Gas Engineers, so commendably suggested by its immediate Past-President, is carried through, and there is a greater cohesion between traders and gas undertakings, some of these obstacles would not be nearly so formidable as they at present appear.

COOKER SIZES.

I would also like to draw attention to the question of the number of cookers the makers supply. If you take the list of any maker, I think you will come to the conclusion that there is not sufficient difference between the smallest and largest to justify the variety of sizes manufactured. Personally, I am of opinion that four sizes are ample to meet the ordinary requirements of the public; and if the demand were spread over this number (which could only be done by joint action), the makers should be able to make, and consequently sell, more cheaply—resulting in less rental being charged to the consumer, and, in turn, tending to increase the output. It would also be a decided advantage to gas undertakings if, by agreement, the dimensions of the ovens of the corresponding cookers of each maker were uniform, so that small parts—such as drip tins, shelves, grids, and possibly linings—were interchangeable, and thus reduce this stock of the parts to be kept. Improvements, however, even in small parts, should not be sacrificed for the sake of adhering to interchangeability.

MECHANICAL PUBLIC LIGHTING.

Members, meeting in a place where experiments with mechanical lighting of public lamps on a large scale are being carried out, will probably expect me to say a few words as to the progress of such experiments. It will afford me much pleasure to give the members such information as I may, consistently with the understanding between the parties concerned that information as to the working shall not be disclosed until the experimental period has terminated.

I am unable to say how long ago it is since the idea of automatically lighting and extinguishing public lamps was first conceived; but it is on record that a Mr. Butcher experimented in the streets of Newcastle in the year 1885, with an apparatus of his own invention. The Butcher apparatus was composed of a metal chamber, containing two small holders sealed in mercury, one of which merely acted as a governor and controlled the bye-pass while the pressure was in action. The other holder contained an inverted cup of such depth that, under normal conditions, the gas-way to the burner was sealed and shut off. When the pressure was applied, the holder rose and allowed gas to pass to the burner; and, on the pressure being removed, it was held in position and prevented from falling by a rack-and-pin arrangement inside the holder. The next wave of pressure at extinguishing time caused a further operation in the rack, and allowed the holder to drop and seal the way to the burner—thus shutting off the gas.

In April, 1903, experiments were commenced with clockwork on 100 lamps in Jesmond; but these were discontinued after a period as the Newcastle Corporation were not then disposed to entertain mechanical lighting.

In May, 1907, experiments were commenced with the pressure apparatus of the Bamag Company, when 82 lamps were fitted up in certain streets near the governor-house. The experiments ceased after six months working, as it was considered that before any final decision was come to as to the desirability of the general adoption of a system of pressure lighting, an experiment should be carried out at a considerable distance from the governor-house.

The Gosforth Urban District Council were approached in October, 1907, for permission to fit up the whole of the 500 lamps in their district with "Bamags." This was readily granted, and they were fitted up and first operated in February, 1908. They are still being operated.

The lighted area consists of twenty miles of streets; the first lamp being at the point where the district joins the City of Newcastle, two-and-a-half miles from the governor-house, and the furthest lamp an additional one-and-a-half miles away.

At the commencement of the experiment, the higher pressure required to actuate the apparatus at this distance was allowed to pass through the whole of the Company's distributing mains on the north side of the Tyne; but, as this was considered to be inadvisable, the main feed to Gosforth was isolated, and the extra pressure confined to that district.

The whole of the lamps are looked after by two attendants, who are provided with special bicycles carrying a light folding ladder, and a holder for a small supply of mantles, &c. They inspect the lamps both at lighting and extinguishing times, and attend to any failures there may be—making a note of same for inclusion in their report to the office. These men also clean the lamps; the whole of their beat being covered once a week.

The number of failures is comparatively low—about 5·74 per actuation, chiefly due to naphthalene stoppages on the service pipes. At one time bye-passes gave a certain amount of trouble, from the fact that they were blown out whenever there was a wind velocity of anything approaching 25 miles per hour. As wind-storms of this and even greater speeds are often experienced in our district, we were obliged to carry out experiments, resulting in the adoption of a cup form of bye-pass, which has proved so efficient that we are now rarely troubled with the bye-passes becoming extinguished unless in extremely bad or hurricane weather.

The installation has afforded complete satisfaction to the District Council; and I believe they are prepared to take it over permanently. But we have thought it advisable to defer the question until the completion of the further experiments I will now refer to.

FURTHER EXPERIMENTS.

In November, 1909, in accordance with an arrangement with the Lighting Committee of the Newcastle Corporation, three systems of 250 lamps each were installed within an area about a mile from the governor-house. These consist of—

Alder and Mackay	Pressure apparatus
Bamag	do. do.
Horstmann	Clockwork do.

It was decided that the experiment should continue for twelve months, and in the sole charge of the Company; the makers taking no part whatever in the working. Each installation is looked after by one man only, who cleans the mantles, &c., as at Gosforth.

As I have already intimated to you, I am not in a position to furnish at present any information with respect to the working of this experiment; but, when concluded, a statement of the results will probably be prepared, and this will be available to such of the members as are interested in the subject. I may, however, without any indiscretion, state that, so far as the experiments have gone, the general results are very satisfactory in each system; and, further, that in my opinion the feasibility of pressure lighting has been established. But under certain conditions it is not desirable to operate apparatus over large areas where district governing does not exist, or where the cost of its installation is prohibitive. In such cases, the difficult portions of the area can be operated by the clockwork system.

As might be expected—conditions being required which were never anticipated in the arrangement of the mains—many difficulties have arisen during the whole of the experiments, most of which steady determination has enabled us to mitigate if not entirely remove.

In conclusion, I think it ought to be mentioned that the Specia

Purposes Section, which, at your last meeting, you authorized to be commenced, is now an accomplished fact. I am sorry more undertakings have not as yet intimated their intention to nominate representatives; but there is no doubt that the benefits to be derived by those who have already joined the section will be such as to induce increased membership. The more opportunities we have for the interchange of ideas, and for agreeing upon uniformity of methods (as hinted at in the course of my address), the more the industry has to gain.

Mr. T. H. Duxbury (South Shields) proposed a hearty vote of thanks to the President for his able and lucid address. He said the President was not only a fully qualified gas engineer, but having specialized in gas distribution work under what he would suggest was one of the most enterprising gas companies in the whole world to-day, he held a unique position; and of his knowledge and ability he had given them proof that morning.

Mr. H. Tobey (Malton), seconding, said that in Mr. Lewis they found a most excellent President. He had given them an address which must be of considerable value to every gas company. Of course, in the case of a company with something like 110,000 to 120,000 consumers, it was necessary to have a system of working; and that the system which had been devised by Mr. Lewis, and which he had expounded to them, showed them that they were working out the thing in a most elaborate and satisfactory manner. Smaller concerns, no doubt, did not require such a system as this; but still, he thought, they would find, if they would look at the address, that if they would take a few hints from it, the scheme would be a valuable one, and might be adopted even by smaller concerns. Presidential addresses, and the papers read as well, enabled them to see what was being done by others, and to gather from other people's experience what would, perhaps, be of great use to them in their own works. They were also indebted to the President for the very interesting excursion they had made that morning round the Elswick Ordnance Works. It was an interesting visit. They had had brought before them a great many things which some of them did not often have an opportunity of seeing—things which somewhat astonished them, in the magnitude of the work and the appliances for carrying out that work.

The President, acknowledging the vote of thanks, said he was pleased to hear there was a certain amount of value in his address. His one aim had been to give them something which might be useful; and if this object had been achieved, then, of course, the pleasure was his.

This concluded the business of the meeting.

Excursion and Dinner.

The company afterwards sailed from the Quayside to Tynemouth, where, at the Bath Hotel, they were entertained to dinner by the Newcastle and Gateshead Gas Company—Mr. W. Sutton, J.P., one of the Directors, presided over a company of about 130.

The Chairman proposed "The North of England Gas Managers' Association," and in doing so said he was pleased to know that the Association had its origin and its inception in the Newcastle and Gateshead Gas Company's offices. The late Mr. W. Hardie had an active interest in the gas industry, and over and again he had the officials of various gas industries about Newcastle with him in his office discussing the best way of doing things. He was sure that this irregular and informal way was very much improved by the Association which they now had. The Association had had in the past three of their esteemed officials as President—Mr. W. Hardie, Mr. Doig Gibb, who was with them that day, and whom they were very pleased to see, and would always be pleased to see in the North of England, and Mr. Thomas Hardie, now their Chief Engineer. Now they had—and he took it as a compliment to the Company—Mr. Lewis, their Distributing Engineer, as President.

The President, in acknowledging the toast, referred to the proposal to change the day of the meeting, and said that the Committee were not taking a vote upon the subject, but wished to ascertain what might be the wishes of the members. Before anything was done, the matter would be brought before the Association. The Special Purposes Section had commenced extremely well. It was undoubtedly going to do a great work, which was only natural, seeing that while the Association met only twice a year the Special Purposes Section would meet monthly. As yet they had only had one meeting, at which their worthy Secretary, Mr. Lees, introduced a subject which affected not only that district, but the industry generally. This was, he expected, the forerunner of many other important subjects which would come before them for discussion, and for the benefit of the industry. They required more members for the carrying on of the section successfully; and he felt certain that when the full benefits were comprehended, they would get these members. In the meantime, those who were not members were losing good material.

Mr. H. Tobey proposed "The Chairman and Directors of the Newcastle and Gateshead Gas Company," to which the Chairman responded.

Mr. F. P. Tarratt (Darlington) proposed "Kindred Associations." This was responded to by Mr. J. Bond, of Southport, as representing the Manchester District Institution of Gas Engineers.

Mr. W. Doig Gibb (London) proposed the toast of "The Chairman." He wished to say how much he was gratified to be once more among them.

The Chairman briefly returned thanks; and the proceedings terminated shortly before five o'clock.

The late Mr. Mark Archer, Managing-Director of the Holmside Collieries, Durham, and of the South Moor Colliery Company, Limited, of Newcastle-on-Tyne, whose death was announced in the "Journal" for the 16th of August, left estate of the gross value of £96,906, with net personalty amounting to £90,727.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

On an invitation from Mr. E. Pilbrow, the Superintendent of the Joint Gas Companies' Exhibit at the Japan-British Exhibition, members of the London and Southern District Junior Gas Association, to the number of about sixty, on Saturday afternoon visited Shepherd's Bush and, after inspecting the excellent show of up-to-date gas appliances to be seen there, were entertained at tea in the Garden Club. Mr. F. W. Goodenough, Controller of the Gas Sales Department of the Gaslight and Coke Company, had consented to preside at the tea; and, on being asked to address the members, he did so. Those present greatly appreciated Mr. Goodenough's remarks, and altogether the afternoon was thoroughly enjoyed.

Mr. L. F. Tooth, the new President of the Association, proposed a hearty vote of thanks to Mr. Goodenough for giving them a few of the scanty moments he had to spare; and with this he coupled the name of Mr. Pilbrow. Mr. D. J. Winslow seconded the proposal, which was supported by Mr. W. J. Liberty, who said they had had the clearest evidence that Mr. Goodenough took a very lively interest in the affairs of the Association. The vote having been carried with applause, Mr. Goodenough, in acknowledgment, remarked that Mr. Liberty was perfectly right in saying that he (the speaker) took very great interest in the Association, and in all the young men engaged in the gas industry. Mr. Pilbrow also returned thanks.

MANCHESTER UNIVERSITY LECTURES ON GAS.

An intimation is to hand—signed by the Vice-Chancellor of the University of Manchester (Sir Alfred Hopkinson) and the Professor of Chemistry, Dr. Harold B. Dixon—giving particulars of the two courses of lectures arranged for the present session, in consequence of the movement originated by the Manchester and District Junior Gas Association, and supported by the Manchester Institution of Gas Engineers, for promoting scientific work in the University by those interested in the gas industry.

First of all there has already started an inaugural course of six lectures, on the science of gas manufacture and combustion, of which the following is the

Syllabus.

Oct. 1, 1910.	"Chemistry of Gaseous Combustion," Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President of the Chemical Society.
Nov. 5 ,,	"Internal Combustion Engines," Dugald Clerk, Esq., F.R.S.
Dec. 3 ,,	"Carbonizing," Harold G. Colman, Esq., D.Sc., Ph.D.
Jan. 1, 1911.	"Construction as applied to Gas-Works," Charles Hunt, Esq., M.Inst.C.E., Past-President of the Institution of Gas Engineers.
Feb. 4 ,,	"Chemical Control of Gas-Works," J. T. Sheard, E q , Chief Chemist, Sheffield United Gas Company.
March 4 ,,	"Pyrometry," J. A. Harker, Esq., F.R.S., of the National Physical Laboratory.

The lectures are given in the Chemistry Theatre of the University at 3 p.m., and admission is free to all interested in the gas industry, on presenting a ticket to be obtained from the Hon. Secretaries of the District Associations (Mr. W. Whatmough, Gas-Works, Heywood, or Mr. J. Alsop, Laymarice, Edgeley Road, Stockport), or from the Registrar of the University.

Then there is to be an advanced course of twelve lectures and demonstrations on the chemistry of gaseous fuel and flame, designed for those who have already acquired a knowledge of gas manufacture.

Syllabus.

Kinetic Theory of Gases. Pressure of Condensable Vapours. Nature of Chemical Change. Flame and its Structure. Theory of Luminous and Non-Luminous Flames. The Ignition Points and Specific Heats of Gases. Temperature of Flames. Phenomena of Explosion in Gases. Pyrometry. Standardization of Thermo-Junction Pyrometers. Constant Temperature Furnaces. Calorimetry. Preparation of Pure Gases. Manipulation and Analysis of Gases. Theory of Fractional Distillation and Condensation.

These lectures will be given by Professors Dixon, Carpenter, and Petavel, Dr. Lapworth, Dr. Norman Smith, and other members of the staff. The first will be held on Monday, the 17th inst., at 7 p.m.; and the fee is £1 1s. for the course. It is expected that some of those attending this course will undertake research work in connection with gas problems.

Arrangements have been provisionally made for the annual meeting of the Yorkshire Junior Gas Association to be held on the 15th inst., when Professor Cohen, of the Leeds University, has promised to lecture on "Smoke."

At the meeting of the Lancaster Town Council last Wednesday, the resignation of Mr. J. C. Mount, Assoc.M.Inst.C.E., who has held the position of Borough Surveyor and Water Engineer for 25 years, was accepted with regret.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

Half-Yearly Meeting at Newport.

Again favoured with fine weather, the Institution last Wednesday held their September meeting at Newport (Mon.), with whose gas-works the new President, Mr. J. H. Canning, is connected. It was the second visit of the members to the town; the previous meeting there having taken place in 1906, during the year of office of the first President of the Institution—Alderman Thomas Canning, the Engineer and Manager of the Gas Company. On their return, they still found a progressive gas undertaking much more than holding its own against municipal electricity. Those who arranged to stay during the evening were able to inspect numerous excellent examples of outside lighting by means of incandescent gas, and numerous startling examples of shop window lighting by the aid of particularly aggressive flame arc lamps, some of which are placed almost in the line of vision of those who pass them. When one sees a diminutive shop window under the glare of three or four flame arc lamps, curiosity as to the cost will manifest itself. If the Newport shopkeepers who favour electricity pay a commercial price for their current, the lighting bills of some of them must be fairly heavy; and if they do not pay a remunerative rate, who makes up the difference? It is, of course, a fact that electricians have sometimes fearful and wonderful methods of charging which are of so complicated a nature that people have considerable difficulty in finding out what they do pay. Whether or not this has been the case at Newport, we will not stop to inquire. It is, however, common knowledge that an expert was lately called in to advise upon the present position of the Corporation electricity undertaking; and that, on the strength of his report that they were selling the current too cheaply, the authorities have recently had to raise the price. There is in this the comforting reflection to those who use the Newport streets that it should not tend to further popularize the use of big flame arc lamps for the outside lighting of little shop windows—or of any shop windows at all, for the matter of that. That the business of the Gas Company is conducted in an enterprising manner, no one who knows Mr. Canning will doubt, and no one who has visited Newport will need to be told. The excellent installations of outside gas lighting that are to be seen have been referred to; and the members had a good example of indoor work in the Savoy Hotel, where luncheon and tea were partaken of at the invitation of the Directors of the Gas Company. Here the whole of the lighting, cooking, and heating is carried out by means of gas. The building is lighted on the high-pressure system; there being 176 burners, yielding a total illumination of close upon 24,000-candle power. Cooking is carried out by a modern and complete set of apparatus in the main kitchen; while, in addition, grillers, water-heaters, and other auxiliary appliances are fixed at various points in the establishment in order to meet the demands of the extensive business carried on. Then the building is heated throughout by gas-fires and radiators; the former being enamelled to harmonize with the general colour-scheme of the respective apartments. The Company have a handsomely-fitted show-room opposite the tram-centre in the town, where an extensive stock of gas fittings and apparatus is maintained. A compressor driven by a gas-engine is installed here, and supplies, besides the outside lamps at the show-room, a great number of shop-lamps in the neighbourhood. With other South Wales towns Newport has, of course, been feeling the effects of the unrest in the coalfield; a number of contracts from abroad having been lost on account of the uncertainty of being able to get the coal. It is, however, pleasant to learn that now things seem to be improving; and thus the town and the Gas Company have both before them every prospect of continuing to progress. That this may be the case will be the earnest wish of all the members of the Institution—and particularly of those who were able to take part in Wednesday's proceedings. The Chairman of the Company (Dr. H. Melvill Brewer), the Directors, the Secretary (Mr. T. H. Hazell), and, of course, Messrs. Thomas and J. H. Canning, left nothing undone to make the day a thoroughly successful one. The welcome extended to them will long be remembered by all who attended the meeting.

THE BUSINESS MEETING.

When the members assembled in the Gas Offices (which had been placed at their disposal for the meeting by the Directors of the Company), the chair was taken by Mr. A. H. Brookman, Engineer and Manager of the Tenby Gas Company, who was the retiring President.

A Welcome.

Before the business was entered upon,

Dr. H. Melvill Brewer, the Chairman of the Newport Gas Company, extended a hearty welcome to the Association. He said he trusted the accommodation would prove to be what they required, and that the deliberations of the members would be satisfactory. He hoped they would be able to form some plan by which to obliterate electric lighting altogether. (Laughter.) Later on at the luncheon, he would see them again.

Minutes of the Last Meeting.

The Hon. Secretary (Mr. Octavius Thomas, of Pentre) read the minutes of the meeting held last May at Cardiff; and they were confirmed.

The Late King.

The Hon. Secretary then read a letter from Mr. Winston S. Churchill in the following terms: "I am commanded by the King to convey to you hereby His Majesty's thanks for the loyal and dutiful resolution of the members of the Wales and Monmouthshire District Institution of Gas Engineers and Managers on the occasion of the lamented death of His Late Majesty King Edward VII. I am to say that the expression of sympathy with Queen Alexandra has been laid before Her Majesty, who desires me to communicate to you her thanks."

Regrets for Non-Attendance.

The Hon. Secretary intimated that letters expressing regret at inability to attend the meeting had been received from, among others, Mr. Alexander Wilson, of Glasgow, the President, and Mr. R. G. Shadbolt, of Grantham, Vice-President, of the Institution of Gas Engineers.

New Members.

Two new members were elected—Mr. Henry Downing Hazell, Distributing Engineer at the Newport Gas-Works; and Mr. William Bernard Mimmack, Engineer and Manager of the Pembroke Docks and Town Gas Company.

The New President.

Mr. Brookman said the time had now come for him to vacate the chair; and he had the pleasure of introducing their friend Mr. J. H. Canning, who would fill the vacancy. Mr. Canning was a gentleman who had given proof of his ability to deal in a masterly manner with questions affecting both gas and electricity. The members would agree that he would fill the chair, not only with distinction to himself, but with credit to their Institution and to the industry in general. He asked them to accord Mr. Canning a very hearty welcome.

Mr. Canning (after having taken the chair, amid applause) thanked the members for the cordial manner in which they had received him, and especially Mr. Brookman for the kind and totally undeserved remarks he had made.

The Retiring President Thanked.

The President said his first duty was a pleasant one—namely, to propose a hearty vote of thanks to Mr. Brookman for the able manner in which he had filled the presidential chair. The Institution had now had a number of Presidents who had all of them sustained the position with dignity; and he was sure that Mr. Brookman was second to none in the way he had carried out the duties.

Mr. R. A. Browning (Neath) seconded the vote; expressing his full concurrence with all that the President had said.

The vote having been carried with applause,

Mr. Brookman acknowledged it. He was afraid, he said, that he could not lay claim to have done very much, though he would have liked to be able to do so. He could only say that the work attached to the presidency of this young Institution had been a very great pleasure to him. Unfortunately, distance had prevented him from attending all the meetings; but he had done his best to maintain the prestige of the Institution, which he sincerely hoped might long continue to make progress.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—In the first place, permit me to thank you most heartily for the great honour you have done me in electing me your President—a distinction I owe purely to your kindness and to no merit of my own. But I am confident that you will extend the same kindness so far as to overlook my shortcomings in the discharge of the duties of this high office. In view of the numerous and admirable addresses delivered in recent years by the Presidents of Associations connected with our industry, I feel it

would be hopeless to aim at originality or novelty in anything I may attempt to put before you, especially as what little I might say has been so much more ably presented, and so much better expressed, by others. It is my purpose therefore to deal very shortly and simply with a few phases of the modern developments of the gas industry.

THE RESTRICTIONS ON GAS SUPPLY.

For sixty or seventy years following its inception, gas, possessing as it did an almost complete monopoly of the field for lighting, made great material progress; but the incentives to invention and the development of the use of gas for other purposes than lighting were altogether lacking. At the same time Parliament imposed rigid obligations and restrictions upon gas undertakings; and under the circumstances of the time, these safeguards no doubt fulfilled a useful purpose. To-day every condition under which gas supply was heretofore carried on has changed; and the gas industry is practically in the same relation to the public as the great bulk of commercial undertakings, inasmuch as it obeys with them the laws of competition, and of supply and demand. Differences are, however, still apparent. While many of the restrictions framed to meet conditions no longer existing still remain, Parliament has, in the public interest, very wisely removed or relaxed a few of these checks to progress. Of those still in force, there are many whose careful revision would be most decidedly to the public advantage; and the united action on the part of gas undertakings to procure such a revision of the General Acts applying to our industry would at the same time both enable competition to be better encountered and benefit the consumer. This point may be urged with the greater freedom inasmuch as the fierce competition in which we are engaged completely eliminates the necessity for many of the old safeguards, the removal or relaxation of which would certainly result in ultimate benefit both to the industry and to the public. There is another marked difference. During the past few years, the prices of most articles of popular consumption have materially advanced, among others that of coal—the raw material of gas manufacture. In spite, however, of the considerable advance in the cost of coal, the price of gas generally has not been advanced, as the benefit of economies effected by means of improved methods of manufacture has been transferred to the pocket of the consumer.

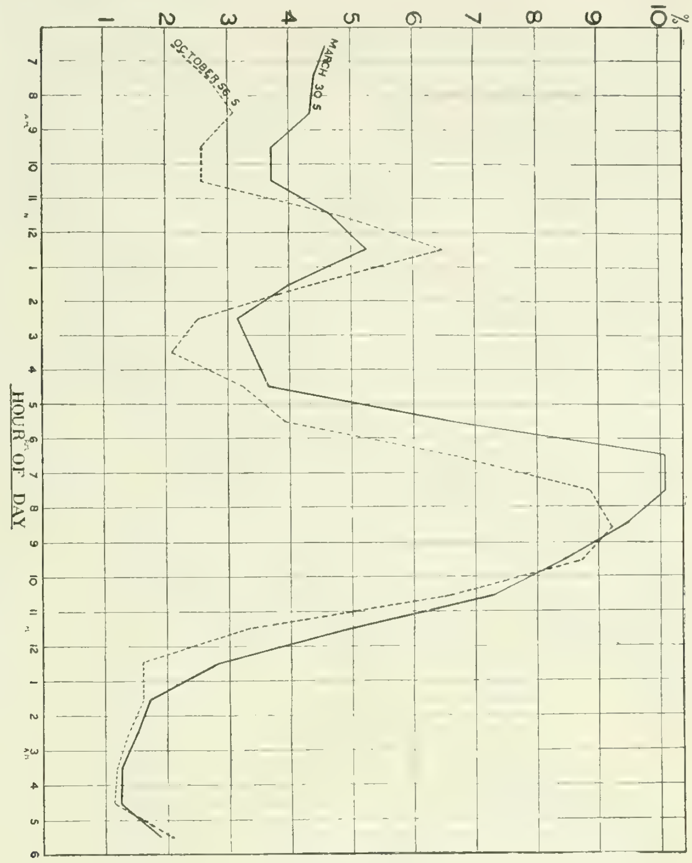
MODERN ADVANCES IN GAS SUPPLY.

The most striking, however, of all modern changes in the industry has been the great development in the use of gas for heating and cooking purposes. The incandescent gas-burner brought about, of course, a great revolution in an already existing field—that of lighting; but the application of gas for heating and cooking is more epoch-making still, in that it has opened up an absolutely new sphere of action, and one, moreover, to which gas is eminently well adapted. In the earlier days of gas lighting—the output being determined by the regular seasonal variations in the length of day and night—it could be very accurately predicted for any given period of the year; a heavy winter fog being practically the only disturbing element. At the present time, however, the erratic variations of temperature possess a great and increasing influence upon both the absolute quantity and the distribution in time of the output of gas.

You are all familiar with the elementary facts of the increase of the heating load (if I may borrow this term from our competitors) during periods of low temperature, and the part played by hot weather in stimulating the demand for gas for cooking purposes. But it is somewhat difficult to ascertain to what extent these influences are operative. This difficulty may to some extent be got over by comparing the hourly output of gas during each of two periods of the year during which sunset takes place at nearly the same hour, but the temperatures of which differ considerably. Probably two of the most suitable periods for this purpose are the days around March 1 and Oct. 1, more especially as our fickle English spring often affords the maximum intensity of cold for the year. This was noticeably the case in 1909, when the average temperature of the week ending March 6 was 30·5° Fahr., and that of the week ending Oct. 2 56·5° Fahr.

The diagram exhibits the average hourly output of gas during each of these weeks expressed as a percentage of the average daily output over the same period. The most cursory examination of the diagram at once reveals the fact that the lighting load is overwhelmingly predominant. It is well that attention should be directed to this point, as there is a disposition in some quarters to assume that gas has been relegated to the status of a heating agent pure and simple. It is clearly evident that there is not a shadow of justification for this gratuitous supposition. The very marked influence of the meal hours is clearly visible upon both curves, but far more distinctly upon the October curve, where the breakfast, dinner, and tea hours are distinctly indicated. It may even be conjectured that the elevation of the October curve beyond the March curve between 9 p.m. and 10 p.m. is due to a demand for gas at supper time at a season when, owing to the mildness of the weather, kitchen ranges are not in use.

The effect of cold weather in bringing into use gas-fires and other heating apparatus is evident over the whole length of the March curve, but more particularly in the early morning from 6 a.m., to 8 a.m., and again on the approach of the colder hours of the evening, from 5 p.m. to 8 p.m. The rapid decrease in the heating load after 8 p.m. is, of course, largely due to the closing of business establishments, and also incidentally seems to indicate that cold weather induces retirement to bed at an earlier hour than that usual in normal weather. In general, this rough diagram indicates plainly that, while gas is increasing in favour for heating and cooking purposes, it is still more than maintaining its ground as a lighting agent; and this naturally leads to an inquiry as to the most suitable methods to be adopted in order both to retain and to add to this business.



Hourly Output of Gas expressed as a Percentage of the Average Daily Output.

THE PUSHING OF GAS SALES.

Advertising and canvassing have been largely resorted to for some years past, not only by suppliers of gas and electricity, but also by the firms supplying lamps, burners, fittings, heating and cooking apparatus, and the thousand and one adjuncts made use of in either industry. Many of the advertisements issued on behalf of electrical manufacturers have not been conspicuous for strict scientific accuracy; and it would, perhaps, be hypercritical, taking everything into consideration, to expect it. But it is very essential that the interests of the gas industry should not suffer in consequence of any failure on our part to correct erroneous conclusions which the public may be led to draw from these widely disseminated statements, and at the same time that the case for gas should be laid fairly and adequately before the public. This work has hitherto been undertaken by a few public-spirited gas companies; but it is certainly full time that the industry at large should combine its forces with a view to meeting this phase of competition. Very much may also be accomplished by local bodies similar to the General Purposes Section it is proposed to form in connection with this Association.

Judicious canvassing and the establishment of a well-kept show-room are very powerful aids to the retention of existing business and the acquisition of new. In connection with these matters, however, there is one point of such overwhelming importance that very special stress may be laid upon it. It is the undoubted fact that unless burners, cookers, and other apparatus are regularly and carefully maintained, the solicitation of new orders is useless. As precept is vain without practice, so also is canvassing without maintenance. At the present time, gas undertakings are prepared to carry out the work of maintaining incandescent lights at such a nominal cost that it is to the advantage of every consumer to place his burners in their hands, as this procedure will result in his obtaining a far better light, in the majority of instances, than he could secure otherwise. Many consumers maintain their own burners, and do so excellently. It would be well if all consumers could do so; but this is a counsel of perfection, and one which want of time and numerous other reasons render it impossible for most people to follow. Cookers on hire should also be regularly inspected and cleaned, as this attention goes a long way towards popularizing the use of these valuable domestic adjuncts. In order, however, that this maintenance work shall be carried out efficiently, it is essential that the outside staff of all gas undertakings shall be thoroughly up to date in all that appertains to their business.

THE OUTDOOR STAFF AND ITS WORK.

Considering the very rapid change that has taken place in the methods of lighting and heating by gas during the past few years,

it is remarkable that the rank and file of the industry have shown such ready adaptability to modern conditions. But every day the apparatus employed and the principles involved become more technical, more scientific; and it is absolutely necessary that those engaged in fitting and maintenance work, which in itself has now become a great industry within an industry, should be afforded the opportunities necessary for obtaining a sound knowledge, both theoretical and practical, of the principles and methods forming the foundation of their every-day work. The outdoor staff are in one important respect on a different footing from the indoor staff. While the latter have always a superior at hand to consult in a case of difficulty, the former, while still under the general direction of the engineer, are bound, from the very nature of their work, to frequently encounter difficulties which they must rapidly solve for themselves upon the spot. It is essential, in the interest of both the consumer and the employer, that the fitter should arrive at the correct solution. This he cannot do unless he is thoroughly grounded in all that relates to his work.

It may not therefore be out of place here to make an appeal to all those connected with the direction and management of gas-works in this district to assist by every means in their power the classes which your Council are now about to arrange for the efficient teaching of all those engaged on the outdoor staff of gas undertakings. The importance of the work is manifest from the fact that the American Gas Institute and many large electrical firms in that country have vigorously taken up this work of educating their employees; while in our own country several of the District Associations are now engaged in preparing schemes for classes. It is manifest that, if we are to introduce successfully the most up-to-date and scientific appliances and fittings, those in charge of the fitting and working of such apparatus must be thoroughly qualified men; and as there are at present no means in this district whereby gas-fitters and others may acquire the necessary knowledge, it is a duty devolving upon all who have the interest both of the public and our industry at heart to assist in providing adequate facilities for those who are desirous to become qualified. The alternative is, of course, the absolute abandonment of modern methods, which is absurd.

COMPETITION OF GAS AND ELECTRICITY.

Even at the risk of repeating what is probably familiar to you all, it still appears to be desirable to refer briefly to gas in its relation to public lighting. It has been stated in all seriousness that the competition of gas with electricity for public lighting purposes no longer exists. This is true as regards a few municipalities owning their own electrical undertakings, and it is also true in so far that it is competition, and not gas, that has been extinguished; for the undoubted superiority of gas for public lighting, both as regards economy and efficiency, has been proved up to the hilt repeatedly during recent years. There is no one here present who does not, I am sure, admire those who give their time so ungrudgingly to the public service, and who transact municipal business with such ability and, generally speaking, with such impartiality. But as even Homer has been observed to nod, so it is to be feared that municipalities owning electrical undertakings occasionally incline their heads and hearts to their own offspring regardless of the expenditure involved. This is very natural—in fact, the usual argument adduced in support of such methods is that the electricity concern being the ratepayers' own property, the public lighting should therefore, as far as possible, be carried out electrically.

This argument appeals rather to sentiment than to reason. Still, in spite of this, we may assume its validity for present purposes. But even if it be the wish of the ratepayers to use their own commodity, they have a right at least to be informed of the cost involved as compared with that of other methods of carrying out the same lighting. This may easily be obtained by means of a system of open tendering, such as is usually adopted both in London and in many provincial boroughs; and such a method of procedure at once enables the public to judge of the propriety or otherwise of carrying out the policy above indicated. Still, there are many independent and competent authorities who do not admit for a moment that the argument above quoted should have any weight whatever. They say, and with some reason, that, in view of the burdens that are already borne by the ratepayers, the cheapest method of lighting should be adopted, provided it is efficient. Electricians make answer that, though they are a little dearer, yet gas cannot compare in efficiency with electricity for public lighting.

Even at the risk of further repetition of that with which you are acquainted, let us now proceed to examine some facts. This year the Westminster Borough Council invited tenders for the provision of a certain definite quantity of light in certain portions of their district. It is to be particularly noted that this entirely disposes of the question of relative efficiency. The Westminster Council are not buying energy, whether gas or electrical, neither are they paying for lamps of any certain nominal candle power. They are buying light pure and simple; and it is immaterial to them whether such light be produced by gas, oil, electricity, or any other agent whatsoever, provided that the light furnished complies with their requirements as to quality and quantity. What has been the result of the tendering? You are, of course, all aware; but the figures are worthy of careful study by all interested in public lighting. The respective tenders were:

Gas	£13,800 per annum.
Electricity	£21,800 ,,

These figures need no comment. A saving of £8000 per annum, being an economy of over 36 per cent., speaks for itself. The consequence has been that Westminster has, after a long experience of electricity, returned to gas for public lighting purposes. And this is no specially selected case. It happens simply to be the latest of a long series. Any visitor to London may view for himself the magnificent gas lighting in Aldwych, Kingsway, Fleet Street, and many other leading thoroughfares which are now being illuminated by gas solely upon the homely, but sound, commercial grounds of efficiency and economy.

The foregoing remarks only imperfectly deal with the question of non-competitive public lighting in reference, chiefly, to the point of view of the ratepayer. There is another aspect more personal to ourselves, and it is the indirect injury done to the reputation of gas as a lighting agent. The general public, having no means of arriving at the facts, and seeing electricity largely substituted for gas in the streets of a borough, are apt very naturally to conclude that this is the result of competition, and that gas is outclassed. Of course, when the facts are known, this impression is at once removed. It is therefore incumbent upon those connected with our industry not to tacitly acquiesce in a public depreciation of gas, but to publish as widely as possible the circumstances, in order that the public may not be led, under a complete misapprehension, to consider that gas is unable to compete with electricity for public lighting. As a matter of fact, gas is easily first in the field of public lighting; and it may be confidently stated that the finest examples of street lighting in the world are those carried out through its agency.

A PROMISING OUTLOOK.

A brief review, therefore, of the past few years in the history of the gas industry can but fill us with the strongest hope and confidence for the future. Most of us here present have during that period seen this great business, which to all appearance seemed to have settled down to vigorous, settled, and conservative maturity, resume more than the full vigour of youth, develop new fields of enterprise, utilize to the full the resources of modern science, and successfully cope with the onslaughts of a formidable and vigorous competitor—one, moreover, endowed with all the prestige and optimism of youth. These are happy auguries for the future; and great as has been the past history of our industry, we may confidently look forward to greater developments and far more extended fields of enterprise in years to come.

At the conclusion of the address,

Mr. Brookman proposed a vote of thanks to the President. He felt sure the members would agree with him that the address was bristling with suggestions and useful advice which they might all of them well take to heart. He was glad that Mr. Canning had devoted the greater part of his address to the question of distribution, because he thought this was a side of the industry which had been somewhat neglected—especially the subject of maintenance and the upkeep of different apparatus by which gas was being used. This was one of the most important matters that any Institution could deal with.

Mr. H. D. Madden (Cardiff) seconded; remarking that the address would be most useful on the records of the Institution.

The vote of thanks having been enthusiastically accorded by the members,

The President, in acknowledgment, said the address could lay claim to no originality, but he thought he might say it dealt with a few points which required earnest attention at the present time.

A Special Purposes Section.

The President remarked that they had a long programme to get through; and the next item on the *agenda* was "To consider, and, if approved, pass, the rules of the Special Purposes Section." If any members would like to ask questions or make suggestions with regard to these rules, he would be pleased to hear them.

The rules were as follows:—

The Special Purposes Section Rules.

1.—The object of the section shall be to deal with such matters relating to the interests of the gas industry as shall from time to time be deemed desirable by the members of the section.

2.—Membership of the section shall be open to any gas undertaking whose engineer and manager is a member of the Institution, on payment to the Hon. Treasurer of the Institution of the sum of 10s. 6d. in the case of undertakings whose make is below 50 million cubic feet per annum, and £1 1s. in the case of undertakings whose make is above 50 million cubic feet per annum, upon registration, and subsequently upon Oct. 1 every year. In addition to representatives so elected, the section may, on the recommendation of the Committee of the section, co-opt persons who, by reason of their professional knowledge and experience, are qualified to assist in advancing the objects of the section. Such persons must be members of the Institution. Provided, further, that such co-opted members shall not exceed three in number.

3.—The accounts of the Special Purposes Section shall be kept separate from those of the Institution; and a balance-sheet to Sept. 30, duly audited, shall be submitted to the Committee every year.

4.—Sub-sections will be formed in various centres, each having a local Secretary, who shall collect and prepare information and forward summarized reports to the other sub-sections and to the Committee of the Institution, and shall also submit to the latter an annual report of the proceedings.

5.—The control of the whole organization, of its sub-sections, officers, finances, and operations, shall be vested in the Executive Committee of the Institution, who shall be competent to discontinue

and wind up the section, whether as a whole or part, upon Sept. 30 in any year, after notice given at the preceding autumn general meeting of members, if its continued existence shall be found incompatible with the best interests of the Institution. Each sub-section shall appoint its own officers, whose appointments shall be subject to the approval of the General Committee. Notice of any proposition for amending these rules must be given at a general meeting of the Institution, and such notice shall appear on the *agenda* issued to the members for the following general meeting.

Mr. J. Robb (Chepstow) asked what duties would be likely to be performed by the section—what the aims and objects would be.

The Hon. Secretary said they were following in the footsteps of the other District Associations—such as the Manchester, the Southern, the Eastern Counties, and the North of England. The object really was to keep in touch with regard to prices of coke, tar, and other things—general commercial transactions—and to, as it were, guide one another as much as possible for mutual benefit, and to take combined action in certain cases where necessary. They could take up (say) the question of railway rates and things of that kind.

Mr. George T. Andrews (Swansea): Joining this Commercial Section does not bind you to fixed prices for coke, tar, &c.?

The Hon. Secretary: It binds us to nothing.

Mr. G. Mayne (Penrhiwceiber) remarked that in the matter of prices there were, of course, difficulties in connection with some works which were not present in others.

The President thought these matters were subjects for consideration at future meetings of the section. He moved the adoption of the rules.

Mr. Brookman seconded; and the proposition was agreed to.

The Proposed Evening Classes.

The President remarked that the next matter was the evening classes for training fitters and members of the outdoor staff of gas undertakings. Those members who were present at the Cardiff meeting in May last, would remember how ably this question was brought to the notice of the Institution by Mr. Madden, who read an excellent paper on the subject. The matter being thus started, the Council had met on several occasions since, and had endeavoured to formulate some sort of scheme as a beginning. It was a very difficult matter, and one in which local considerations had to be taken into account. They had also to cover a very large and scattered district. Therefore it might take a little time and patience before the scheme was in working order. He would ask the Hon. Secretary to report generally what had been done up to the present.

The Hon. Secretary said they were well forward with the arrangements so far as Cardiff was concerned. The main difficulty had been to get what they considered a capable teacher. It would be no use to do the thing by halves. For Cardiff they had now a teacher in view. Arrangements for classes at Pontypridd and Newport were getting on; and there was every hope of having a class at Swansea. This was as far as they had gone. They intended to circularize the members as soon as the arrangements were completed.

The Thermal and Thermo Dynamic Efficiency of Town Gas in Practice.

Mr. Thomas Canning (Newport) then read a paper on the "Thermal and Thermo Dynamic Efficiency of Town Gas in Practice." This, together with a report of the discussion to which it gave rise, will be found on pp. 42 to 46.

Mr. Brookman proposed a vote of thanks to the author, and remarked that it had been decided to further discuss the paper at the next meeting. Its importance required fuller consideration for it than they were able to give that day.

Mr. Andrews seconded; remarking that the paper required careful study.

The vote was heartily accorded; and Mr. Canning briefly acknowledged it.

Appointment of a Representative on the Council of the Institution of Gas Engineers.

The President said the next business was the election of a representative on the Council of the Institution of Gas Engineers for the year commencing in June, 1911. As members were probably well aware, the position was at present ably filled by Mr. Browning; but it would be necessary after June next to have a new representative. The Council had unanimously decided that the most fitting person to take up the duties of the position would be the retiring President, Mr. Brookman; but he would be pleased to receive any other nomination that might be made.

Mr. E. H. Swain (Pontypridd) proposed Mr. Brookman for the office. He had carried out the duties of President in such an excellent manner that he had proved himself fitted to represent the Institution in London.

Mr. Andrews seconded the motion; and it was carried.

Place of Next Meeting.

The President said that, with regard to the place for holding the next meeting, the Council thought it advisable on this occasion to leave the selection absolutely open. They would be pleased to receive suggestions from the members; but if no one had a proposal to make, the matter could be left in the hands of the Council for decision.

This course was agreed to, on the proposition of Mr. J. A. Boucher (Maesteg), seconded by Mr. Mayne.

Thanks to the Gas Company.

Mr. Madden proposed a hearty vote of thanks to the Chairman and Directors of the Newport Gas Company, for their kindness in placing a room at their disposal for the meeting.

Mr. Swain seconded, and the proposition was carried with applause.

Mr. T. H. Hazell, the Secretary of the Company, said he regretted the Chairman was not present to respond to the vote of thanks. In the estimation of the Directors, it was a very simple service that they had been able to render to the Institution that morning. It had been a pleasure to the Board to place the room at the disposal of the members. They felt that those connected with the industry were all members of a great co-operative society; and they wished the Institution well in their fight against darkness.

This concluded the business.

The Luncheon.

Business done with, pleasure became the order of the day, and, upon the invitation of the Chairman and Directors of the Gas Company, the members adjourned to the Savoy Hotel, where a party of about fifty sat down to luncheon. The Chairman, Dr. Melvill Brewer, presided; and he was supported by two other Directors of the Company—Mr. C. D. Phillips and Major J. C. Rennie Brewer. The guests having fully enjoyed the excellent fare provided,

Dr. Brewer, after the honouring of the Loyal Toast, asked Mr. Phillips to propose the next toast.

Mr. C. D. Phillips then gave "The Wales and Monmouthshire Institution of Gas Engineers and Managers." He dwelt upon the benefits accruing from meetings of this character—especially in the case of gas engineers, who were not opposed to one another in competition in the same district. Everything one engineer could teach another, he pointed out, was for the general good of the gas industry. They had one common enemy at the present time—the electric light; and they all did what they could to help one another to put this light out. He did not say they were going to altogether put it out; but gas people had the light that never failed, and so long as they possessed this, and did all they could to cheapen it and educate the people to the fact that it was the best light and also economical for heating, power, and other purposes, he was sure the industry had a great future in front of it. Mr. Thomas Canning, he believed, was the first President of the Institution; and now his son occupied this position. What could they want better than this—from father to son? He thought the paper presented to the members that day was one of the best commercial papers he had ever read. Mr. Thomas Canning was a scientific man; but they also wanted a man to bring in the money. The aim of the Institution was to be both scientific and profitable. They must make their science profitable; and he thought Mr. Canning had given them some very good ideas as to how this could be done. They all remembered the revered name of Mr. Thornton Andrews; and he was glad to see his son present with them, as well as Mr. Brookman, of Tenby, who was a very old friend of his. It was a pleasure to the Gas Company to welcome members of the Institution; and he hoped the day would be altogether a successful one. He coupled with the toast the name of Mr. J. H. Canning.

The President, in returning thanks, remarked that the Institution, considering that it was so young, had made great progress, and had been highly successful. This was due, in his opinion, to three causes. First of all, they had had a succession of able Presidents. In the next place, too much credit for the success of the Institution could not be given to their Hon. Secretary, Mr. Octavius Thomas, who had worked hard, and spared no pains at any time to promote the welfare of the organization. Last, but by no means least, a great deal of the success had been due to the support the Institution had received at all times from those directing gas undertakings—whether members of the boards of companies or of the committees of municipalities owning gas-works. They had extended hospitality and offered facilities for visiting works, and assisted in every way the holding of the meetings. One matter he would like to refer to was the question of papers. The Council, and he was sure also the Secretary, were desirous of seeing those who were in charge of smaller gas-works assisting as far as possible with papers at the meetings. Such papers would be welcomed; and no one need be afraid that undue criticism would be offered.

Mr. Brookman, in proposing "The Chairman and Directors of the Newport Gas Company," remarked that it was one of the most progressive concerns in the United Kingdom. In welcoming the Institution as they had done that day, they showed that they appreciated the efforts which were being made by organizations of this character to further the interests of the great gas industry. The Institution was practically a brotherhood, the members of which were always ready to impart to one another any information they might have. There was no stint in this respect, nor any attempt to hide anything. He coupled the name of the Chairman with the toast.

Dr. Brewer, in reply, said that when it was first known the Institution were coming to Newport, there was no hesitation on the part of the Directors in asking the members to accept the little hospitality they could offer them. They also wanted to show them their works at Crindau. He thanked them on behalf of the Company.

Mr. Thomas proposed a hearty vote of thanks to the Secretary of the Company, Mr. T. H. Hazell, for the trouble he had taken to make the occasion such a success.

Mr. Brookman seconded the proposal, Mr. Andrews supported it, and it was cordially agreed to.

Mr. Hazell remarked that he did not think there was any need for a special resolution of this kind. He had only carried out his duty in doing the best he could under the instructions of the Gas Company. From first to last, the desire had been to give the Institution a hearty welcome.

Mr. Brookman said there was just one other toast he would like to

propose—"The health of the esteemed Hon. Secretary, Mr. Octavius Thomas." No one who had not been President of the Institution really knew what was the value of Mr. Thomas's services. He was deserving of their heartiest thanks. On this subject he (the speaker) had once before made a suggestion; but it had not so far taken practical shape. This was, that they should make some sort of presentation to Mr. Thomas, who gave time and money to the Institution. In proposing the toast on this occasion, he would ask the members to carry out his idea. He would leave the matter in their hands; but he certainly thought the time had arrived when they should recognize Mr. Thomas's services by not only thanking him in words but also in substance.

Mr. THOMAS having briefly returned thanks,

Mr. ANDREWS said he would be glad, with Mr. Brookman and others, to form a Committee to carry out this project. He thought they had better proceed by first of all circularizing the members.

VISIT TO THE CRINDAU GAS-WORKS.

In brakes which had been provided, the members were then driven to the Newport Gas Company's Crindau Works. Though gas is still being made at the Mill Street station in the centre of the town, the principal manufacturing operations are carried on at Crindau, and no doubt in course of time the whole of the gas required will be sent out from these works. It was more than a quarter of a century ago that the increased demand for gas owing to the development of Newport led the Directors to acquire the extensive site at Crindau on which works designed by Mr. Thomas Canning were opened in 1885. Ample room exists for any further extensions of these works that may from time to time be required. When the party arrived, the services of a photographer were requisitioned; and then a tour of inspection was made, under the guidance of Mr. Thomas Canning, the Engineer and Manager, and of his son Mr. J. H. Canning. The time at disposal was profitably employed; and the only regret was that the visit could not be a longer one. In the design of the works, economy, uniformity, and the need for extensions in time to come are points that were perpetually kept in view. The works are in two ranges of substantial buildings situated on either side of a wide road leading to the coke-yards at the lower end.

The retort-house contains twelve benches of nine 18 feet retorts; each bench being equal to a make of 150,000 cubic feet per day, thus giving the entire house a capacity of some 1,750,000 feet daily. When it was determined to instal modern carbonizing plant, the walls and roof of the house had to be raised; and it was decided to do this without interfering with the original foundations. Hence, as regards length the dimension of the old retorts was adhered to. The members had the opportunity of seeing at work the Fiddes-Aldridge stoking machine, by which the discharging and charging are accomplished in one operation; and it was carrying out its task with smoothness and rapidity. Six-hour charges are the practice; the amount of coal put into each retort being about 8 cwt. Thus the Fiddes-Aldridge machine at each operation deals with some 14 cwt. of material—8 cwt. of coal, and about 6 cwt. of coke.

The siding from the Great Western Railway which serves the works stands about 25 feet above the general level; and this enables the coal to be tipped direct from the trucks either into the breaker-hopper or any portion of the store. Nowadays one frequently sees coal-waggons tipped by pushing up one end from underneath with a ram; but at Crindau the end of the 10-ton truck is drawn up by means of a travelling electric crane. Electric capstans of the most modern type also enable the traffic on the siding to be handled rapidly and efficiently. The coal is fed from the breaker-hopper through a powerful crusher; and it is then elevated to the top of the retort-house, and distributed by means of an endless push-plate conveyor to hoppers which run the entire length of the house, and which are fitted with Aldridge-Gibson patent doors for supplying the stoking-machine beneath. The stage floor of the house is, it may be remarked, built in reinforced concrete; and the retorts are heated by Winstanley regenerative furnaces.

The treatment of the coke at the Crindau works is also of an interesting character. On being discharged from the retorts, the coke drops straight into waggons (holding about a ton) on the ground-level, where it is partially quenched by water-sprays. These waggons run on rails, and are fitted with trunnions; and when they reach the outside of the retort-house, they are picked up by an electric telpher apparatus, dipped into a tank of water for the final quenching of the coke, and then carried to the store in the yard. Arrived here, the coke is gently deposited on the heap; the result being a remarkably small amount of breakage. This, however, is not the only work of the telpher, the track of which is continued over the railway siding at a high-level, and thus provides a rapid and very efficient means of loading coke (again with a minimum of breakage) into waggons. This is an important branch of the work, as, of course, much of the coke is sent away from the store in large quantities for shipment. In addition to what has been mentioned, too, the telpher is used for all traffic to and from the railway siding, except the tar, which is pumped up into tanks on the high-level, and the oil, which is discharged by gravitation into a tank on the works.

Attention was drawn by Mr. Canning to the fact that the water used for spraying the coke is not allowed to go to waste. After use, it flows into a culvert and passes through filters; and then, by means of a Gwynne high-pressure 3-inch centrifugal pump, it is raised to an overhead tank. From this, the water flows by gravitation to the sprinklers in the retort-house; and in this manner it is used over and over again.

Adjoining the retort-house are the condensers, scrubbers, and large tar and liquor tanks; while near these are at present being erected a tar-separator, with centrifugal washer-scrubber of the latest type. Just beyond the scrubbers are seen the boiler-house, exhauster-house, and pump-house. In the exhauster-house there is ample room for further sets of apparatus. Opposite the exhauster-house is situated a new power-house, where electric power is developed by means of gas-engines for distribution to the various points required in working. This building contains three gas-driven generating sets of a total capacity of 75 kilowatts. Thus there is derived from gas the whole of the energy required for the machinery which is particularly adapted for the distribution of this energy by means of electric motors; and experience has shown that in no other manner can electric current be so economically generated as by powerful and well-equipped gas-engines.

There are two purifying-houses, containing purifiers in groups of six. Those in the second house are of the most modern type; being fitted with Ramsden-Smith patent valves, and covers of the Green type. Both lime and oxide are used for purification; the former being necessary on account of the employment of Monmouthshire coal. Near the works entrance are situated the meter and governor house and the weigh-office, with other offices and testing-rooms; and behind the meter and governor house are the holders. There is a water-gas plant of the Economical Gas Apparatus Construction Company's type; and for this a separate set of apparatus is provided right up to the holder, where the mixture with the coal gas takes place.

All through the works, the visitors were struck with the cleanliness, orderliness, and extreme quiet prevailing. The workmen, it is hardly necessary to say, are well looked after. There are excellent recreation, mess, and bath rooms, &c.; and a portion of the land not yet required for extensions has been let out in allotments to the employees.

On leaving the works, the party returned in the conveyances to the Savoy Hotel, where tea was partaken of in the roof garden; and thereafter the members separated.

THE THERMAL AND THERMO DYNAMIC EFFICIENCY OF TOWN GAS IN PRACTICE.

By THOMAS CANNING, of Newport.

[A Paper read before the Wales and Monmouthshire District Institution of Gas Engineers and Managers.]

The intention of this paper is a very simple one. It is, within a brief compass, to draw attention to the value of gas as a fuel—applied in the first place to an internal combustion motor, and, secondly, as used in the ordinary gas-fire. Whole treatises have been written on at least one of these subjects; but the information regarding both is very scattered, is often confused, and is frequently uncertain. This paper is an attempt to collect and co-ordinate some at least of the information rather than to give the results of any original research. Some original points may be found here and there; but, as a rule, I have subordinated my own views to those of others whose opportunities have more especially qualified them for the valuable work of research. It would be impossible within the limits of a paper to give any adequate survey of so wide a field; hence I have only attempted to bring together some few facts, and to give a very few commonplace hints on certain practical points more intimately touching our own special business.

There is set out in the table below the thermal value of fuel—solid, liquid, and gaseous:

Heat developed per pound of	steam coal . . .	13,800	B.Th.U.
,, ,, ,, ,,	town gas . . .	18,960	,,
,, ,, ,, ,,	petroleum . . .	18,500	,,
,, ,, ,, ,,	producer gas . .	1,812	,,
,, ,, ,, ,,	blast-furnace gas .	1,062	,,

The value given for coal is an average made up from the results of various tests of steam coals—some of high value and some low. In like manner, the value given for town gas is also an average, and is given in the gross. I know that it will be contended by some that the figure is too high; by others, that it is too low. It may be one or the other, but not in any great degree; for, so far as I have been able to obtain information, I think I have struck a fair average. The estimate I have given of the value of crude petroleum is taken from the best results obtained under the best conditions of working in the United States of America. Here I have been unable to arrive at any average; for petroleum, unlike coal, varies little in its composition. On the whole, then, it would seem that the manufacturers of town gas in Great Britain and Ireland are in possession of a fuel which, while it is the equal of the best liquid fuel, possessing also the advantage of being immediately utilizable, which the liquid fuel is not; it is superior to coal, and is 10·4 times more valuable than producer gas, and 17·8 times more valuable than blast-furnace gas.

It cannot be doubted that town gas, on account of its greater thermal efficiency, would be the one selected in every gas-engine were it not for the fact that the engine does not require for its efficient working a high flame temperature gas. A low flame temperature gas, such as producer gas, has been found equally suitable in working the gas-engine, and can be produced cheaper

than town gas. With respect to blast-furnace gas, this, of course, is cheaper than either, representing as it does ultimate cheapness, inasmuch as it is a bye-product which, previous to its utilization for power purposes, went to waste. Undoubtedly, the steam-engine, using coal as a fuel, especially with the improvements that have been made both in economy and adaptability in recent years, has still its own place, and will maintain it But, nevertheless, the steam-engine has not made such rapid strides, either for land or marine purposes, as has the gas-engine.

Ten years ago, a gas-engine of from 1000 to 1200 B.H.P. would be quoted, and has been quoted in fact, as an example of great advance. There are now installed at the Eschweiler Collieries, Alsdorf, Germany, twin tandem gas-engines of 2400, 2600, and 2800 B.H.P.; while the total capacity of the station is from 14,500 to 15,000 B.H.P. The gas used is coke-oven gas; and the capacity is twice that of the former steam plant, which has been removed in order to make way for the gas installation. But this is surpassed by another and very recent installation by the Indiana Steel Company, of Gary, Indiana, who have erected a gas-driven blowing plant for their blast-furnaces. The plant consists of eight units; each unit being a gas-engine of the Westinghouse four-cylinder twin tandem double-acting type. By these engines the blowing plant is driven so as to supply 265,000 cubic feet of free air per minute. The cooling water for the cylinders is supplied from a 16-inch main. The oil for lubrication is supplied from overhead tanks containing 2500 gallons, which are, in turn, filled by two storage tanks, each of 25,000 gallons capacity.

Reference is not made to these large plants with any other view than to show the progress made in gas-engine construction and adaptability, and to draw public attention to these facts, which contradict the prevalent delusion now existing that, when big units of power have to be considered, sources of energy other than gas have to be utilized. In fact, it has been recently rumoured (upon no sufficient authority, however) that gas may in future be employed as the motive power for battleships. It is idle to credit this rumour, which started on the launching of the battleship *Orion* the other day. Details of this vessel were supplied liberally by the Press; but, as a matter of fact, it may be taken as certain that no adequate details whatever have been supplied to the public, and that even the actual dimensions of this mighty battleship are known only to the few immediately concerned in knowing them. Still, it is supposed that the ship has an aggregate horse power of 27,000, obtained by four sets of turbine engines from eighteen Babcock and Wilcox boilers, which can, if required, burn oil fuel as well as coal.

This is conjecture. But he would be a hardy prophet who would say that a plant of this magnitude, if it exists, could be easily replaced by an existing form of internal combustion motor. Still, this is not impossible; for already oil-engines have been used on cargo vessels up to 800 to 900 shaft horse power, and with gas-engines up to about the same power. The advantage in the case of the gas-engine equipment was to give greater space for cargo. The producers were placed immediately above the engines, and economically, too; bunkers being placed directly over them in a deck casing, and the labour of storing and trimming consequently abolished. Attempts at the present moment are being made in Germany—and, it is to be understood, with hope of success—to employ Diesel engines up to 9000 shaft horse power in the aggregate, in cargo vessels. The power will be applied direct to the propeller shaft, as in these days, when there is a choice of almost perfect machine gearing, there is no need whatever to employ any other motor to facilitate the transmission of power; while the process of reversing can also be achieved with nearly as much facility as with the steam-engine.

But our attention has to be specially concentrated upon a gas that we produce ourselves, and which is made to suit other purposes besides that of power. Proceeding, now, from the point at which I started—namely, the question of thermal efficiency—I should like to place before you some of the results published by the Committee of the Institution of Civil Engineers, who, in 1906, made very valuable researches (and many experiments) on the thermal efficiency of gas-engines. Three gas-engines—one of 5 I.H.P., one of 25 I.H.P., and one of 50 I.H.P., were carefully tested at half-load and at full-load; and the following table shows the results.

Size of Engine.	5 I.H.P.		25 I.H.P.		50 I.H.P.	
Load.	Half.	Full.	Half.	Full.	Half.	Full.
Indicated horse power	3·6	5·72	14·5	25·9	34·1	56·3
Brake horse power .	2·87	5·20	10·82	20·9	27·9	52·7
Mechanical efficiency	0·80	0·90	0·75	0·80	0·82	0·94
Net B.Th.U. per hour	32,260	49,630	117,200	187,700	267,500	450,600
Thermal I.H.P. efficiency per cent. .	28·0	29·0	31·5	35·0	32·5	31·8
Thermal B.H.P. efficiency per cent. .	22·4	26·1	23·6	28·0	26·7	29·9
Thermal efficiency standard . . .	0·496	0·496	0·496	0·496	0·49	0·49
Relative efficiency I.H.P. per cent. .	56·4	58·4	63·5	70·6	66·3	65·0
Relative efficiency B.H.P. per cent. .	45·2	52·6	47·6	56·4	54·5	61·0
Cubic feet per I.H.P.	15·78	15·33	13·77	12·78	13·67	13·94
Cubic feet per B.H.P.	19·80	16·87	18·45	15·84	16·70	14·90
Air-gas ratio	8·49	9·15	8·42	9·17	7·97	8·27

It is interesting to compare these results with those given by that very eminent authority on all questions connected with the gas-engine—Mr. Dugald Clerk. I will quote from his paper on "Limits of Thermal Efficiency in Internal Combustion Motors," read before the Institution of Civil Engineers [see Minutes of Proceedings, No. 3696, Vol. CLXIX., Oct., 1907, p. 129]:—

Designation of Engine.	L.	R.	X.
Exhaust waste.	34·1	37·1	39·9
Jacket waste and radiation . . .	34·1	29·6	25·4
Indicated horse power	31·8	33·3	34·7
	100·0	100·0	100·0

The engine powers are not given in Mr. Clerk's table; but the motors are designated by letters as above—the letter "L" indicating a small gas-engine, "R" a larger one, and "X" a somewhat larger one still. In the 5 I.H.P. gas-engine that was tested by the Committee of the Institution of Civil Engineers, the thermal efficiency is 29 per cent. at full-load; and in the gas-engine "L" tested by Mr. Dugald Clerk, is 31·8 per cent. In the 25 I.H.P. engine tested by the Committee, the thermal efficiency is 35 per cent. at full-load, and 33·3 per cent. in Mr. Dugald Clerk's test of gas-engine "R." In the 50 I.H.P. gas-engine tested by the Committee at full-load, the thermal efficiency is 31·8 per cent.; whereas in engine "X" tested by Mr. Dugald Clerk it is 34·7 per cent. Of course, it must be understood that the powers represented by "L," "R," and "X" may not have been, and probably were not, of the same powers as those tested by the Committee of the Institution of Civil Engineers. But it is somewhat curious to notice that, whereas the thermal efficiency rises regularly in Mr. Dugald Clerk's test, there is a drop in the thermal efficiency of the 50 I.H.P. engine as compared with the 25 I.H.P. engines tested by the Committee.

We now arrive at the point to which I attach the greatest importance, and to which I wish to draw your attention—namely, that the whole question of the economy and efficiency of a gas-engine depends principally upon its thermal efficiency; and the higher the thermal efficiency, naturally the greater economy there is in the use of the gas-engine. Now the figures given above, as you will see, represent, for the gas consumed, a relatively high thermal efficiency. For many years it has been supposed, and no doubt it is true of old-fashioned or badly-constructed gas-engines, that the efficiency was 20 to 25 per cent.; and upon this calculation many damaging statements prejudicial to the gas-engine have been circulated, and are still being made by ignorant people. They can be circulated no longer, however, for with small engines, worked by town gas, there is an efficiency of 30 per cent.; and as the engine goes up, the efficiency goes up to, let us put it roughly, 35 per cent. I will here briefly make one comment. Looking at this efficiency, it might strike a good many people that, considering the great loss in heat in the jacket cooling and in the exhaust, some one might do for the gas-engine what has been done for the steam-engine when the principle of double and triple expansion was discovered and applied.

I believe one maker of gas-engines tried some years ago to introduce two pistons; but his trial was in every sense a failure. The efficiency of the motor was lowered, and the mechanical difficulties created were so great that the engine was too complicated to be permanently worked. Nevertheless, it would be sometimes rather dismaying to know that there is apparently so great a waste, or what looks like waste, of thermo dynamic energy. Professor Bertram Hopkinson, after a long investigation carried out very carefully by himself and others, states [see Minutes of Proceedings, Institution of Civil Engineers, Vol. CXXVI., p. 212. "Hopkinson on Heat Flow and Temperature Distribution in the Gas-Engine"]: "Taking the engine on which the experiments here described have been made, it has been found that the quantity of heat carried away by the jacket-water in full-load running may be anything from 1400 to 2000 B.Th.U. per minute, according to the gas supply. Under average working conditions, it may be taken as 1600 B.Th.U. per minute."

This, however, is not so formidable as it looks; for it has been stated and proved by Mr. Dugald Clerk, as the result of his further investigations on "The Limits of Thermal Efficiency in Internal-Combustion Motors" [see Minutes of Proceedings, Institution Civil Engineers, p. 131, Vol. CLXIX.], that only 44·7 per cent. of the total heat given to the working fluid could be utilized, assuming heat lost to the walls to be entirely suppressed. Taking this as the basis of calculation, a gas-engine converting into power 30 per cent. of the thermal power available, has a thermal efficiency of 67 per cent. of the ideal value, and an engine converting into power 35 per cent. of the thermal units available has a thermal efficiency of 78 per cent. I have also seen recorded tests of engines converting into power 39 per cent. of the thermal units available; and in this case, the efficiency would be about 87·5 per cent. There is thus shown an enormous advance within the last few years in the power and adaptability of the gas-engine; and that, used with town gas, for many purposes, it is still the best, most efficient, and most economical motor, cannot be questioned.

Here is an instance in point. Recently at Newport a gas-engine has taken the place of an electric motor, which the consumer had found to be very costly. The gas-engine is only rated at half the power of the motor which it replaced; but it performs the same work at a cost even lower than the relative difference in

rated powers. The capital cost, however, of a gas-engine is considerable, and is the only reason, in my opinion, why it is sometimes passed over in favour of a less efficient motor. A remedy for this is only too palpably apparent. It is a well-considered scheme of hire-purchase; and unless this scheme is set on foot in every town where there is a demand for power supply, I am quite certain that progress of this form of utilizing gas as a fuel must, by the nature of things, be seriously hampered.

It is perfectly certain that the engineer or manager of a gas-works should take a very strong interest in the supply of a gas-engine, in its fixing, and in its working, within his own district. Frequently the gas-engine is bought by the consumer without any knowledge on the part of the gas manager; and it may be a very inefficient motor, on account of its type, or its age, or its condition. This is a great misfortune. Where possible, if this could be secured by hire-purchase, the gas-engine should be of the newest type by one of the best makers, properly fixed, and subsequently properly worked. In regard of the working of a gas-engine, I will only draw attention to two points, but two which are of supreme importance. The first is lubrication. Lubrication is infinitely more important in a gas-engine than in a steam-engine, and more especially the lubrication of the cylinder. There should always be used the proper oil and the proper quantity of it. The latter is frequently attained in the most modern type of engine automatically; but the user of the engine should be instructed upon the importance of having only the best oil and keeping up the full-feed.

Another point, and one of more importance still, is the size of the gas-meter. Makers of gas-engines are doing themselves great injustice by prescribing a meter too small. This, I regret to say, is almost universally done. In the case of a 120 H.P. engine, a 400-light meter is commonly specified by the makers of the engine, because the approximate quantity of gas required by the engine at full-load, per hour, is the quantity which this meter is calculated to pass within an hour. Now this is ridiculously wrong, and has a bad effect upon the meter, a bad effect upon the user, and the worst effect of all upon the maker of the gas-engine; for this want of capacity interferes seriously with the working of the engine. It is true that a 400-light meter working at full capacity will deliver 2400 cubic feet of gas per hour, working continuously throughout the hour; but how can the consequences be otherwise than bad if this same meter is compelled in a fraction of the hour to deliver in spasms and in jerks the quantity of gas required for the working of the engine? I need not dwell upon this further, excepting to draw attention to a formula by which I understand some people calculate the size of the meter required for gas-engines, and that is:

$$\text{B. H. P.} \times 3{\cdot}4 + 5 = \text{N}.$$

In the above formula, "N" equals the number of lights. It would be a pity to meddle with this formula; and for fear of spoiling it, I will not even hint at an improvement. But meters for gas-engine work should be supplied between two or three times the size now commonly specified. With reference to the injury done to the reputation of the makers of the gas-engine, I should like to draw attention to the fact that irregular and intermittent ignition follows the use of too small a meter, especially when the engine is running at full-load. Ignition fails to take place at the proper time, and what I might call post-ignition ensues. By the time, however, that ignition takes place, the exhaust-valve has been opened; and here I will leave this point, as those who understand gas-engines will be able to follow the rest of the consequences. Take "A," "B," "C," and "D," makers of gas-engines, the attention of "A" may be drawn by some gas engineer to this matter; but inasmuch as "B," "C," and "D" still prescribe the smaller meter, "A" is afraid to ask for a larger one for his engine. I trust, therefore, that makers of gas-engines as a body will consider this matter. It is no use for the gas manager to make a representation to the user and ask for a larger meter when the maker has prescribed a small one.

To complete this survey, I only add the following results recording the relative values of various fuels for generating power:—

Thermo dynamic value of 1 lb. of	town gas	= 1·80 B.H.P.
,, ,, ,, ,,	petroleum	= 1·66 ,,
,, ,, ,, ,,	best coal with modern engine	1·50 ,,
,, ,, ,, ,,	producer gas	0·176 ,,
,, ,, ,, ,,	blast-furnace gas . .	0·1035 ,,

Turning, now, to another way in which gas is used as a fuel, I should like to offer one or two observations on the value of a pound of gas consumed in a gas-fire. We have seen that in thermo-dynamic energy, town gas holds the foremost place. The answer to this question is not very far to seek; but perhaps the more authoritative answer is that given in the Appendix to the Gas Heating Research Committee's Report—a Committee which is still sitting, has done admirable work, and is likely to do better still. The report to which I here refer is the one presented to the meeting of the Institution of Gas Engineers in June last.

In Table I, No. 7, an open gas-fire, 13 in. by 6·5 in., with an eight-flame burner consuming almost exactly 1 lb. avoirdupois of gas in an hour, corrected to standard temperature and barometric pressure, gave 42·85 per cent. of radiated heat, and 37·15 per cent. of direct convected heat, while 20 per cent. of the heat passed up the flue. The temperature of the outside air was 14·3° C. (=57·7° Fahr.). This was raised to 28° C. (= 82·4° Fahr.), within the room; while the temperature of the flue air went up to 68° C, (= 154·4° Fahr.). I venture to say without doubt that this is a very good result. If a gas consumer can have the temperature of his room raised 25·7° Fahr., within a single hour of lighting his fire, and for the small consumption of 31 cubic feet of gas, there cannot be very much to complain of.

I will now take the case of a small fire tested under the same conditions and with the same glow-fuel—namely, fire-clay. I have used here a strange term—glow-fuel; and I should like to give one word in explanation of what I mean by this. The fuel in a gas-fire is gas; but it does not at the burner fulfil all that a fuel should do. Its work as a fuel is completed by the material subsequently applied to convey the heat. This material certainly fulfils some of the purposes of fuel; but as it does not fulfil all the purposes of fuel, I venture to call it glow-fuel. I will now refer to No. 6 on Table I., Appendix to the Gas-Heating Research Committee's Report. The dimensions of the fire were 4 in. by 9·5 in., the burner a three-flame one; the gas rate in cubic feet per hour 9·62; the percentage of radiated heat being 36·93 per cent. of direct convected heat 26·57 per cent. and 36·5 per cent. of the heat passed up the flue. The temperature of the outside air was 13° C. (= 55·4 Fahr.); while the temperature of the air inside the room was 27·5° C. (= 81·5° Fahr.), and the temperature of the flue air 64° C. (= 137·2° Fahr.).

Now it will be noticed that in the case of No. 7, the heat passing up the flue was only 20 per cent., while in No. 6 it was 36·5 per cent. Again, in the case of the larger fire—and, of course, it is to be understood in a larger room—the temperature was increased to 82·4° Fahr., whereas the temperature in the smaller room went up to 81·5° Fahr. This shows that heat and temperature are not convertible, and they stand in relation to each other very much as volume does to pressure. Here, in this small gas-fire, with a consumption of gas less than 10 cubic feet per hour, quite sufficient heat was generated to warrant the turning-down of the gas-fire at the end of the hour. With regard to actual thermal efficiency, the result is given in calories in the table; and these were, 136·7 in the larger fire, against 137·4 in the smaller one. I will not draw all the conclusions that might apparently, be drawn from these results. I am perfectly sure that the Committee do not themselves draw more conclusions from their experiments than are warranted up to now; and I will simply remark that the pressure to No. 7 fire was 3·21 inches, while the pressure to No. 6 was 1·12 inches. It will be noticed that with the high pressure and the wider fire the percentage of heat radiated, and the percentage recovered by direct convection, was very much higher than in the case of No. 6; and as these are the points to be arrived at—more especially the increase in the heat radiated—it would certainly go to show that a comparatively high pressure and a wide and not deep glow-fuel are the more desirable elementary conditions for a good gas-fire.

I say that I will not pursue this question, nor draw any conclusions under this head; I merely wish to point to the fact. What I prefer to say is this, that the results obtained with the small fire, with its very small gas consumption, are astonishing, and must convince anyone that there are no better or quicker means of heating a room, putting aside all question of cleanliness and convenience, than by the use of a gas-fire. To those who would care to follow up these questions of radiation and convection, I should like to refer them, in addition to the report of the Research Committee, to a paper read before the Institution of Gas Engineers at the Dublin meeting in 1907, by Mr. J. H. Brearley, of Longwood. In this connection, it is not so easy for me to show the relative value of 1 lb. of gas as it was in the case of the gas-engine; but I think we may be satisfied with what has been achieved by the makers of gas-fires up to the present, and that the absolute value of 1 lb. of gas, as set down in the table from which I have drawn my figures, shows that a very high thermal efficiency can be obtained. Can a higher thermal efficiency be obtained? Is all the heat that escapes through the flue lost? I have always ventured to think that it is not, and that the only heat that is lost is that which escapes at the top of the chimney into the open air. I do not say that the Committee in conjunction with the makers of gas-fires will not reach a higher thermal efficiency than has already been reached. I think and hope they will; but, as in the case of the gas-engine, I do think that we are approaching the realization of the ideal efficiency.

In the selection of gas-fires, it very frequently happens that the fire chosen by a consumer is not one that gives the best thermal effect. It is perfectly right that a maker of a gas-fire should try and render the appearance of it as artistic as he can, consistent with due observance of economy. Still, some of the best gas-fires at the present moment are not the most ornamental. It would be very invidious to point even to any type of gas-fire, for there are really on the market several good types. Generally speaking, however, the type which gives a fine area to the glow-fuel distributed thinly is the more efficient fire; and there is no reason why it should not have an ornamental setting. A very good type is that which combines with the quality that I have mentioned the quality also of the basket gas-fire, which is easily inserted in a fire-grate, and which gives when lighted a home-like appearance to the room. The fireside in winter is a sacred place to all of us; and the appearance of the fire in the historic glow of the log, or the clear burning coal, still carries all its traditional influence and glamour as the centre of home. The gas-fire must therefore be homely as well as efficient, and not too dear.

But besides this choice, other things have to be attended to, and not the least is the flue. A good flue, a broad flue, and a

ue as free as possible from angle hindrances, should be an ideal ı this respect. Do not be afraid that too much heat will pass way; a great deal of it comes back in a useful form through the alls of the building. In addition to the flue, there is the gas ıd air adjustment to look to. No user of a gas-fire should be lowed to commence using it without being properly instructed y some member of the gas company's staff who understands ıoroughly the proper adjustment of gas and air necessary for the ficient working of the fire, the proper glow-fuel, the proper uantity, and how to use it. The proper adjustment of gas and ır and the proper flue area are two points to be well considered; nd the care expended upon them will eventually result in a large ıcrease in the use of this most convenient domestic appliance. proper attention is given to the flue and also to the ventilation f the room, there will not be much need to speak of the danger f carbon dioxide or carbon monoxide. In respect of carbon ıonoxide, there is not the slightest chance of its appearance in ny good gas-fire working normally.

Then, as regards carbon dioxide, whatever quantity of this is roduced should find its way off in the flue gases; and only a own-draught, which must be provided against, would bring it ack into the room. But, as a matter of fact, there is little to be eared from this carbon dioxide in connection with the burning f town gas. The carbon dioxide generated in the consumption f gas is very different from that exhaled from the lungs as far as egards health. The latter is already infected with organic im-urities which may cause disease, whereas the former contains o organic impurity, and, up to a very considerable quantity, ıay be safely breathed even where little provision has been made or ventilation. But where ordinary ventilation obtains, the uantity present would be imperceptible. I should like to intro-luce a table from the lecture of Professor Vivian B. Lewes, on The Use of Gas from a Hygienic Standpoint," printed in the ransactions of the Institution of Gas Engineers, 1907, p. 202:—

Gas Lighting.

wo Welsbach "C" Burners (on pendant) each Consuming 4 Cubic Feet of Gas per Hour, and Giving 140 Candles.

	Carbon Dioxide. Parts per 10,000.	Temperature. Deg. Fahr.
Outside air	0·03	61·0
Between joists	0·06	66·0
Ceiling level	0·44	74·7
Breathing level	0·05	63·0

Electric Lighting.

Three 16-Candle Power Incandescent Lamps.

	Carbon Dioxide. Parts per 10,000.	Temperature. Deg. Fahr.
Outside air	0·03	61·0
Between joists	0·04	61·5
Ceiling level	0·09	62·5
Breathing level	0·06	61·7

The increase in carbonic acid at the breathing level where electric light is employed, as compared with gas, is owing to the act that the whole of the organic exhalations are left upon this evel where electric light is employed, whereas in the case of gas hey are carried up to the ceiling level. Now what is applicable o the incandescent burner applies with stronger force to the gas-ire; for this latter is aided by the flue. The truth is that with he great improvements that have taken place in gas-fires in ecent years, tending to make them providers of radiant heat in he same sense as the ordinary open coal-fire, they are as healthy o use as, and very much more convenient and cleaner than, any oal-fire. They are also smokeless; and these certain advantages must assuredly advance from day to day the appreciation of the general public in regard to the value of the gas-fire.

On flueless gas-stoves, commonly called radiators or gas-heated steam-radiators, I should now like to make a remark. These stoves heat by convection; and, in my opinion, while not applicable for domestic heating, they may be applied with perfect safety and great advantage to the heating of public halls, churches, chapels, schools, skating rinks, &c. This question is simply one of ordi-nary ventilation, which should be carried out whether gas-heated steam-radiators be fixed in the building or not. I will just give one case in point here where these stoves have given the greatest possible satisfaction in Newport. The cubical content of the building in question is 29,532 feet. For the purposes of heating, there were fixed two twelve-double loop, 32 inches high, gas-heated steam-radiators, and two ten-double loop, 32 inches high. They have been fixed since Feb. 2, 1907, and have given up to now the greatest satisfaction. The building is ventilated upon the Boyle system; and on the date named, one twelve-loop and one of the ten-loop radiators were lighted—that is, half power—at 10 p.m. at night. At 10 a.m. on Feb. 3 the temperature inside the edifice was 48° Fahr., whereas the temperature of the outside air was 32° Fahr. The other two radiators were then lighted; and within one hour the temperature in the building rose to 60° Fahr.

The consumption during the night when the two radiators were on was 37 cubic feet per hour, and during the day, when the four radiators were on, the consumption per hour was 74 cubic feet; maintaining a temperature in radiator of 216° Fahr. The pres-sure varied, and was very probably all through higher than 1 inch, probably approximating to 2 inches. I think the publications by makers of gas-fires of gas consumption in any of their apparatus, tested under very favourable conditions with a low pressure, give results lower than can be obtained in real practice, causing dis-satisfaction to consumers. From long experience, I should advise each maker, when giving the consumption of gas for anything he makes, to add 20 per cent. to his own calculation, and then he will approximate to the actual results obtained in every-day working all the year round. By some mistake on the first day, all four were allowed to remain lighted until six p.m. when the tempera-ture had risen to 75° Fahr.—a temperature, of course, which is unnecessary and inconvenient. But it shows the power of a gas-heated steam-radiator. There has never been a complaint with respect to the action of these stoves from the day they were fixed up to the present time. They are attended to and inspected from time to time, and that is all. In this town alone there are no less than fifty churches, chapels, schools, and other public halls heated by means of these radiators, which in every case give the greatest satisfaction on the grounds of economy, efficiency, and health. I have not the smallest doubt whatever that this number will con-tinue to increase very largely; but in this, as in all other matters, proper conditions of fixing, clear instructions to the user, and regular supervision, contributed very much to the success that has been achieved.

The experiences here recorded are respectable; but there are many others whose experience takes a far wider range than mine. Among them, as one who has had great opportunities of placing these stoves, I would cite Mr. F. W. Goodenough, of the Gaslight and Coke Company, who, I think, in this matter will not disagree very far with me.

In conclusion, then, I would say that manufacturers of town gas possess, as I have endeavoured to show, in the article they manufacture, a heating power of unrivalled efficiency, whether burning internally in a combustion-motor or externally in a gas-fire. For obtaining the highest results, it is only necessary to perfect the motor so far as in human things any approach may be made to ideal perfection. The rest will be simply a matter of convincing the public upon the point; and that conviction will certainly follow easily and readily the larger the opportunity that is given to the public of being able to test for themselves the in-trinsic value of the gas-engine and the gas-fire.

Discussion.

The PRESIDENT (Mr. J. H. Canning, of Newport) trusted that he might be permitted to congratulate Mr. Thomas Canning on having given the members a very excellently thought-out paper, and one which was deep, and which covered an immense extent of ground. It was also a paper which would take a deal of hard thinking and mental digestion before it could be thoroughly appreciated. The author had dealt with one or two points to which he (the speaker) would like to refer. The first of them was on the subject of gas-engines. He would not say that it was impossible to buy a second-hand gas-engine that would give satisfactory results. This was far from the case. Given proper selection and proper judgment, it was perfectly possible to obtain a second-hand engine that would furnish good results; but there were a certain number of these engines at present being used by consumers which were exceedingly antiquated. He had known of engines that had been consuming anything from 40 to 60 cubic feet of gas per brake horse power; and such engines could not result in anything but great damage to the re-putation of the local gas undertaking. It was a peculiar fact that consumers who employed machinery of this character saw the en-gine struggling day after day with indifference, and continually experienced the difficulties met with in starting it. Often it took half a day with some such engines before they were fairly started, and a large expenditure of energy on the part of the man driving it—and he might say, also a great deal of strong language occasion-ally. But in spite of all this, the consumer who had purchased the engine invariably refused to believe that there was anything wrong with it. First of all, he would make a complaint with regard to the pressure of the gas—at least, this was generally the order. Then he would complain that something was wrong with the service; and afterwards he would make complaint of the quality of the gas. Having finished the series of complaints, he would possibly start again at the beginning, and ring the changes on these three things *ad infinitum*. But in the long run—and this was the dangerous aspect—the electricity canvasser came on the scene, and the consumer was "ripe" and "fell into his mouth" without any effort on his part. The antiquated gas-engine, in fact, had been one of the most efficient canvassers the electricity under-taking could have desired. The remedy for this state of things was no doubt the one suggested by the author of the paper—that was, giving the consumers the opportunity of obtaining on the hire-purchase system the very best and latest type of gas-engine possible. Another question to which he would like to allude was the thermal efficiency of gas-engines. It was wonderful what a long time it took some of their electrical friends to come up-to-date with regard to what was taking place around them. He believed even at the present day some of them were inclined to base their calculations and comparisons of the relative efficiency of gas and electric lighting upon the old flat-flame burner. In fact, he had a distinct recollection of having seen some such comparison only a few weeks back. The maker of it apparently had never seen an incandescent burner. In the same way, it was frequently stated that the thermal efficiency per indicated horse power of a gas-engine was in the neighbourhood of any-thing from 19 to 22 per cent. Or perhaps some very generous people would put it at 25 per cent.; whereas they would see in the table given in the paper that the efficiency, even in the lowest

case, fell very little below 30 per cent. Therefore, the more publicity they could give to the actual results, the better it would be for them. The great point they must aim at was the obtaining of full credit for what gas was capable of accomplishing—whether for lighting, heating, or power purposes. The public were not generally aware of it. Those connected with the gas industry, of course, were; and they were—mistakenly—apt to think sometimes that the public were equally well informed. With reference to the question of gas-fires, there was one point that struck him greatly in the paper—and that was the difference of pressure under which the two fires alluded to were tested. One of them was tested, he believed, at about 3 inches and the other at 1 inch pressure; and from the manner in which the results were stated, it was impossible to make any comparison between the fires, unless a whole series of tests were carried out at varying pressures in the two cases. It seemed to him that a great deal of the superior efficiency of the larger fire was due to the higher pressure, inasmuch as such a pressure would tend to give a better mixture of gas and air in the burner, and possibly a better combustion. Then there was another point—and a very important one. This was the question of the flues to be fixed to gas-fires. Too much stress could not be laid upon this. At present flues were usually arranged in such a manner as to almost completely baffle the exit of the waste gases from the fire; the intention probably being to absorb as much as possible of the heat before entering the chimney. But the necessity for this arose from the fact that the "glow fuel"—if he might use the term employed in the paper—and the flame from the burner were not properly proportioned to each other. If such proper proportion existed, practically all the heat that should be withdrawn from the flame by the fuel would be taken up before the waste gases approached the flue of the fire; and the flue could then be arranged in such a direct manner as to carry off, without the least baffling or obstruction, the whole of the waste products. There was no doubt that a good many of the complaints one heard from time to time with regard to the inefficiency of gas-fires arose to some extent from this. Then with regard to the fixing of meters for gas-engines, and their size. It was quite clear that a gas-engine placed an extremely great strain on a meter as at present constructed. The question was whether the existing type of gas-meter was the best one possible for such a purpose. He felt some hesitation in dealing with this matter, because it was rather a thorny problem—a great number of factors having to be considered. There was no doubt whatever that the present gas-meter—either wet or dry—was a remarkably accurate and efficient apparatus, used under the ordinary steady, equal conditions of gas consuming. But when there was a draught through it, as the author of the paper had said, "in spasms and jerks," no meter of this type could possibly stand such treatment for very long. The point was therefore whether some better kind of meter for the purpose could not be invented. He knew perfectly well that the makers of gas-meters at present were bound down very tightly by the legal restrictions governing the sale of gas; but he would ask whether, in the public interest, it would not be advisable that this legislation should be revised, so as to afford a clear field and every opportunity for the invention of a new and more compact meter, on better mechanical principles than prevailed at the present time.

Mr. H. D. Madden (Cardiff) also thought the paper was one they could not deal with straight away. It seemed to him that they should study it, and carefully take all the points out, so as to see all that would emanate from the suggestions. They would find in it much food for thought. One great thing was that it had hammered home the case of gas and its purity, especially with regard to carbon dioxide. This was a bogey that they were faced with every day by their friends the electricians. One of the most important things they had to fight to prove, not to electricians, but the general body of consumers, was that air in which gas was burnt did not contain a greater proportion of so-called poisonous products than electrically lit rooms. Dissemination of this fact was very necessary. They could not leave off driving it home. They were moving in the direction of higher pressures and getting higher temperatures; and one often wondered why more was not done in this way. At Woolwich Arsenal they were doing all sorts of work with high-pressure gas; and they found that the higher the pressure, the greater was the heating value they obtained from it. In his opinion, the industry would move very much along this line in future. Another point which was important was the number of cubic feet of gas consumed in the engines shown in the table per indicated horse power and per brake horse power; and with reference to this, he would like to ask a question. When the engines were at half-load, there was a much greater difference between the figures of consumption per indicated and per brake horse power than when they were on full-load. Was he right in assuming that this difference was caused by overcoming the inertia and the friction, which were not in proportion so much when the engine was on its higher duty? They could not attach too much importance to the question of the composition and calorific power of their gas. He did not think so much attention had been paid to this matter as might have been the case; but it seemed to him most necessary that the gas should be sent out as constant as possible in regard to its calorific power, composition, and pressure over the whole of the district during every hour of the twenty-four. In the past year, he had been working on this subject. It was perhaps a little difficult to keep the pressure throughout a district constant over the whole day, and it was a matter that required a lot of attention in the first place. But they should, as far as possible, keep the pressure constant over the district through the twenty-four hours. This uniformity of pressure was a most important factor in giving satisfaction to the consumers who had fires and engines; and at the same time they should, as he had said, be very careful that the calorific power or constitution of the gas did not vary unnecessarily. There was every indication, he thought, that they would be able to work to very nearly a straight line on the district in both these matters.

The Hon. Secretary (Mr. Octavius Thomas, of Pentre) said he would like to refer to the question of the size of meter prescribed for an engine. The point that arose in his mind was whether it would not be better to have an anti-fluctuator of such a character as would overcome the difficulty of the size of the meter. Assuming that they had a meter sufficiently large to pass through in an hour the gas required for this period, could they not have an anti-fluctuator which would overcome the fluctuation of the engine?

Mr. R. A. Browning (Neath) remarked that he had heard that a large increase in the consumption of gas had been experienced in Birmingham, and it had been found that the use of producer gas was being largely done away with, and coal gas installed in its place. This was very satisfactory. Mr. Canning right through his paper had shown that town gas was much cheaper and better than producer gas.

Mr. Thomas Canning, in the course of his reply to the points raised by the different speakers [it was resolved that the paper should be further discussed at the next meeting], remarked that he had been very much struck with the warm praise given to the paper by the President; and he could only say that he did not suggest those words to him. [Laughter.] No doubt there must still be a great deal to be said on the question of pressure. The work under high pressure, so far as they had had experience of it, had certainly shown better results. To bring about what Mr. Madden had referred to—namely, a constant pressure, along with a constant value for the gas—would be ideal distribution indeed. If they could get up a practically constant day-load, and work to a straight line continuously, there was no question whatever that they need not fear the competition of anybody or anything. The President had alluded to the construction of the meter at the present time. Very many improvements had been made in respect to the gas-burner, gas-fire, and gas-engine; but to suit the varying demands which had arisen for gas, besides the ordinary consumption for domestic purposes, such as lighting and heating they had not a special meter. He was inclined to think the time had arrived when they should have one; and he believed the suggestion of the President in this connection was a good one. Mr. Madden drew attention to a feature in one of the tables—that relating to the results published by the Committee of the Institution of Civil Engineers. It was a very striking point—the consumption of gas being so high at half-load and so comparatively low with a full-load. It would require considerable time to fully explain this; but Mr. Madden had practically furnished the explanation himself. It was the relationship existing between inertia and friction. Inertia, of course, would be considerably higher at the lower speed; and then it must be remembered that in the working of a gas-engine it was all a forward impulse. The consequence was that, as one increased the speed, one rapidly destroyed all the effects that might arise for impeding efficiency from either of the two elements referred to by Mr. Madden. The opinion had been expressed by Mr. Thomas that in all probabilit[y] a good anti-fluctuator, properly fixed, would overcome the diffi[-] culty of having too small a meter; but he (the speaker) was no[t] quite sure that it would. He was aware that there was a ne[w] anti-fluctuator being brought out which claimed to do this. A[s] yet he had had no experience of it; but the anti-fluctuator itsel[f] would, of course (or ought to), automatically close the moment i[t] had received the charge required for the engine. He kne[w] that the idea had been tried of having two anti-fluctuators and this had proved better, because one or the other cam[e] into use, so to speak, alternately. But, all the same, it amounte[d] simply to this. An engine would only take in its charge [of] gas at the point of the cycle when it was required; and then would take in its full charge, and would have nothing less. I[n] the case of an engine running at a very rapid speed—say, 20[0] revolutions per minute—look what this meant. He thought th[e] remedy was that the meter should be large. This seemed to hi[m] a better way out of the difficulty than to have an anti-fluctuato[r] though, at the same time, he had so open a mind on the matte[r] that he should give the anti-fluctuator a trial. If it proved that could overcome the difficulty, he would be very pleased indee[d]. Mr. Browning had touched upon an important point; and he wa[s] quite correct in what he said. In the small industries whic[h] thrived so greatly in Birmingham, but not at Newport, or Cardi[ff] or anywhere along that coast, there had been, and was to-day, a[n] enormous gas consumption for the day-load which they could no[t] get in their own district. These small industries required sma[ll] gas-engines—he meant small compared with the leviathans h[e] had referred to at the opening of his paper. Town gas had bee[n] used previously for these; but a little while ago suction produc[er] gas began to take the place very largely of coal gas. There had n[ot] been a more cheering fact put before the meeting, or one that th[e] members would be more pleased to hear, than the statement [of] Mr. Browning that in Birmingham they were going back to tow[n] gas again.

PROFESSOR HAROLD B. DIXON ON THE CHEMISTRY OF GASEOUS COMBUSTION.

Inauguration of the Manchester University Lectures.

E first of a series of lectures on "The Science of Gas Manu- ture and Combustion" arranged with the Manchester Univer- authorities by the Manchester District Junior Gas Association, pported by the Manchester District Institution of Gas En- eers (to which reference has already been made in the OURNAL") was delivered in the Chemistry Theatre of the iversity on Saturday afternoon by Mr. HAROLD B. DIXON, A., Ph.D., F.R.S., President of the Chemical Society, and ofessor of Chemistry at the University, who chose for his bject "The Chemistry of Gaseous Combustion." There s a large attendance, about eighty being present, including . H. Kendrick (Stretford), the President of the Manchester strict Institution of Gas Engineers, Mr. G. W. Shepherd, esident of the Yorkshire Junior Gas Association, Mr. W. anfield, a Past-President of that organization, and Mr. F. horp, President, most of the members of the Council, and Mr. Alsop, the Secretary of the Manchester and District Junior Gas ssociation. These lectures, and an advanced course on "The hemistry of Gaseous Fuel and Flame," have been arranged th the object of bringing gas engineers and others connected th the gas profession into closer touch with the University; e scheme having had its origin in a suggestion made by Mr. horp in the course of his Inaugural Address to the Junior Gas ssociation in January.

Mr. THORP presided, and in opening the proceedings said he ould have preferred that someone more prominently identified ith the gas industry had been appointed to the position; but the presentatives of the Senior Association, with that magnanimity hich had characterized them all along in connection with the aming of the scheme, had requested him to take the chair, ecause the idea originated with the Manchester and District unior Gas Association, of which he was now President. By the embers of the Junior Association, Oct. 1, 1910, would long be emembered as a day of days—a day on which long-cherished opes and ambitions had been realized; and he hoped that Pro- essor Dixon and the University authorities would have no reason o regret the kindness they had shown by arranging for the ectures now to be inaugurated. They were deeply indebted to Professor Dixon, who had given up another Saturday afternoon or their benefit—sacrificing himself on the altar of duty to give hem the first lecture of the course. He (Mr. Thorp) would not veary them with a history of the movement, but he thought they ll realized that the gas engineering profession ought to be raised n the eyes of the general public, and occupy a higher position han it now did in the professional world. Many people still ap- peared to consider a gas engineer as a sort of glorified foreman stoker; while an electrical engineer was always looked up to as something more than the general body of men. They hoped by the inauguration of these lectures to show that it was necessary or gas engineers to have the very highest technical and scientific attainments to enable them to keep their positions. He thought those who had recently inspected the new tank and gasholder in course of erection at the Bradford Road station of the Manchester Corporation would realize the skill and the technical knowledge required on the part of the Engineer under whose guidance the work was being carried out. It was hoped by the lectures which had been arranged to bring about a closer connection between the University and those engaged in the gas industry; and the general public would see, by the reports in the newspapers, that gas engineering demanded the highest skill and technical knowledge. He thought the day had passed when Universities were to be regarded merely as great centres for the learning of the dead languages. To-day they dealt with practical problems of everyday life. And they had all come to realize, in Mr. Balfour's words of the previous week, that "there never has yet been a great result attained for science which has not sooner or later had its re-action upon the fortunes of the whole human race." Now that they had a direct connecting-link between the Manchester University and the two local Gas Associations, he looked forward to something being achieved. It was quite true that they had at the Leeds University a Chair of Fuel. This, however, was more of a national affair; and it was hoped that much good would result from the scheme. At the Manchester University there would be, in connection with the new scheme, opportunities for research work which might have far-reaching results. They had on one side Professor Dixon (to whom they owed a great debt of gratitude), who was the first authority of the day on gaseous combustion and the chemistry of flame; and on the other they hoped to discover among their number an inventive genius who would be a worthy successor of the great engineering inventors of the past. Lancashire had from among her sons produced men of great inventive capacity in their own industry. In support of this statement he need only mention one name—that of Thomas Fletcher, of gas-stove and gas-appliances fame, who was born, he believed, within five miles of Manchester. He hoped that before this series of lectures had concluded they would be able to show the gas profession and the general public that the work of the two Gas Associations had produced something which was really valuable. Their opportunities were great. Should they grasp them, and show the world that they could not only obtain privileges but bestow favours by their exertions? He asked the members to give the scheme a fair trial, and support the Council by attending the lectures. The "Chemical Trade Journal," when noticing Professor Armstrong's paper at the British Association meeting, said: "If only one-fifth of the scientific knowledge that has been applied to the electrical industry had been applied in the gas industry, the latter would have been in a position to defy competition from any source, from the illuminating and heating point of view. But the help of science is not to be gained by pouring cold water on any scheme before it has had time to develop." He (Mr. Thorp) commended these remarks to their notice. If they did not succeed as well as they had hoped to do, he asked that cold water should not be thrown on the scheme, but that it should be given a fair trial. If this were done, and with the University staff to assist them, he was certain that something would be accomplished. In asking Professor Dixon to give his lecture, he (Mr. Thorp) said this gentleman needed no introduction from him to his present audience, as his work in the realm in gas science and practical experiment was too well known.

Professor DIXON, who was received with much applause, said that before proceeding with his lecture he had to apologize for the absence of the Vice-Chancellor. It had been his intention to be present; but he had been called away, and had asked him (the speaker) to express his regret at being unable to take part in what he called an "auspicious occasion." The privilege of addressing a body of experts, continued Professor Dixon, was always appreciated by a man of science, though he naturally felt a "fearful joy" in the fact that his audience brought understanding and knowledge to dissect his arguments and criticize his conclusions. "But," added the Professor, "my appreciation of the privilege I enjoy to-day rests upon a broader basis; for, however much this lecture may fall short of the ideal address, which is, I take it, to be intelligible to all and yet to contain something new to everyone, I have the satisfaction of knowing that you have asked me to speak on some aspects of the researches on combustion that have been of late carried out in the University under my direction, and that your presence is a sign that the members of your profession desire a closer connection with the scientific work of the University. I hold the opinion very strongly, and every year's experience confirms it, that the work of scientific laboratories is most fruitful when the directors of the laboratories are in touch with actual industrial problems. This is not to say that Professors of Chemistry should spend all their spare time in what you would call expert work. Far from it. But a professor is a better-armed man of science if he knows the methods and appliances of one or more of the great industrial processes; and, moreover, if it be his duty to prepare men to become works chemists, capable of original ideas, he will find that the road to success lies in his giving them research problems which have some bearing on their particular industry. It seems to me that, if our industries are to be scientifically guided, we greatly need more co-operation between the works and the university in dealing with the problems waiting for solution, even in the gas industry. Many problems can best be attacked on the small scale in the laboratory; and the man who, under proper guidance, has solved some problem and found the conditions of success can best guide and correct operations on a larger scale. It is for this reason that I welcome the beginning of what I hope will be a lasting connection between the Manchester University and the gas industry of the district. In Leeds, the leaders of the gas industry in Great Britain have established a Professorship of Fuel and Gas Engineering. I rejoice to think it has been founded at the Leeds University, and that the first holder is an old student of Owens College—Dr. W. A. Bone. I should like to congratulate the gas profession and the University of Leeds on the foundation of the George Livesey Professorship. In a more humble way, we desire to connect our department with the gas engineers of the district for our mutual advantage."

THE LECTURE.

Proceeding with his lecture, Professor DIXON explained that it was in 1876 that he first began his experiments on the combustion of gases. The problem was one which had to be investigated by Bunsen: How did one gas, such as oxygen, divide itself between two others, such as carbon monoxide and hydrogen, in an explosion, when the combustible gases were more than sufficient to unite with all the oxygen? Was the division of the oxygen in accordance with the law of mass action, or was this law modified in the peculiar "step-like" progression found by Bunsen? From this investigation three conclusions had been reached, one of which had been largely overlooked by chemists.

(1) The law of mass action was found to hold good; but the final equilibrium depended on two opposite reactions between the cooling gases being balanced; this equilibrium being reached after all the oxygen had combined. The opposite reactions were that between carbon monoxide and steam to form carbon dioxide and hydrogen, and that between carbon dioxide and hydrogen to reform carbon monoxide and steam:

$$\frac{CO + H_2O}{CO_2 + H_2} = \text{constant.}$$

(2) This constant was found to be greatly affected by the

temperature of the vessel containing the gases. A series of experiments clearly showed that the quantity of steam produced was larger the cooler the vessel. When the temperature was raised progressively, the proportion of steam formed fell regularly and then became constant. As this constancy always occurred at the point where steam could not be condensed on the walls, it was proved that the condensation of the steam took place during the actual duration of the explosion flame—

Temperature of Vessel. Deg. C.	Equilibrium Found. $\frac{CO + H_2O}{CO_2 + H_2}$.	Temperature of Vessel. Deg. C.	Equilibrium Found. $\frac{CO + H_2O}{CO_2 + H_2}$.
10	7·0	60	4·1
0	5·9	80	4·0
20	5·2	100	4·0
40	4·5	125	4·0

We conceive the gases to be composed of a vast number of molecules moving in straight lines and coming into collision one with another and with the sides of the vessel. In the flame an appreciable time elapses during which the molecules are in sufficiently rapid motion to react chemically with those they come into collision with. It must happen then that while the change is proceeding a number of steam molecules just formed in the flame strike the side of the vessel. The experiments show that a large number of these molecules stick to the surface (when it is cool), and, being condensed to the liquid form, take no further part in the chemical change. The removal of one of the reacting bodies, of course, alters the equilibrium, and less hydrogen and more carbon monoxide are found unburnt in the final products.

The mechanical action of a surface may thus largely modify a flame; but the physical nature of the surface may also profoundly affect the gases close to it, especially at a high temperature. We do not know the actual nature of chemical combination, but it is certainly related to the electric changes carried by the atoms. Heated lime and other earths give out a stream of negative "electrons;" and this discharge may facilitate chemical change in the layers of gas next to the surface. It would probably well repay the investigator who studied the electric action of the oxides used in incandescent lighting.

(3) The fact, discovered in 1876, that carbon monoxide and oxygen did not burn with flame when the gases were well dried, led to many investigations as to the action of moisture in chemical combustion. There could be no doubt, as Dr. Brereton Baker had shown, that water influenced the initiation of chemical change, and that such inflammable substances as phosphorus, sulphur, and carbon could not easily be ignited when dry, and that pure hydrogen itself showed peculiar resistance to ignition. But while steam, or liquid water particles, influenced the beginning of chemical changes, it did not follow that no chemical change could take place without the intervention of water, or that reactions at the high temperature of explosions did not occur directly between gases.

The extinction of a flame of carbon monoxide when brought into dry air [which was shown experimentally] might be due to the dissociation of carbon dioxide at the flame temperature. If the oxygen were taken from steam, the heat evolved in the change would be about one-seventh that due to direct oxidation. The CO_2 molecule would thus be comparatively cool at the moment of its formation; and though the total heat evolved by the indirect would be the same as that of the direct oxidation, the time required for the indirect change would be longer, and therefore the average temperature of the flame lower. At all events, carbon monoxide does react with steam, and the freed hydrogen can react with free oxygen; so that the hypothesis is a possible one. Many other hypotheses had been advanced to account for the disability preventing the oxygen burning the monoxide directly—one that the oxygen, *per se*, was too stable, or that gases only reacted in equal volumes. He had shown, however, that neither the stability of the oxygen nor the "law of equal molecules" could be the cause, for carbon monoxide would not explode with ozone, with chlorine monoxide, or with nitrous oxide. On the other hand, the dried gases united readily without inflaming in the presence of red-hot platinum, and in the burning of dried cyanogen the carbon monoxide first formed would burn in excess of oxygen—either prolonging the flame, as in explosions, or else burning with a separate flame, as in Smithells' flame-separator. Steam, therefore, was necessary for the burning of carbon monoxide only under certain conditions. The explanation suggested seemed the only one consistent with all the facts.

After describing the phenomena, and showing experimentally the immense rapidity and the violence of the explosion-wave in different gases, Professor Dixon briefly explained the theories that had been put forward to explain the propagation of the wave. In his sound-wave theory, as well as in the modified theory put forward by D. L. Chapman and M. Jouguet independently, each layer of gas is supposed to be fired in turn by adiabatic compression due to the burning of the layer immediately next to it; an intense pressure-wave being driven through the column of gases of sufficient intensity to fire the gas as the wave reaches it. *Such a wave—like a sound-wave—is propagated by collisions between two molecules.* As Sir J. Larmor had shown, there is no time for the occurrence of collisions between three or four molecules simultaneously. Such collisions are indeed comparatively rare, and practically all chemical reactions in gases must take place between two molecules—certainly all changes which travel with the rapidity of sound. But it has been shown that the explosion-flame does travel with this rapidity. If this argument is valid, it cannot be that in the explosion of gases all changes depend upon the interaction of three molecules simultaneously, one of them being water, as Professor Armstrong has contended. Any such changes as the burning of cyanogen to carbon monoxide and nitrogen when fired with its own volume of oxygen cannot require, as Professor Armstrong suggests, the triple collision of cyanogen, steam, and oxygen molecules to form products which would require another collision before giving the final simple bodies found. All the experimental evidence shows that no water is needed to bring about the change; and the rapidity of the flame is quite irreconcilable with the complicated changes suggested. Dr. Brereton Baker and Professor Bone, after experiments carefully conducted, agree with the view that water is not necessary for many reactions between gases at a high temperature.

With regard to the burning of hydrocarbons, Professor Bone has shown that the oxygen probably combines directly with carbon and hydrogen simultaneously—*e.g.*, that a marsh gas molecule and an oxygen molecule give in the first instance formaldehyde and steam:

$$CH_4 + O_2 = CH_2O + OH_2.$$

At the moment of collision, we may picture the marsh gas and the oxygen molecules forming an unstable oxygenated compound which flies apart into separate molecules the next instant. The lecturer said that so far he was willing to agree with the formation of Professor Armstrong's "compatible compounds;" but he could not agree that these have a separate "life" as molecules—*i.e.*, that they have the motion and the free path of an ordinary molecule. Such a "compound" is a mere phase in the collision, the redistribution of "affinities," and the "break-up" which occur in chemical change.

Professor Dixon next exhibited the apparatus he had used in studying the adiabatic compression of gases. He said he had succeeded in compressing various mixtures of gases, such as carbon disulphide with oxygen, hydrogen with oxygen, to the ignition-point, and photographing the flame produced on a rapidly moving film, so as to draw out and analyze the flame. These photographs, which were thrown on the screen, showed that the column of compressed gas was not ignited instantaneously, as Professor Nernst had predicted on theoretical grounds. In some mixtures, considerable time elapsed between the mixture reaching the "ignition-point" and the appearance of the flame. This "pre-flame period" was of considerable importance. During it the gases were self-heated through several hundred degrees centigrade at least. It had been shown, for instance, that a mixture of hydrogen and oxygen must have been self-heated to 1000° C. before the flame appeared, though the true "ignition-point" was lower than 550° C.

In conclusion, Professor Dixon drew attention to the conditions for obtaining the highest flame temperatures, and therefore, probably, the highest illuminating value, from gases. It was shown experimentally how pressure affected the intensity of combustion, and what must be sought for in using gas or air under pressure to secure greater intensity of combustion on the surface of an incandescent mantle.

At the close of the lecture,

Mr. D. V. Hollingworth (Salford) moved a vote of thanks to Professor Dixon for his address, and also for his great assistance and influence which had made possible the inauguration of these lectures and the formation of the classes for the study of the chemistry of gaseous fuel and flame. If the members of the Association desired to particularly thank Professor Dixon, they should do their best to attend the lectures and the classes; for he was sure no greater pleasure could be given to the Professor than to see the lectures and classes well attended, and to find students making use of the laboratories for research work. There was no reason why they should not build up a closer connection with the University, and so benefit the whole gas industry; and when they came forward with a greater scheme of research work, he hoped the Association would have the sympathy and the support of the whole of the Lancashire and Yorkshire gas industry. (Hear, hear.) There were several discoveries which were needed in the gas industry. Let them see to it that such problems had been solved by some member or members of the Manchester and District Junior Gas Association.

Mr. J. Alsop seconded the resolution, which was carried with acclamation.

Professor Dixon an Honorary Member.

At the request of the Chairman, Mr. Alsop read a resolution which had been passed by the Council of the Junior Association. It was to the effect that, to mark the members' appreciation of the valuable services of Professor Dixon in raising the status of the Manchester and District Junior Gas Association, and for the important educational assistance afforded to them by the inauguration of a series of lectures on the science of gas manufacture and combustion at the Manchester University, whereby a direct connection between the University and the Association has been established, Professor Dixon be enrolled an honorary member of the Association, and that a special membership card with the resolution inscribed thereon be presented to him.

Mr. Thorp then handed the membership card to Professor Dixon, remarking that the members might well call it "Dixon Day."

Professor Dixon, in responding, said he was much gratified at having this presentation. He felt they should one and all try to

ke up this movement in earnest. He would like to see some of em undertake scientific research bearing on their own problems, th such help as the University could possibly supply, and with e encouragement which the University could give them. There as some stimulus to be derived from the very atmosphere of a ace like the Owens College—a stimulus he had himself felt ever ice the day he set foot in the laboratories where Roscoe and horlemmer had worked. The stimulus of research was—like e pre-flame period in gases—self-heating. A man who made discovery as the result of his researches had more confince in himself, and was more ready to tackle other problems; d if they did not exactly get what they aimed at, they would ive the satisfaction of knowing they were always "somewhere ar the unknown," and would be pioneers whose labours would utilized by others. He begged to thank the Junior Gas Association for their kind resolution. The honorary membership of eir body was an honour of which he felt justifiably proud; and e appreciative words with which it had been presented to him ade it doubly welcome. He would always look back with pleaure to the day he became one of them.

This concluded the proceedings at the lecture. Subsequently, owever, and after tea, a considerable number of the members the Junior Association re-assembled in the Chemistry Theatre, hen a discussion took place on the different points raised in the cture. In this way some of the matters dealt with by Professor ixon, not quite understood, were made clear.

AS ENGINEERING AND FUEL DEPARTMENTS AT THE LEEDS UNIVERSITY.

Revised Courses of Study.

We have received from Dr. W. A. Bone, F.R.S., Livesey Proessor of Applied Chemistry (Coal Gas and Fuel Industries) in he University of Leeds, the prospectus for the session 1910-11 f the Gas Engineering and Fuel and Metallurgy Departments. t furnishes particulars of special interest to some of our readers.

The courses of study have been drawn up to meet the requirenents of students who are preparing for responsible positions ither as gas engineers or in the fuel and metallurgical industries. The courses in Gas Engineering and in the Technology of Fuel will deal chiefly with the manufacture and distribution of coal gas and gas lighting problems, bye-product coking processes, and he production and application of gaseous fuels for heating and power purposes. Students who can devote three years to attendance at the University are strongly recommended to take the B.Sc. degree course; but they must previously have passed the matriculation examination conducted by the Joint Matriculation Board of the Universities of Manchester, Liverpool, Leeds, and Sheffield. During the first year, the student will attend classes in Mathematics, Physics, Chemistry, and Applied Mechanics. During the second year, he will continue the study of Physics and Chemistry, and also take a course in Engineering and Mechanical Drawing, as well as a special course of lectures on the Chemistry of Gases, supplemented by work in the fuel and metallurgical laboratories. In the third year, he will devote his attention mainly to his special subject, but will also spend six hours a week in the mechanical drawing office (Engineering Department). At the end of the course, the student will qualify for the B.Sc. degree by passing the prescribed final examination in his principal subject, *plus* Chemistry and Engineering as subsidiary subjects. A diploma in the Gas Engineering or Fuel and Metallurgy will be awarded to graduates of the Leeds or some approved University who, having graduated in science with Chemistry or Engineering as a principal subject, shall have attended for one year the prescribed course for the third year of the ordinary degree course, and have passed an examination thereon. The degree of B.Sc. with Honours may, in Gas Engineering or Fuel and Metallurgy, be conferred upon students who, having obtained a diploma, shall have spent an additional year in research in the Department, to the satisfaction of the Examiners. There are two-year courses, intended for students who, while not proposing to proceed to a degree, desire to take systematic instruction either in Gas Engineering or in Fuel and Metallurgy.

Students entering for these courses must produce certificates of having passed the Matriculation examination, the Oxford or Cambridge Local examination in Mathematics, the London University Matriculation or other approved examination, or they will be required to pass the University's special entrance examination, comprising Arithmetic, Algebra, Geometry, and Trigonometry. The first year's course will be the same for all students, and will include Mathematics, Physics, Chemistry, and General Engineering, up to the intermediate standard, with laboratory works in the three last-named subjects. The second year's course may be differentiated according to individual requirements, and will include Chemistry, Fuel and Metallurgy, or Gas Engineering, with practical work, and in certain cases Mechanical Drawing. Students who have passed satisfactorily through the two-years course may be permitted to enter for the diploma examination. In special cases, when a student has served an apprenticeship as a gas engineer, and has acquired a knowledge of Mathematics, Physics, and Chemistry substantially equivalent to the standard of the first year's diploma course, he may be allowed to take a one-year course in the subjects comprised in the second year's diploma course; but such one-year course will not entitle him to enter for the diploma examination.

The teaching staff at present consists of Dr. Bone, with Mr. Harold H. Gray, B.Sc., as Demonstrator, and the following Special Lecturers: Dr. Harold G. Colman, on "The Manufacture of Coal Gas;" Mr. Ernest Bury, M.Sc., on "Bye-Product Coking Processes." There are two other subjects in the prospectus—"Distribution and Uses of Coal Gas" and "Refractory Materials;" but the lecturers have not yet been appointed.

The following is the syllabus of the lecture courses:—

I.—Physical and Chemical Properties of Gases.

[Professor Bone, Thursdays at 2 p.m. throughout the session.]

(*a*) Kinetic theory. Fundamental gas laws. Van der Waal's equation. Compressibility and liquefaction of gases. The critical state. Specific heats. Dissociation. Diffusion and transpiration. Viscosity of gases. Modern theories as to the nature and conditions of chemical changes in gaseous systems. Velocity of reaction chemical equilibrium. Influence of moisture and surface in gas reactions. Occlusion of gases by metals and the action of gases upon solids generally. Principles of thermo-chemistry. Gas calorimetry. Heats of combustion of gases.

(*b*) The mechanism of combustion, &c. Slow combustion. Ignition-points of gaseous mixtures. Flames and explosions. The explosion wave. Rates of explosion. The combustion of carbon, carbon monoxide, and cyanogen. The combustion of hydrogen and of hydrocarbons. The action of steam upon incandescent carbon. The reversible system $CO + OH_2 = CO_2 + H_2$. The action of CO upon metallic oxides. The thermal decomposition of hydrocarbons.

II.—Technology of Fuel (General Course).*

[Professor Bone and Mr. Gray, Thursdays at 10.30 a.m., first and second terms.]

Fuels, their classification and distribution. Mechanical theory of heat. Heat transmission. Specific and latent heats. Variation in specific heats of gases with temperature. Heat recuperation. General chemical and thermal aspects of combustion. Fuel calorimetry. Pyrometry. Radiometry. Analysis of combustion products. Heat balances.

General description of fuels—natural gas, petrol, petroleum, shale oil, peat, coal. British coalfields and fuel resources. Analysis and valuation of coals for industrial purposes. Distillation and gasification of coal. Coalite. Coke. Coal gas, producer gas, and water gas.

Advantages of gaseous fuels. The firing of boilers and furnaces. Internal-combustion engines.

III.—Technology of Fuel (Special Course).

(Carbonization of Coal; Gaseous Fuels.)

[Professor Bone, Tuesdays at 11.30, first and second terms.]

First Term.—Distillation and carbonization of coal. Influence of temperature upon the character and yields of various products. General review of principles underlying carbonization processes and of operations involved in the manufacture of coalite, coal gas, and "bye-product" coke. Coal tar.

Second Term.—Principles underlying the gasification of coal and coke. Action of air and of steam upon incandescent carbon at different temperatures. The blast-furnace as a gas-producer. Cleaning and utilization of blast-furnace gas for power purposes. Gas-producer design and practice. Selection of fuels. Quantities of gas required for furnace work and for power purposes. Typical gas-producers, including suction producers. The cooling and washing of gas for power purposes. Ammonia-recovery system. Efficiencies of gas-producers. The manufacture and uses of "blue" water gas.

IV.—Manufacture of Coal Gas.

A special course of 20 lectures by Dr. Harold G. Colman on Wednesdays at 6 p.m. and Thursdays at 9 a.m. during the second term (January to March), to be delivered in alternate sessions—viz., 1911-12, 1913-14, &c.

V.—Distribution and Uses of Coal Gas.

A special course of 20 lectures on Wednesdays at 6 p.m. and Thursdays at 9 a.m. during the second term, to be delivered in alternate sessions—viz., 1910-11, 1912-13, &c., by specially appointed lecturers.

[Detailed arrangements for 1910-11 will be announced during November.]

VI.—Bye-Product Coking Processes.

A special course of eight lectures by Mr. Ernest Bury, M.Sc., on Saturdays, at 3 p.m., during the second term in alternate sessions—1910-11, 1912-13, &c.

VII.—Refractory Materials.

A special course of eight lectures on Saturdays at 3 p.m., during the second term in alternate sessions—1911-12, 1913-14—by specially appointed lecturers.

VIII.—Gas Lighting and Heating.

[Professor Bone, Tuesdays at 11.30 during the third term.]

The nature and structure of coal gas and hydrocarbon flames. Theories of luminosity. The bunsen burner. Construction of "atmospheric burners for various purposes. The incandescent mantle. Acetylene as an illuminant. Outlines of photometry and spectrometry.

The newly erected and equipped laboratories, particulars of which have appeared in the "Journal," will be open during the session from 9.30 a.m. to 1 p.m., and from 2 to 5 p.m., except on Saturday afternoons. A fully-equipped workshop, with mechanic in charge, will be provided in the new building. The equipment will allow for instruction and research in the following (among other) subjects: Gas analysis, photometry and spectrometry, gas

* This course is specially intended for engineering students and others who wish to acquire a general knowledge of fuel technology. It will also form part of the second year's course for students taking the B.Sc. degree in either Gas Engineering or Fuel and Metallurgy.

calorimetry, gaseous combustion and explosions, the chemistry of gas production, testing of gas coals, and experiments with gases under high pressures, including compression and liquefaction of gases, and the analysis and testing of coals. Arrangements will be made to enable regular students to carry out efficiency trials of gas-producer plants, &c., and help will be given to those who desire to gain practical experience in gas-works during the summer months. Students will also be encouraged to make themselves acquainted with the researches which are being carried out in the department, the results of which will, at convenient intervals, be explained. In this connection, the prospectus states that, in addition to the work which is being carried out by the holder of the Gas Fellowship established by the Institution of Gas Engineers, an investigation on the use of coal gas for heating purposes is being conducted by a specially appointed Research Chemist, under the direction of a Joint Committee appointed by the Institution of Gas Engineers and the University. Students will therefore be able to study the methods which have been devised for the investigation of gas-fires, &c.

Midland Junior Gas Engineering Association.

The programme of the forthcoming session of the Association, which has been received from the Hon. Secretary (Mr. G. C. Pearson, of the Nechells Gas-Works, Birmingham), shows that the following are the fixtures: Oct. 8, Presidential Address of Mr. R. S. Ramsden, of Burton-on-Trent, and a paper on "Tar Distillation," by Mr. A. R. Warnes, of Messrs. J. Hardman, Limited, Birmingham. Nov. 12, a paper on "Ammonia Recovery, with Special Reference to Apparatus employed therein," by Mr. W. H. Johns, of Birmingham. Dec. 10, visit to the Birmingham University. Jan. 14, 1911, a paper on the "Development of Incandescent Gas Lighting," by Mr. W. J. Pickering, of Birmingham. A date in January to be fixed later, evening visit to Messrs. Parkinson and W. & B. Cowan's Birmingham works. Feb. 11, a paper entitled "Practical Hints on Retort-Setting," by Mr. T. Brooke, of Birmingham. March 11, a paper on the "Birmingham Coal Test Plant," by Dr. W. B. Davidson and Mr. G. C. Pearson, of Birmingham. April 8, visit to a works. Some date in May, joint meeting of the Junior Associations in Birmingham. The Council invite the co-operation of each member in their endeavour to increase the membership of the Association, which, they point out, having regard to the important and extensive district covered, is not nearly so large as it should be. No doubt, those who have already experienced the benefits accruing from joining the Association will do their best to increase the membership-roll.

"Transactions" of the Belgian Gas Association for 1909-10.

We have received from the Secretary of the Belgian Association of Gas Managers (M. Emile van Heede, the Manager of the Molenbeek Koekelberg works of the Compagnie Continentale du Gaz, in the suburbs of Brussels) the "Transactions" for the year 1909-10. The general meeting was held on the 16th of June, 1909, in the Hôtel Ravenstein, under the presidency of M. Prisse, the Director of the Compagnie Générale pour l'Éclairage et le Chauffage par le Gaz. The technical matter submitted to the members, and contained in the pamphlet, consisted of a communication by M. Coune, on "The Bueb System of Vertical Retorts;" and it was followed by a report by the Gas Committee of the Ghent Town Council on the conditions for the future supply of gas, which concludes with the adoption of a calorific instead of an illuminating standard for the gas. It was brought up by M. Jean de Brouwer; and it was decided to include it in the "Transactions." M. Van der Willigen contributed a paper on "Carburetted Water Gas for Small Works;" and M. Greyson de Schodt discoursed on "The Utilization of Gas." The rest of the pamphlet is occupied with descriptions of the four gas-works supplying Brussels—the Municipal, Forest, Jette St. Pierre, and St. Gilles—accompanied by a number of plates. The first three of these works were described in the "Journal" in connection with the visit of the Institution of Gas Engineers and of the members of the Société Technique du Gaz en France to Brussels last June; and some particulars of the other will be given in an early issue. The Association received from the Gas Department of the Municipality, from various local authorities and companies owning gas-works, and from trading firms, a sum of 27,600 frs. (£1104) for the erection, equipment, and carrying on of the pavilion in the grounds of the International Exhibition. The revenue for the year to June 15, 1910, was 46,747 frs. (£1870), and the expenditure, including 13,673 frs. (£547) for the pavilion, 15,460 frs. (£618); leaving a balance in hand of 31,287 frs. (£1252).

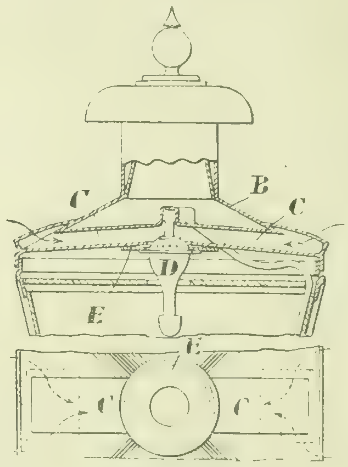
The Engineering Exhibition at Olympia was brought to a close on Monday evening last week with an informal gathering, at which Captain H. Riall Sankey, the Chairman of the Council, presided. Having briefly referred to the success of the exhibition, he called upon Mr. Doherty, of the Worthington Pump Company, to make a few remarks. Mr. Doherty complied with the request, and, on behalf of the exhibitors, asked the Organizing Manager (Mr. F. W. Bridges) to accept a gold card-case as a small memento of their appreciation of him. Earlier in the day, a meeting of exhibitors was held at which a resolution was passed expressing satisfaction at the way the arrangements had been carried out.

REGISTER OF PATENTS.

Lantern for Inverted Incandescent Gas-Burners.

Ede, E. P., of Highbury, N., and Kempton, C. H., of Vauxhall, S.E. No. 16,411; July 14, 1909.

In a street lantern constructed according to this invention, the air supply is led through passages extending from the walls of the head or top of the lantern to the burner; while the products of combustion are dispersed by a baffle below the air passages so as to deflect them towards the sides of the head of the lantern, and allow them to escape through the tent surmounting the lantern.



Ede and Kempton's Street Lantern for Inverted Gas-Burners.

A vertical section is given of the lantern, with its top closed down, and a part plan of the underside of the head. The lantern comprises the usual body portion and a hinged head and tent. Within the head B are provided two passages C, extending from oppositely disposed openings, in the head and meeting above the burner D. These passages may be slightly inclined upwards (as shown) or horizontal; and the openings are provided with shields, having side openings to prevent a too rapid inflow of air. Where the passages meet, there is formed an opening through which the head of the burner projects, and is attached to the gas-supply pipe; the air supply entering the burner at its top. The lower portion of the burner passes through a circular opening in the reflector which surmounts the lantern body. Below the air-passages C there is a baffle E, preferably in the form of a circular plate surrounding the top of the burner. When, however, the lantern is to carry two burners, the opening is elongated to allow them to pass through it.

The air supply enters the passages C from opposite directions, and on reaching the centre of the lantern enters the burner D, where it mixes with the gas in the usual manner. The products of combustion pass up through the opening in the reflector, strike against the baffle E (whereby they are deflected towards the sides of the lantern), and pass upwards to the tent, whence they escape.

Manufacture and Purification of Coke or Other Fuel.

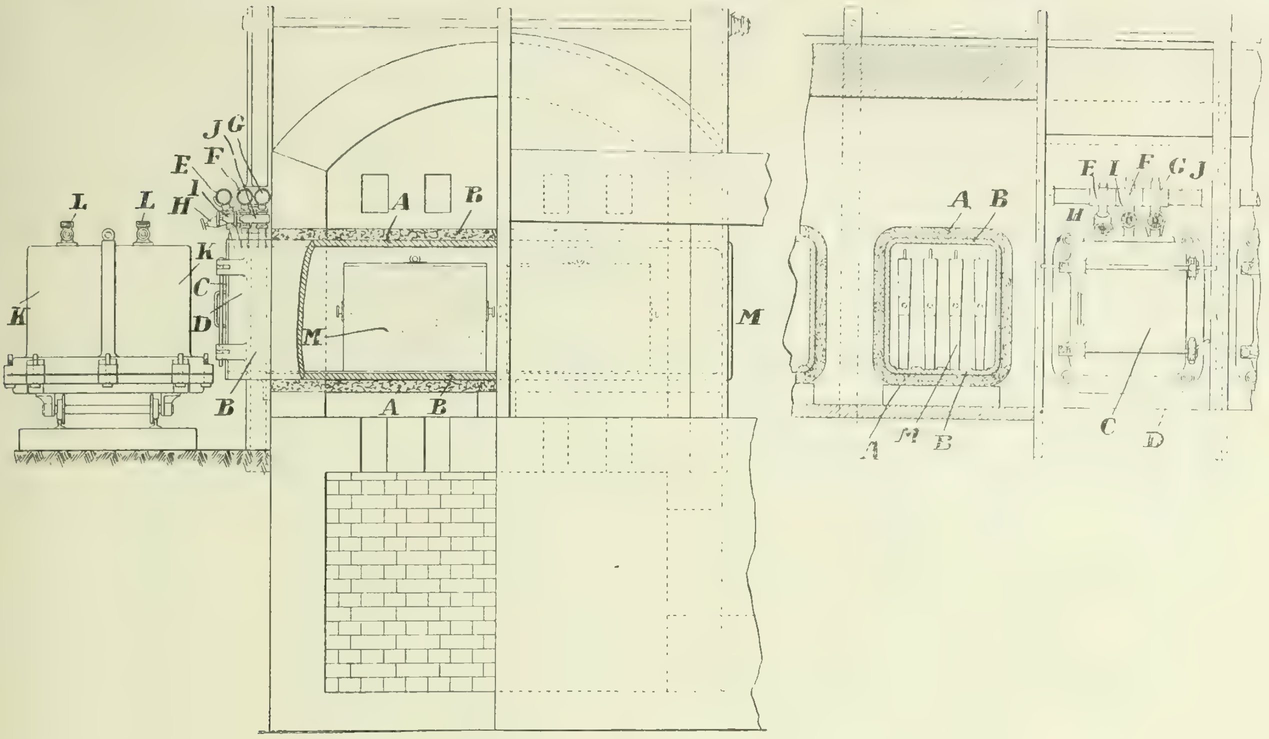
Simpson, W. S., of Battersea Park Road, S.W.

No. 20,237; Sept. 3, 1909.

This invention—relating to "apparatus for, and methods of treating, carbonaceous substances in vacuum for extracting impurities therefrom and for purifying the coke"—is shown in part sectional side elevation of the furnace employed, and a part sectional front elevation of a portion of the furnace; one retort being closed and the other open and showing the cases or packages for containing the fuel. The earlier invention was described in the "Journal" for Aug. 30, p. 578.

The retort (or series of retorts) is made of a fire-resisting material A, lined with a cast-iron or steel tube B, which projects somewhat at one or both ends. The ends may be closed by cast-iron doors C, arranged so that they are easily closed or opened and form an air-tight joint when closed. The projecting ends D are provided with three tubes E F G, affording inlets or outlets to the retort. These pipes are fitted with cocks or other closing devices H I J; so that they may be opened and closed independently. In operation, one tube E is connected with an exhaust pump (not shown) whereby the vacuum is created and maintained in the retort, and whereby also the volatilized substances resulting from the distillation of the contents of the retort may be drawn off and conveyed into suitable condensing apparatus. A second tube F is connected with an external reservoir or generator of gases (not shown) suitable for the purpose of purifying the substances under treatment in the retort—such, for instance, as carbon monoxide, "which thus introduced is efficient to assist in eliminating sulphur and sulphurous compounds from the contents of the retort; and the third tube G is connected with a separate and auxiliary exhausting and condensing plant (also not shown).

In operating the apparatus, the valves I and J are first closed and the valve H opened to allow of a vacuum being created in the retort. To partially distil the coal or other substance forming the retort-charge and recover certain bye-products which volatilize at comparatively low temperatures, the vacuum connection E is then closed, and the desulphurizing and purifying gases are introduced into the retort, either by pumping or natural expansion. All the outlets from the retort being closed, the gas is admitted through the second pipe or tube F; and then, after a suitable time, this gas-supply tube F is closed, and the third tube or pipe G is opened. Further distillation of the sulphurous impurities and other bye-products is in this way carried on at varying



Simpson's Apparatus for Producing Coke.

temperatures, and the sulphurous impurities and further bye-products or impurities are separated and drawn off for condensation.

When the operation is complete, the doors of the retorts are opened, and the contents (still hot) are withdrawn and passed into a receiver K, so constructed that it may be hermetically closed and the air exhausted from it by a vacuum pump through the valved pipe L until its contents are cooled. Any further substances which may be given off while cooling are recovered, whether gaseous or otherwise.

In some cases, it is said to be convenient, before introducing the coal into the retort, to place it in suitable cases or packages M, both for convenience in handling and for shaping the coke into compact blocks or slabs during the cooling process. Such cases may be made of sheet iron or steel, preferably rectangular in shape, of any convenient length, and from 4 to 6 inches in width or thickness, having a cover hinged to one side and having suitable perforations on the edges or sides to allow the free escape of gases or other volatile substances during the process of distillation.

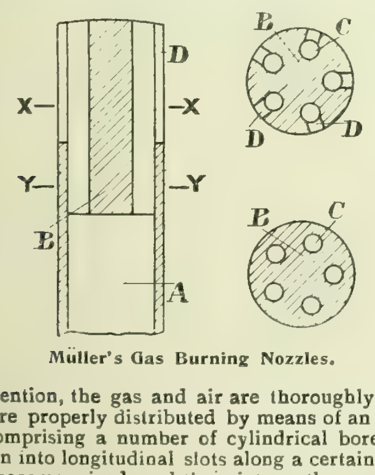
In cases where carbon monoxide is employed, this is generated without the use of steam, and may be generated in a separate receptacle and conveyed thence by a suitable pipe into the vacuum retort; or it may be generated in a receptacle having perforations in its top, which may be placed in the bottom of the vacuum retort or some other suitable part of the retort. In the latter cases, after the charge has been subjected to the first vacuum, the heat is raised to a temperature sufficient to generate carbon monoxide from the substances supplied within the retort. The carbon monoxide is allowed to remain for a period varying from 15 to 45 minutes, according to the magnitude of the charge, and is then withdrawn, and the process is carried forward to a completion.

Nozzles for Burning Gas.

Müller, R., of Essen-Ruhr, Germany.

No. 25,261; Nov. 2, 1909. Date claimed under International Convention, Nov. 3, 1908.

In horizontal furnaces for coke making, &c., the gas for producing the needful high temperature is supplied to the burner-chamber by means of nozzles constructed on the bunsen principle—a construction that has "the disadvantage that the gas and the air are not properly mixed, but escape in separate jets from the nozzles." According to



Müller's Gas Burning Nozzles.

the present invention, the gas and air are thoroughly mixed, and the burning mixture properly distributed by means of an interchangeable burner-head comprising a number of cylindrical bores which, at the upper end, open into longitudinal slots along a certain length; so that the gases first become mixed and the mixture then escapes in fan-like jets.

A longitudinal section through the burner-head is here shown with cross sections on the lines X and Y respectively. The burner-head A, connected in any desired manner to the mixing-pipe, is closed at the top by a solid part B, provided with cylindrical conduits C, which, at their upper portion D, are slotted along a certain length outwards. The number, size, and distribution of these channels C depend on the conditions of every individual case—on the nature of the gas to be burned, and on the size of the burner-head.

Retort-Furnaces.

Tully, C. B., of Great Winchester Street, E.C.

No. 20,592; Sept. 8, 1909.

This invention relates to retort-furnaces of the type in which the gas-producer and combustion chamber are superposed and arranged between two groups of retorts, and communicate with one another by apertures arranged in, and along the length of, the dividing-wall; and the invention has for its object "to provide an improved retort-furnace of this type for the destructive distillation of coal in which the uniform application of heat to the whole length of the retorts and to each of the retorts in the setting is ensured in such manner that the burning of the retorts is precluded."

The gas-producer or furnace is arranged centrally within the setting and between lateral series of batteries of retorts, and it advantageously takes an elongated and relatively narrow form. The combustion chamber, which is divided off from the retorts, is constructed in the setting immediately above the gas-producer or furnace, and is of a length corresponding thereto; and a common discharging chamber is provided above the combustion chamber, into which the gases are led after passing from the combustion chamber, through the brickwork of the setting, and around the retorts and thence to the chimney.

The retorts are preferably provided of small diameter, and in sets which are arranged in series on each side of the furnace or gas-producer and combustion chamber, so that the radiant heat from the furnace and the combustion chamber is effectively utilized, while "the arrangement is of special convenience, in that access is obtained to the discharging door of each of the retorts from outside, and in that a space is left beneath the whole series of retorts on each side along which waggons may pass into which the residue of distillation may fall without the necessary use of any conveyor, and without the necessity of any discharging apparatus."

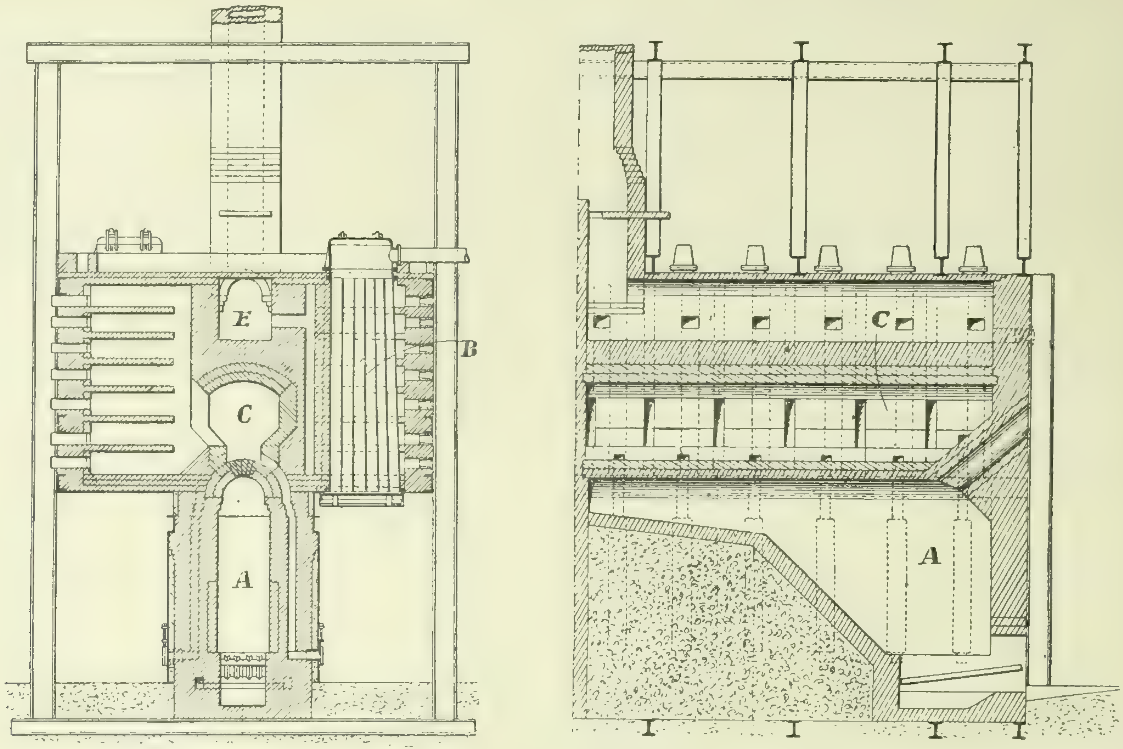
The illustrations on page 52 are a sectional end elevation of a retort-furnace setting—taken on separate lines.

The gas-producer A is built integrally with the retort-setting, and of fire-brick or refractory material, between two lateral series of retorts B. The gas-producer or furnace has an arch or dome throughout its length; and there are a number of holes or ports therein for the passage of the gases into the combustion chamber C, disposed immediately above, and in line with, the producer.

The charging tube (of fire-clay) is inclined towards the furnace chamber, and opposite to it in the furnace chamber is an inclined wall of fire-brick, which is advantageously extended rearwardly at a less inclination, so that the gas may pass out into the combustion chamber throughout the whole length of the furnace.

At each side of the furnace are passages, at intervals (for air) opening out near the lower extremities of the furnace setting and passing upwardly and around the arched top into opposite positions in the lower part of the combustion chamber, so that the air admitted to the latter is heated by traversing the whole length of the furnace on each side.

The combustion chamber has a number of lateral outlet apertures leading to a corresponding number of spaces disposed in a vertical plane or parallel with the respective sets of retorts. These spaces are formed



Tully's Retort-Furnace.

by vertical walls D, of which there are two on one side of each set of retorts and one upon the other side; the walls extending nearly the whole length of the respective sets of retorts and bending into the solid brickwork of the setting above and below.

A series of six horizontal partitions are provided in each of the spaces surrounding the retorts and between the walls D, so that the gases are divided into a corresponding number of streams.

At the end of the first vertical wall, dampers are provided by means of which the hot gases may be regulated as required; there being a damper for each of the separate passages formed by the horizontal partitions referred to. The gases then pass along the side of the second vertical wall in an opposite direction, and then in contact with one side of the set of retorts, passing then around and in an opposite direction along the other side of the set of retorts. They then discharge into a vertical passage common to the respective sets of retorts, passing thence to the gas discharging chamber E, which is disposed above, and in line with, the combustion chamber.

Recovering Ammonium Sulphate Direct from Coke-Oven or Retort Gas.

Fabry, R., of Sheffield.

No. 4473; Feb. 23, 1910.

The object of this invention is to recover simultaneously from coke-oven or retort gas the ammonia contained therein, together with so much sulphur as is capable of forming enough sulphuric acid to completely neutralize the recovered ammonia.

The principle of the process is based on the two following well-known reactions: 1. A neutral solution of sulphate of zinc brought in contact with gases containing ammonia and an excess of sulphuretted hydrogen is quickly decomposed, with simultaneous formation of dissolved sulphate of ammonia and a precipitate of zinc sulphide. 2. Zinc sulphide in solid but finely-divided form absorbs oxygen rapidly when roasted in an oxidizing atmosphere, and is converted into neutral zinc sulphate, provided the roasting takes place at a temperature sufficiently low to prevent the dissociation of the zinc sulphate produced. Both reactions are quantitatively complete, so that theoretically a given weight of zinc sulphate can be transformed into zinc sulphide and subsequently re-obtained without loss by oxidizing the latter at a suitable temperature.

The principle of the invention consists in washing the hot or cold crude coal gas by means of a neutral solution of zinc sulphate, and obtaining thereby, as final products of the gas-washing, a neutral solution of sulphate of ammonia and a precipitate of zinc sulphide, to the exclusion of any other dissolved or precipitated compound.

The pure and neutral solution of sulphate of ammonia finally obtained through the washing of the crude coal gas is concentrated by evaporation until the sulphate of ammonia crystallizes, and is recovered in the form of dry crystals. The zinc sulphide is separated from the ammonium sulphate solution before the latter's concentration and dried. It is then roasted at a suitable temperature in an oxidizing atmosphere, so as to obtain a fresh quantity of neutral zinc sulphate, which is dissolved and used again to wash the crude coal gas.

The process is preferably carried out with hot coke-oven or retort gases, so as to avoid any condensation of the water vapour contained therein, and so prevent the formation of any noxious effluent. It is also advisable that the hot or cold crude coal gases be thoroughly deprived of their tarry components before undergoing the process described, as otherwise the final products are liable to be adulterated with tarry matters.

The successful working of the described process necessitates the presence in the crude coal gas of a volume of sulphuretted hydrogen equal or superior to that which is necessary to combine with the ammonia contained in the same crude coal gas.

Should the gas under treatment not fulfil this condition, it would be necessary to increase artificially the volume of sulphuretted hydrogen available; and this may be most conveniently done, the patentee remarks, by adding the required quantity of sulphur in the coke-ovens or gas-retorts. Such added sulphur will be preferably run regularly in the retorts or coke-ovens in liquid or melted state. It will not affect the quality of the coke or gas produced, because it will be entirely converted into sulphuretted hydrogen when coming in contact with red-hot crude coal gas, and as such will remain volatile until it is subsequently recovered together with the ammonia.

The most important advantages of the process are said to be as follows: 1. No more sulphuric acid is required for recovering in a marketable form the ammonia from coke-oven or retort gas. 2. The whole process is carried out by means of neutral solutions and a neutral precipitate. 3. The whole plant is inexpensive to erect, inexpensive to work, and easily supervised. 4. All the ammonia and the bulk of the sulphuretted hydrogen are extracted from the coal gas. 5. The process may be carried out equally well both with hot or cold coal gas, and the results are unaffected by the temperature of the gas. 6. It may be easily and inexpensively applied to existing bye-product recovery plants. 7. The sulphate of ammonia produced is of excellent colour and quality—not containing any free acid or cyanogen compounds of any description. 8. The consumption of chemicals, steam, water, and power is very small.

APPLICATIONS FOR LETTERS PATENT.

21,727.—Harris, W. J., "Gas-ovens." Sept. 19.

21,728.—Gerald, E. E., "Gas-igniter." Sept. 19.

21,737.—Stewart, J. & W., and Bethell, R. P., "Gas-producers and gas regenerative furnaces." Sept. 19.

21,789.—Stettiner Chamotte-Fabrik Akt.-Ges., "Retort-furnaces." Sept. 20.

21,865.—Cayla, P. B. du, "Gaseficator for hydrocarbon gas." Sept. 21.

21,869.—Adamson, R. A., "Cleaning pipes and tubes." Sept. 21.

21,870.—Adamson, R. A., "Joints for rods." Sept. 21.

21,894.—Lane, H., "Gas-producing apparatus." Sept. 21.

21,938.—Bozon-Verduraz, C. & J., "Making connections on charged mains without interrupting the supply." Sept. 21.

21,963.—Hawley, W., "Hurdle-grids of gas-purifiers." Sept. 22.

21,991.—Cox, W., "Gas-meter diaphragms." Sept. 22.

22,052.—Scott, G. L., "Gas-stoves." Sept. 23.

22,126.—Jaubert, G. F., "Extracting the free hydrogen contained in industrial gases." Sept. 23.

22,127.—Tessier, A. C., "Manufacturing gas." Sept. 23.

22,159.—Claxton, E. J., and Lewis, A., "Governing the flow of fluids." Sept. 24.

22,168.—Shakeshaft, C. E. M., and Clarkson, T. J. R., "Coin-freed gas-meters." Sept. 24.

22,170.—Scottish Central Iron Company, Ltd., and Harrison, P., "Gas-fires." Sept. 24.

22,175-6.—Pace, P. C., "Generating combustible vapour." Sept. 24.

22,177.—Wilson, W. A., "Duplex burner for gas-stoves." Sept. 24.

22,181.—Keith, J. & G., "Gas-lamps." Sept. 24.

22,183.—Kent, W. G., and Hodgson, J. L., "Measuring orifices placed in a pipe-line." Sept. 24.

22,184.—Kent, W. G., and Hodgson, J. L., "Automatically regulating the flow of liquids." Sept. 24.

The Directors of the Gas and Commercial Securities Corporation, Limited, recommend a final dividend at the rate of 6 per cent. per annum, free of income-tax; making 5 per cent. for the period to Aug. 31.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Relations of Municipal Gas and Electricity Departments.

SIR,—I have read with much interest the "Editorial" hereon in our issue of Sept. 20. Without expressing agreement or disagreement with the article in general, I will, with your permission, make a few comments on the paragraph relating to prices of gas and electricity.

So much has been said on electric supply economics, that it is difficult to add anything new thereto. I must, therefore, content myself with a restatement of the broad principles underlying any equitable system of charging for supplies.

Electricity undertakings, unfortunately, have next to no power of storage. They have to bear relatively high standing costs and low running costs; in other words, their chief expenses are due to the necessity of being in readiness to supply. The actual running costs, though proportional to output, are of much less importance. It must, therefore, be patent to all unbiassed minds that the total costs are bound to vary according as the hours of demand are long or short. Hence the value attached to constancy of demand, or, as it is usually termed, "load-factor."

Another feature bearing directly on costs is that, owing to the diversified character of consumers' demands for purposes other than lighting, and to the resultant differences in times of demand, it is not necessary to provide 100 per cent. of plant to meet the same amount of demand. Conditions in Manchester, for instance, are such that, at the utmost, not more than 40 per cent. of the sum total of consumers' individual maximum demands occurs at the time of heaviest load on the stations. The consequent saving in capital and other standing costs is obviously great. Hence the value set on the relation between consumers' peak-loads and station peak-loads, or, as it is generally termed, the "diversity factor."

From the foregoing, I think it will be readily seen that there is ample warrant for the wide disparity between the charges for electric lighting and for electric power supplies, or, to write more correctly, between short-hour and long-hour consumers.

A recognition of these principles, thus broadly stated, governing the prices of electrical supplies, has, I take it, enabled Mr. Newbigging and his colleagues of the Gas Department to come to the conclusion contained in the joint report.

Contrast the position of gas undertakings. Their power of storage, as is well known, is by no means slight. For example, with the completion of the new gasholder at Bradford Road, Manchester will have available more than a day's supply at any time of the year.

Their costs for material used in production—apart from equipment—are broadly speaking, proportionate to output. Their standing costs in relation to running costs are nothing like so important as with ordinary electric supply undertakings. Taken altogether, the economic bases of the two kinds of undertakings are strikingly dissimilar.

It is then quite evident that, under present conditions, the differentiation between gas-power prices and gas-lighting prices can never assume anything like the importance in the rival industry.

Finally, may I add that, should the day ever arrive when gas for power can be supplied in Manchester or elsewhere at 5·4d. per 1000 cubic feet, electricity departments will probably be prepared to buy in large quantities as their business extends? Considerable scope will offer itself for large gas-engines at electric generating stations when gas can be had at about the price named.

Dickinson St., Manchester, Sept. 26, 1910.

S. L. PEARCE, Chief Engineer, Manchester Corporation Electricity Works.

[Reference to our correspondent's letter is made in "Electric Supply Memoranda" on p. 22.—ED. J.G.L.]

The Salaries and Allowances Questions at Manchester.

When the Special Committee appointed by the Manchester City Council to consider the conditions of service of Corporation officials met again last Thursday, several members suggested that the Committee should dissolve without doing anything more, as a protest against the action of the City Council in passing at the last meeting increases of salaries recommended by the different Committees. It was contended that in sanctioning these advances the Council had nullified the whole of the work done by the Committee. Finally, on the advice of the Town Clerk, the dissatisfied members did not press their proposal to a vote. It was decided, however, not to proceed any further until after the November elections, when, according to present arrangements, the Committee will receive the views of the Standing Committees on the question of retiring allowances for officials. It will be remembered that at a recent meeting of the Council an elaborate report was presented by the Conditions of Service Special Committee, and that a resolution was carried referring the report back to the Committee, on the ground that it was not complete; the questions as to age-limit and retiring allowance not having been dealt with. Since then the Council have approved of increases of salary which, in some cases, exceed the maximum fixed by the Special Committee.

Price of Gas at Chorley.—The question of the price of gas to prepayment meter consumers was the subject of discussion at the Chorley Town Council meeting on Thursday, when Mr. Sandham, a Socialist member, complained that it was unjust to saddle the cost of fittings provided by the Corporation upon consumers by prepayment meter, who were charged 8d. per 1000 cubic feet more than users of ordinary meters. He contended that the difference should not be more than 1½d. or 2d. Mr. Wilson, in reply, said that, gauged upon the capital outlay, the cost to the Corporation for supplying gas through prepayment meters was 7·7d. per 1000 feet more than to ordinary users. A motion that the time was not opportune to reduce the charges to prepayment meter users was carried by an overwhelming majority.

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday—Alderman W. F. COTTON, D.L., J.P., in the chair.

The SECRETARY AND MANAGER (Mr. F. T. Cotton) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ended the 30th of June, were presented. The latter showed that the gross revenue amounted to £156,302, and the expenditure, including interest on loan capital, &c., to £115,838; leaving a profit of £40,464. Adding £438 carried over from the previous account, there was a total of £40,903 to the credit of the profit and loss account. The Directors recommended the declaration of a dividend on the consolidated ordinary stock at the rate of 5 per cent. per annum. Payment of this would absorb £36,534, and leave a balance of £4369 to be carried forward.

The CHAIRMAN, in moving the adoption of the report, said he thought the shareholders might congratulate themselves on the results of the working during the period covered, seeing that it was the first half-year's operations under the altered conditions caused by the Act of last year. They were aware that the Directors, in order to meet the views of the Municipal Council of Dublin and other local authorities, made a very considerable reduction in the price of gas, amounting to nearly £25,000 per annum on the amount sold. No doubt they were desirous of hearing how, under such circumstances, the Company had been so successful. Well, they might recollect that when he had the honour of addressing them in March he was in a position to say that one section of the new apparatus erected in the retort-house lately built at the Great Brunswick Street station had been completed and put in action, and that so far it had been giving great satisfaction, leading to considerable economy in the manufacture of gas. He ought to mention that, during the first three months of the half year under review, this section was not of sufficient capacity to manufacture gas to supply the city of Dublin and the surrounding townships; hence it was necessary to keep in action the old retort-settings as well as the new ones. However, to the use of this new section might largely be attributed the results which the shareholders had before them. The second section was on the point of completion. It would be brought into action immediately; and from its use they might well anticipate similar satisfactory results. He might remind them that in the corresponding period of last year it was found necessary to draw upon the reserve fund to the extent of £4034 in order to pay the dividends that were now recommended by the Directors; whereas on the present occasion, notwithstanding the enormous reduction in the price of gas, they were not only able to pay the dividends recommended on the half-year's working, but also to carry £4369 to the next account. With the new apparatus, the yield of gas per ton of coal carbonized was much larger than before; and this statement also applied to the coke, breeze, tar, and ammoniacal liquor. He expected that during the current half year they would make still greater progress; and he might say he saw no reason why this should not be so in the future operations of the Company, for he did not think they had nearly arrived at their best. Referring to the accounts, it would be seen that during the half year there had been expended, under the head of capital, £9993. Of this sum, £4750 was spent on engines and apparatus for the new retort-house, £2791 on new and additional service-pipes and mains, and £2451 on additional meters and automatic fittings. There was also an expenditure of £2694 on new burners and mantles; but this sum had been charged to revenue. Turning to the revenue account, it would be found that the sale of gas, including meter-rents, only produced £131,604, against £133,914 for the corresponding period of last year. However, for residuals they received £24,373, against £19,367; and besides they had savings in nearly all items of expenditure. Since the last meeting, there had been put in 1764 new automatic installations, each comprising a cooker, brackets, and pendants. There had also been let on hire and attached to ordinary consumers' fittings 614 cookers and 119 heating-stoves, in addition to 120 of these stoves, ten gas-fires, and seven cookers bought and fitted at consumers' expense. The Company had now in operation 38,000 free and 5575 hired cookers; also 612 heating-stoves and fires. This was a very small number for Dublin and the surrounding townships, even making allowance for their lesser population when compared with London and many other large towns and cities. It was calculated that there were in use in two of the London Gas Companies' districts 1,400,000 gas-cookers, water-heaters, and ring-burners for boiling purposes. While the Dublin works were in a state of transition to bring them under the new conditions imposed upon the Company, there were some complaints of bad light. But in nearly all cases it was found to be owing to the burners in use being quite unsuitable for the gas now supplied, which was 14-candle. This quality was precisely the same as that supplied all over London, Edinburgh, Glasgow, Manchester—indeed, all over the kingdom; for Parliament had for some years been reducing the standard to a uniform 14 candles with the new test-burner. There were at present in the House of Commons Bills which were only waiting third reading, whereby 43 companies would come under the new conditions. He regretted to say that there were still a considerable number of flat-flame burners in use by the Company's customers. When one considered that incandescent mantles had replaced the flat-flame burner in almost every city and town in the United Kingdom, it seemed strange that consumers of gas in Dublin should be so far behind in adopting a system so economical. One incandescent mantle would light a room 1600 cubic feet in capacity; and yet people would continue the use of the wasteful flat-flame burner, which consumed about four times the quantity of gas, and did not produce half the quantity of light. He might mention that in the case of consumers of gas by free slot-meters, the Directors arranged when in Parliament to supply, and they were fixing for them on application, one incandescent burner with mantle and chimney free of cost.

The motion was carried, and the dividend recommended were declared.

THE GLASGOW SMOKE ABATEMENT EXHIBITION.

The Smoke Abatement Exhibition which is being held in Glasgow has proved so unqualified a success from the point of view of the attendance of the public, that the proposal was made that it should be kept open for a week longer than was intended. The Executive Committee considered the proposal last week, and resolved, in view of the difficulties in the way, to adhere to the original intention to close next Saturday. As an indication of the interest that has been taken in the Exhibition by the gas industry, we may say that Mr. Alexander Wilson, Gas Engineer and Manager of the Glasgow Corporation, has forwarded a list of names of about sixty gas managers who had visited it between the 16th and the 28th ult.

On Wednesday last, the first annual conference of the Smoke Abatement League of Great Britain was held in the City Chambers, Glasgow—Lord Provost M'Innes Shaw presiding.

The Lord Provost said that, through the initiative and action of the Corporation, an exhibition was running in the city for the purpose of showing to the public what could be done by the utilization of gas, electricity, and smokeless fuels in dwelling-houses and offices to prevent pollution of the atmosphere. The Corporation of Glasgow were manufacturers both of gas and electricity on a large scale; and it appeared to him it only required the rousing of a healthy public opinion and a keen civic conscience on the subject to create a largely increased demand for those smokeless means of heating and obtaining power.

Principal J. W. Graham (Manchester), the President of the League, explained its objects and what had been done since its formation at Sheffield a year ago. The idea, he said, was that the League should be a central body, consisting of branches in various localities. The branches were intended to do the local work of oversight and inspection; and the central body's function was to form agencies for doing parliamentary work and in general to guide the movement. Their efforts during the past year had been mainly to draw up a smoke charter, or sort of summary as to what was desirable. This was got up as a memorial, and signed by 19 large municipalities; and in June it was presented by a deputation to Mr. John Burns, who gave it a very favourable reception. Principal Graham then delivered a short address on "The Relative Proportion of Domestic Smoke to Factory Smoke." In Manchester, a number of analyses of air had been made. First of all, the ordinary soot from household fires was analyzed, then boiler soot, and, thirdly, the ordinary air of Manchester as revealed by the deposits left on the cotton wool of air purifiers in a hotel in the centre of the city. Roughly, without claiming perfect accuracy for the figures, results showed that factory and domestic smoke were about equally responsible for the pollution of the air of Manchester.

Sir Hugh Shaw Stewart, speaking of the effects of smoke and winter fogs upon buildings, pictures, and works of art generally, said it was not enough to do away with coal smoke. He was fortunate in getting the opinion of a very distinguished scientist, who said that the complete combustion of coal would obviate smoke but not the sulphuric acid which came from the combustion of the contained sulphur and which when brought down by rain had a destructive action on many kinds of stone. The use of coal gas obviated both effects; nearly all the sulphur being removed in the purification. Therefore they could overcome all the difficulty in cities by adopting gas or electricity.

Mr. A. H. Pettigrew (Glasgow) dealt with the deterioration of goods and merchandise through smoke and fogs. He ventured to say that on such an occasion of fog as last November, when for five days the fog fiend held the city in its grip, the loss to traders of all sections, from the small shopkeeper to the great wholesale and retail emporiums, amounted in the aggregate to £100,000. The fog attacked the warehouseman on three sides. Not only did it spoil his goods, but it cost him a small fortune for lighting, and it killed his trade for the time being by keeping customers away. If there was a class in the city whose profound gratitude the Corporation would gain if they successfully tackled the fog business, it would be the shopkeeping class. He would suggest that one way to do it, and the only way, was for each individual, either by consent or compulsion, to clean his own doorstep, so far as polluting the atmosphere was concerned.

Dr. Magnus MacLean (Glasgow Technical College) spoke of the advantages of warming rooms by electrical energy. He understood a proposal was shortly to come before the Corporation to give current for heating purposes at 1d. per unit. The proposal was not to put in new wiring or new meters, but to find the average current for a year or two, and charge the excess, if heating were used, at 1d. per unit.

Dr. A. K. Chalmers (Medical Officer of Health, Glasgow) dealt with the medical aspect of smoke pollution. He said the first point he would like to emphasize was that they were living constantly on the brink of a catastrophe, which only required certain weather conditions to precipitate. He gave illustrations from the experience of Glasgow. In 1874-5, after seven weeks of frost, the death-rate rose to 67 per 1000, half of which was due to lung disease. The death-rate for that year was 31. In 1895, after a period of prolonged frost and fog, the deaths in the first ten weeks of the year exceeded by no fewer than 1871 the number of deaths occurring in the corresponding period of 1892-4; and no period of life escaped. Under one year, the deaths rose from an average of 644 to 906—an increase of 41 per cent.; between 1 year and 60 years of age, the numbers rose from 1800 to 2800—an increase of 53 per cent.; and over 60 years of age, the deaths rose from 600 to over 1200—an increase of 103 per cent. The deaths from pulmonary disease, which averaged 1066, with a death-rate of 8 per 1000, rose to 2256, with a death-rate of 16. The winter of 1909 was remarkable for the recurrence of dense fog extending over several days, with an interval of a few weeks between. Here, again, the average annual rate of 18 rose to 25 during one week in November, and to 33 in December; and again the same disease predominated. It was greatest among young children and old people. Among infants, the numbers, which had been 217 in the three weeks ending Nov. 20, rose to 325 in the three weeks following that date; while among persons over 60, the deaths increased from 218 to 415. Wide fluctuations in weekly deaths were now more influenced by fog conditions than by zymotic diseases; and under conditions of prolonged cold and fog, the height to which a death-rate might rise was almost appalling and almost unlimited. Surely the epithet "disaster" was not misplaced when lives were sacrificed in this manner to what was at least contributory negligence on our part. The speaker referred to the difficulty gas engineers were under in providing gas when fog suddenly descended; and he advocated the establishment of a meteorological station in the Clyde Valley—as already existed in the Thames Valley—so as to foretell by a few hours the advent of conditions likely to produce dense fog.

Mr. Frank White (Bradford) briefly addressed the conference on the most recent legislation on the subject of smoke abatement. He mentioned that the Bradford Corporation had been successful quite recently in obtaining parliamentary powers for the prevention of the smoke nuisance; and these would come into force on Aug. 1 next year. Though there had been for some years past a steady diminution in the smoke emitted, it was found that more stringent powers were necessary. The small penalties imposed in the Police Court had no deterrent effect; and the Corporation sought and obtained the powers they now possessed and intended soon to put into operation.

Councillor W. B. Smith (Glasgow) spoke in support of "the desirability of having a uniform law throughout the United Kingdom and administrative means so that uniformity of inspection and administration may be secured."

There was a short discussion upon this, after which the proceedings were brought to a close by a vote of thanks to the Lord Provost and the speakers.

EDINBURGH AND LEITH GAS COMMISSIONERS.

Price of Gas Reduced—Scottish Office and Accounts.

A Meeting of the Edinburgh and Leith Gas Commissioners—the first since July—was held on Monday, the 26th ult. Lord Provost Brown, of Edinburgh, presided.

The Works Commissioners recommended that the prices to be charged for gas after the October-November survey should be: To ordinary meter consumers, 2s. 8d. per 1000 cubic feet; to outside consumers, 3s. 2d.; for gas-engines and trading purposes within the boundaries, 2s. 3d.; beyond the boundaries, 2s. 9d. In a report upon the subject by the Engineer (Mr. W. R. Herring), it was stated that the late Treasurer (Mr. John S. Gibb) and he estimated that the same quantity of gas would be sent out during the current year as was sold during the past financial year. In the latter case, 79,542,000 cubic feet more were sold than in the previous year. Provision had been made for reducing the prices of gas by 2d. per 1000 cubic feet. Last year the Commissioners made a special rate for gas used in gas-engines, but at the time deferred for further consideration the proposal to make the reduced rate apply to trading purposes generally. In order that the Commissioners might see to what extent it would affect their revenues, he had prepared data as to quantity, and assumed in the estimate that gas sold for gas-engines and for trade purposes other than lighting, heating, and cooking—that was to say, where gas was used in approximately equal quantities principally during daylight hours throughout the year—it could profitably be sold on the same basis as for gas-engine use. It was therefore suggested that this rate for the current period should be 2s. 3d. per 1000 cubic feet; such gas being supplied through a separate meter, which the consumer would pay for installing. Credit was taken for the quantity of gas sold per prepayment meter, at the lighting rate; but an additional item appeared on the revenue sheet, separately accounting for the 1s. 2d. per 1000 cubic feet charged for the extra cost of supply by this means. This was, however, subject to reduction by the sliding-scale already established. The estimates showed that, after making the reductions proposed, and after allowing for all oncost charges, including the contributions of £16,000 to the special reserve fund, there would remain on the year's working a surplus of £2084. One penny per 1000 cubic feet on the year's estimated consumption of 1,963,184,000 cubic feet represented a sum of £8180 per annum.

The estimates provide for an expenditure of £343,102, of which £97,226 is for coal, and £1909 for gas oil. The revenue is made up of £264,143 derived from the sale of gas, as compared with £281,360; £63,037 from residual products, as compared with £64,893; £5956 from maintenance and labour in connection with stair lighting; £4407 for the use of prepayment meters and other charges; £36 for meters hired for special purposes; and £6609 received as gas-stove rental and for the fitting of incandescent appliances.

The recommendation was adopted unanimously.

The Finance and Law Committee reported that they had remitted to the Convener, Judge Inches, and the Convener of the Works Committee, Judge Bryson, to deal with the matter referred to in the letter from the Scottish Office. It was explained that the Conveners had replied to the letter.

Lord Provost Brown said he signed the annual accounts on the assurance that they were made up absolutely in terms of the arrangement with the Scottish Office. It seemed to him this was not the case.

Mr. W. R. Herring said the Scottish Office were asking for information; and the Conveners had given the information wanted. The Office had been furnished with copies of the accounts; and they would mark the columns which they wished to be laid before the public. The whole statement was much too large for publication.

At the request of Lord Provost Brown the letter was read. It was as follows:

With reference to the abstract of accounts of the Edinburgh and Leith Corporations Gas Commissioners for the year 1909-10 forwarded by you on the 28th ult., I am directed by the Secretary for Scotland to make the following observations.

1.—The available borrowing powers of the Commissioners at the close of the account are put at £118,749, as against £109,716 at the close of the account for the preceding year. In what way is this increase explained?

2.—The contribution to sinking fund in respect of money borrowed—viz., 1 per cent.—appears to be calculated on the amount borrowed *less* sums previously paid off by means of the sinking fund, instead of, as usual, upon the full amount borrowed inclusive of such sums.

3.—It is observed that although £50,424 was carried to the credit of the sinking fund in 1909-10, only £3880 or thereby was applied from the fund

uring the year in redeeming debt, and that at the close of the year the mount of the sinking fund invested or in bank reached the large total of 241,119. Is there any special advantage in accumulating the sinking fund n this way rather than in applying it to pay off debt? It is understood that he fund is not invested at a higher rate than is payable in respect of the nnuity debt of the Commissioners, and that the Commissioners are entitled o redeem the annuities subject to the provisions of sections 48 and 49 of heir Act of 1888.

4.—It is observed that the reserve fund authorized to be created by section 86 of the Act of 1888, and to be increased to a maximum amount of £150,000 by section 9 of the Order of 1902, is referred to in the accounts for 1909-10 as a "General Reserve Fund," while the supplementary provision directed to be made by section 7 of the Order of 1908 is credited to a special reserve fund. A considerable proportion (viz., about £7000, irrespective of interest accumulations) of the sum of £20,542 at the credit of the general reserve fund at the close of 1909-10 appears to have been set aside under the second proviso of section 9 of the 1902 Order, which enacts that the sums so set aside are to be applied "for the purpose of this section." Do the Commissioners consider that these sums (with accumulations) may only be applied in "meeting any deficit which may occur on the sale of the existing works on property of the Commissioners," or do they regard the term "purpose" in the last-mentioned proviso as including also the various purposes specified in section 86 (7) of the 1888 Act? Further, have the Commissioners yet ascertained or formed an estimate of the amount of the "deficit" referred to in section 9 of the 1902 Order?

5.—Can particulars be furnished of the item £48,487 (coal, lime, &c.) in the balance-sheet such as are given in the accounts of other local authorities?

6.—Does the item "Meters broken up . . . £973 12s. 8d." in the "Details of expenditure" mean that a sum of £973 12s. 8d. was expended during the year on new meters purchased to replace meters broken up? What was the cost of the broken-up meters as included in the item £64,228 in the capital account?

7.—Items amounting to £1110 15s. 8d. are charged in the revenue account in respect of depreciation on stoves, &c. This amount cannot be traced in the capital account, nor does it appear to be transferred to a depreciation fund. How is it disposed of?

8.—The abstract of accounts for 1909-10 only gives partial effect to the suggestion in the concluding paragraph of the Scottish Office letter of Jan. 5, 1909, in respect that a table summarizing the statistical facts as to the quantity of gas made, &c., &c., in each year since the Commissioners were constituted is not appended thereto as requested. As such a table has been drawn up by the Commissioners, the Secretary for Scotland will be glad to be informed whether there is any objection to publishing it as an appendix to the annual abstract of accounts, and thus furnishing to gas consumers or other persons interested the same information as is supplied with respect to gas undertakings in the accounts of other public authorities."

The reply of the Conveners was as follows:

1.—The increase in the amount remaining to be borrowed as at May 15, 1910 (£9033), as compared with the previous year, arises from the facts (1) that mortgages which fell due in the course of the year were not renewed or replaced to the extent of £3073, and (2) that the amount borrowed on deposit receipt was reduced by the sum of £5960. Consequently, £9033 was added to the amount "remaining to be borrowed."

2.—The contribution to sinking fund in respect of money borrowed has always been calculated on the amount borrowed, less sums previously paid off by means of the sinking fund. This, in our view, is in conformity with section 93 of the 1888 Act, which prescribes that the amount to be set apart shall be "not less than 1 per cent. per annum on the amount for the time being borrowed under this Act."

3.—The Commissioners have, at every favourable opportunity, exercised the power to redeem annuities by agreement (section 47 of the 1888 Act), and during the current financial year a sum of £6836 has been applied in this way. The sinking fund moneys are invested at an average higher rate than is payable in respect of the annuity and mortgage debt, and, therefore, the sinking funds benefit to some extent. The question of redeeming debt more rapidly has been before the Commissioners of late, and they have decided to take action in this direction.

4.—The amounts set aside under authority of section 7 of the 1908 Order have been placed to a "Special Reserve Fund Account," because the section referred to does not limit the amount which may be accumulated for the special purposes named, and it was, therefore, thought desirable to keep the fund quite distinct. The Commissioners are of opinion that the amount standing from time to time at the credit of the general reserve fund is applicable for the various purposes specified in section 86 (7) of the 1888 Act, and section 9 of the 1902 Act. The Commissioners have taken steps to dispose of certain parts of the old works, but so far without result; and they have not yet formed any definite estimate of the "deficit" referred to in section 9 of the 1902 Act.

5.—The answer to question 5 is in the affirmative, but it is thought, for commercial reasons, not desirable to publish details.

6.—The sum charged in the accounts for "meters broken up" is the value (based upon current prices) of the meters actually destroyed during the year; and is in keeping with the practice followed for many years. The cost of the broken-up meters, included in the item £64,288, was approximately £973 12s. 8d.

7.—The amount charged to revenue account for depreciation on stoves, &c. is deducted from capital expenditure. During the year under review, the amount chargeable to capital account in respect of stoves, &c., was less than the amount written off as depreciation by the sum of £804 7s. 11d., and this amount is entered in the column headed "Deductions during year to May 15, 1910 (capital account)."

8.—There is no objection to publishing in the appendix to the accounts a table giving particulars as to gas made, &c. Statistical tables, giving a large number of details, were submitted to you (prints of which are enclosed herewith), and we shall be glad to have your comments thereon. If you consider a table or tables of a less elaborate character would meet your wishes, perhaps you would suggest headings for the same.

Heywood's Gas and Water Accounts.—The abstract of accounts of the borough of Heywood, prepared by Mr. J. Meadowcroft, the Borough Accountant, shows that the net profit of the Gas Department for the last financial year was £972, compared with £223 for the preceding period. The accounts of the Heywood and Middleton Water Board disclosed a deficiency of £10,820, compared with £11,027 for the previous year; Heywood's share of the loss being £5585.

Reduction in Price for Public Lighting at Edmonton.—At the last meeting of the Edmonton District Council, a letter was received from the Secretary of the Tottenham and Edmonton Gas Company (Mr. E. Topley) stating that, under a three years agreement which they had just entered into with the Tottenham District Council, the charge for public lighting in the district had been reduced 6d. per lamp per annum; and therefore the charge to the Edmonton Council would be lowered by a similar amount.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 22.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl 1	5	Alliance & Dublin Ord. .	87—89	+3½	5 12 4
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	+1	4 1 8
200,000	5	May 12	7	Bombay, Ltd.. . . .	6⅜—6⅝	..	5 5 8
40,000	5	,,	7	Do. New, £4 paid .	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c. . .	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c. .	16—16½	..	4 4 10
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246—249	..	5 0 5
330,000	,,	,,	9½	Do. New . . .	184—186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref. .	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb. .	99—101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk. .	155—158	..	5 1 3
460,000	20	Sept. 29	10⅝	British	44—45*	+½	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c. . .	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c. . .	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c. . .	106—108	..	5 1 10
55,000	,,	June 29	3½	Do. 3½ p.c. Deb. .	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	5½—6½	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	50½—51½	+1½	5 16 6
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. . .	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk. .	105—108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do. .	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	—1	3 14 1
800 000	Stk.	June 10	5	Continental Union, Ltd.	97—99	1	5 1 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk. . . .	104—105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord. .	96—98	..	5 2 0
486,090	10	July 14	12	European, Ltd. . . .	23½—24	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord. . .	106—107	+½	4 7 2
2,600,000	,,	,,	3½	Do. 3½ p.c. max. . .	87—89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	17—17½	..	6 5 9
131,000	Stk.	Sept. 15	7¾	Ilford A and C . . .	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112—114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb. . . .	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental .	187—189	+1	4 15 3
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A. .	219—221	..	4 10 6
718,100	,,	,,	7	Do. B . .	162—164	+½	4 5 4
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4 9/16—4 13/16	..	6 4 8
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb	99—101*	+1½	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101*	+¼	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd. . .	12½—13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd. . . .	138—140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6—6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A. . .	131—133	..	5 3 0
60,000	50	,,	13	Do. B. . .	124—126	..	5 3 2
100,000	50	,,	12	Do. C. . .	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	99—101	..	4 19 0
398,490	5	Apl. 29	7	Primitiva Ord. . . .	7¼—7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref. .	5⅛—5⅜	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb. .	97—99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd. . . .	15¼—15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref. .	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb. .	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	May 27	7	South African	11—11½	..	6 1 9
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	+2½	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord. . .	110—112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c. .	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c. .	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97—99	..	5 1 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112—113	+½	4 8 6
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c. . .	139—141	..	4 15 9
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex div."   † Next dividend will be at this rate.

LEICESTER GAS UNDERTAKING.

The New Manager.

At the Quarterly Meeting of the Leicester Town Council last Tuesday—the MAYOR (Mr. G. Chitham) presiding—it was reported that the accounts of the gas undertaking for the half year ending June 30 showed that the net profit, after paying interest on the capital, was £33,351. After deducting the sum of £7707, the half-yearly payment to the sinking fund, and in part repayment to the Public Works Loan Commissioners, a balance of £25,644 remained. For the six months there was a profit of £635 on the electricity works, after meeting interest and sinking fund charges.

Alderman SMITH, in moving the adoption of the two reports, said, referring to the gas-works, that it was the most successful half-year's working, so far as gross profits were concerned, since the undertaking was taken over by the Corporation. The gross profit, before deducting interest and sinking-fund payments, was £53,746, compared with £45,942 for the corresponding half of 1909. The net disposable balance in the past half-year's working, after providing for interest and sinking-fund charges, was £25,644; an increase over the corresponding period of 1909 of £7637. This increased profit was attributable to an increase in the receipts and a decrease in the expenditure. The cost of coal was £4081 less than in 1909; 3300 tons less being used owing to the increased quantity of gas made per ton, and to 9 million cubic feet of water gas being manufactured. Then £2376 less had been paid in carbonizing wages through the full working of the mechanical stokers, and the increased quantity of gas per ton of coal carbonized. The reserve fund stood at £26,032; and the Committee thought that this amount, having regard to the fact that the retort-house, buildings, gasholders, &c., were uninsured, was insufficient to meet the ordinary risks that were possible and probable in connection with gas manufacture. They therefore strongly recommended that a further £5000 be added to the reserve fund at the end of the current financial year. Since the Corporation took over the gas-works in 1878, after paying interest on capital, the profits had amounted to £1,027,656. Out of this sum, £247,501 had been paid to the sinking fund, £23,000 to the reserve fund, and £37,000 to the renewal fund. Including last half year, £745,000 had been contributed to the rates; and, in addition to this, the reduction in the price of gas was equivalent to £50,000 per annum. The success of the gas-works was largely due to the skilful management of the late Engineer (Mr. Alfred Colson) and the efficiency and loyalty of his chief assistants, the staff, and the workpeople generally. The Council would join the Committee, he was sure, in offering to the officers, the staff, and the workmen of all departments, this word of appreciation. As to the electricity works, there had been an increase of 15,800 units generated, but a decrease of £549 in revenue. The decrease in revenue was caused by the economy of the electric filament lamps which consumers were using. The net profit, after payment of sinking fund, was £635, against £907 last year. The balance now in hand was £2021. Since 1907, the total revenue had fallen from £32,882 to £28,832, a difference of £5000; but the net profit had only dropped £2600. There was a greater demand for electricity at present, and the prospect for the coming year was even better. As to the injunction restraining the Corporation from carrying on their electric wiring and fittings department, the Committee had decided not to appeal against it. The question of separating the Gas and Electric Light Departments' management was being considered by an expert; and pending the expression of the expert's opinion, the Council would not expect him to offer any opinion on the subject. When the expert's verdict was received, the Committee would go into the question.

Mr. SNOW asked if the time had not arrived when a reduction could be made in the price of gas.

Alderman SMITH, in reply, said it was easy to suggest a reduction in the price of gas; but to reduce the price 1d. per 1000 cubic feet would mean £8332 per annum. Again, when other corporations increased the price of gas owing to the increased cost of coal, Leicester kept its price the same. Next year they would have to pay at least £3000 extra for coal. The question could be considered better at the end of the financial year.

The reports were approved.

Alderman SMITH then dealt with the portion of the Gas and Electric Lighting Committee's report which related to the appointment of the new Manager of the gas-works, in succession to the late Mr. Colson. The Sub-Committee, he said, had unanimously decided on the appointment of Mr. Hubert Pooley, of Stafford, at a commencing salary of £800 a year. The Committee had made exhaustive inquiries, and had decided that, all things considered, Mr. Pooley was the best man they could find as their Gas Manager. He possessed exceptional advantages, which led them to believe he was the right man for Leicester. At Stafford he had carried out alterations under great difficulties. His relations with the Committee, the staff, and the workpeople at Stafford were of the most cordial character; and he took great interest in a profit-sharing scheme which affected the workpeople, and which he (Alderman Smith) thought might be introduced in Leicester.

Mr. Pooley's appointment was confirmed by 49 votes to 5.

Mr. POOLEY, on being invited into the Council Chamber and informed by the Mayor of his appointment, said it would be his earnest endeavour at all times to maintain the very high reputation which their undertaking had always held in his profession, and to follow in the steps of Mr. Colson.

New Issues of Gas and Water Capital.—It will be seen, from announcements which appear elsewhere, that Messrs. A. & W. Richards will resume their sales of gas and water stocks and shares at the Mart, Tokenhouse Yard, E.C., next Tuesday, when four important new issues of capital will be offered, by order of Directors—viz., Barnet District Gas and Water Company, £10,000; Aldershot Gas, Water, and District Lighting Company, £7000; Harrow and Stanmore Gas Company, £5000; and Great Yarmouth Water Company, £5000.

A "GREATER MANCHESTER" PROPOSAL REVIVED.

The proposal for an amalgamation of Manchester and Salford has been revived; and at the next meeting of the Salford Town Council an influentially signed petition will be presented in favour of the scheme. Twenty-two years ago a similar proposal was considered by a Joint Committee representative of the City and the Royal Borough; but it fell through because the conclusion was come to that there was no economic reason at the time for amalgamation, and that Salford would flourish more rapidly as a separate borough. The petitioners in favour of amalgamation now submit that the experience of the intervening years has shown that the anticipations of those who did not approve of the scheme have not been realized, and that, so far from improving, the economic condition of the borough has deteriorated; for, while the population and the rateable value of the borough have increased, its expenses have grown in greater proportion. The rise in rateable value in Salford, it is pointed out, has been mainly in small houses, largely inhabited by people whose business is in Manchester, while the development of the city has been in the direction of large works, offices, and warehouses, which yield a greater income in rates. It is urged that Manchester will always attract the large enterprises; while Salford will continue to supply residential accommodation for a growing proportion of the people employed in the city, without at the same time deriving any benefit from the rates imposed on the works, warehouses, and offices needed for these new enterprises. The petitioners will also submit that by amalgamation a great saving will be effected in the cost of administration and the working of such departments as the gas, electricity, and tramways. Five years ago, the Salford Town Council rejected an amalgamation proposal by 37 votes to 8.

BARRY GAS AND WATER UNDERTAKINGS.

The Past Year's Working.

At a recent Meeting of the Barry Gas and Water Committee, a report on results of the working for the year to March 31 was presented by Mr. T. E. Franklin, the Gas and Water Engineer and Manager.

Dealing first with the Gas Department, Mr. Franklin points out that there was a decrease in the amount of capital expended of £942. On the carbonizing plant, there was only £388 spent, as against £1160 the previous year; and while the capital expenditure on mains and gas-fires was slightly increased, there was a decrease on services, meters, stoves, and the fitting-up of houses. The Local Government Board have not only refused to allow the payment of the Council's own workmen when engaged on new work out of capital, but have, in a recent sanction for a loan, deducted the sum of £433, money so expended during the last few years. This amount has had to be taken from the reserve fund; and in future these payments will have to be provided out of revenue. The quantity of coke, breeze, and tar made for sale showed a decrease; while that of ammoniacal liquor exhibited considerable increase. Owing to the inefficiency of the station-meter, the total make of gas could only be estimated; and the figure was placed at 161,500,000 cubic feet. The quantity of gas sold showed an increase of 3,085,920 cubic feet as compared with 1908-9; being 156,735,670 cubic feet, against 153,649,750 cubic feet. The amount of unaccounted-for gas was 1,580,030 cubic feet; and that used on the works was reduced by over 600,000 feet. Coal cost £800 less than in the previous year—£9098, against £9898. This saving was due partly to the lower prices and partly to improved working, as, notwithstanding the increase in make of over 3,000,000 cubic feet, the quantity of coal carbonized was reduced from 15,707 tons to 15,230 tons—a saving of 477 tons. The make per ton of coal averaged 10,604 cubic feet—an increase of 535 feet per ton over that of 1909, and 1009 feet over that of 1908. The alterations to the hydraulic main, and the erection of a tar-tower were thus justified, as, though necessitating strict and constant attention, the anticipated increase of make was obtained. The expenditure out of revenue on the gas-works showed a decrease of £660; the amount spent being £1243. In this sum was included the cost of the retort renewals and repairs; conveyor, and gas-engine, &c., repairs; and the general upkeep of the works. A sum of £1482 was spent on the maintenance of the mains, meters, &c.—a decrease on the expenditure of the previous year of £69. In addition to the various work paid for out of revenue, a new set of exhausting plant, complete with accessories and foundations, was installed and provided for out of the reserve fund. The working of this plant has so far been very satisfactory. The total income for the year, as compared with that of the previous year, was augmented by £611. The increase in gas-rentals, &c., accounted for £555 of this sum; while that on residual products was only £56. The capital charges for the year were 1s. 1·35d. per 1000 cubic feet of gas sold. There was a substantial increase in both the gross and net profits over those of the year 1908-9; the gross profit being £14,846, and the net profit the record one of £6122. The respective increases were £2289 and £2203.

Referring to the figures in connection with the Water Department, Mr. Franklin says there was an increased expenditure of £63 on mains, meters, &c. The amount spent from revenue shows a total decrease of £191; being £807, against £998 during the previous year. The cost of the repairs and maintenance of works and plant at Biglis was reduced by £137, and as compared with 1907-8 by £218. In 1908, three patent forced draught furnaces were fitted to the Biglis boilers, at a cost of about £135; being paid for out of revenue. After their installation, the fuel costs were greatly reduced; a saving of £267 being effected during 1908-9, and of £352 during last year. There was also a saving in the repairing of mains, &c., of £54. The quantity of water pumped was very substantially reduced; the figures for the past three years being: 1907-8, 287,144,000 gallons pumped; consumption per head per day, 24 gallons. 1908-9, 257,235,000 gallons pumped; consumption per head

per day, 21¾ gallons. 1909-10, 232,679,000 gallons pumped; consumption per head per day, 19½ gallons. It will thus be seen that the more frequent inspections of fittings, washering of taps, and serving of notices, brought about a great reduction in the waste of water. A slight decrease of £49 occurred in water-rentals, &c. The gross profits (£5422) showed an increase of £316. Compared with 1908-9, the deficiency was lowered by £381, and with 1907-8 by over £1500. The deficiency in 1907-8 was £3911; in 1908-9, £2749; and in 1909-10, £2368.

The net profit on gas being £6122, and the deficit on water £2368, there was left a net surplus of £3754, compared with £1170 for the previous year.

The Committee, after going through the statements, unanimously expressed themselves as very pleased with the results. The Chairman (Mr. J. T. Hogg) said the results were the most satisfactory ever seen in connection with the Council. Not only were they the largest profits ever had from the department; but he did not think the works had ever attained such a state of efficiency as they were in at present.

ROAD-TARRING WORK IN GERMANY.

From "Engineering Record," New York.

The status of bituminous road work in Germany is shown in a report presented to the Association of Technical Officers of German Cities by Herr Sperber, Chief Engineer of Hamburg, and Herr Franze, City Engineer of Frankfort-on-the-Main. Letters of inquiry were sent to 89 cities; 43 replies were received concerning surface tarring, 11 concerning mixing methods of making bituminous roads, and 32 concerning the use of dust-preventives.

The experience in 43 German cities with the surface tarring of roads and footpaths was summarized substantially as follows: In most towns crude tar freed as much as possible from water, and obtained direct from the gas-works, is employed; only Munich having used in addition distilled tar and a mixture of pitch and tar. Berlin and Stettin have employed distilled tar, and Königsberg and Münster purified tar. Cologne has made experiments with apokonin (a proprietary compound of heavy coal-tar oils with hydrocarbons having a high boiling-point) as well as with tar. Stettin and Lübeck add some tar oil (up to 25 per cent.) to the tar, in order to dilute it. Dresden has used crude mineral oils, tar oils with and without admixture, and apokonin. The tar is generally heated up to 70° to 130° C., according to the quantity of water and ammonia previously liberated, so that it is applied to the surface on the average of about 90° to 100° C. Bielefeld has used tar at only 40° C. Cologne heats apokonin to 80° to 100°.

Cold tar has only been used experimentally at Brunswick on a small stretch of footpath. The roads were first thoroughly cleaned with hand-brooms or sweeping-machines (in Mayence with broom and jet-pipe). At Dantzic the surfacing was previously scarified. Then the tar was applied to the cleaned roadway with machine sprinkling carts, manual sprinkling carts, water-carts fitted with old sprinkling devices, or watering cans. In the case of footpaths, the tar was applied to the 2·4 to 4 inch coating of fine gravel, sand, or clinker after it had been in use for from five to six weeks by the traffic, and in part after being previously rolled afresh (Brunswick). At Wiesbaden all the playgrounds have been tarred, with very good results, since 1904.

Many towns have tarred only those old surfacings which were in good condition; and in nine towns the surfacings were previously repaired. One town (Stuttgart) will in the future tar only new surfacings, as do Aix-la-Chapelle and Leipzig. Dantzic has not tarred, but has rolled on the old roughened bed of road metal a layer of gravel 4 inches thick saturated with hot tar.

The period for finishing the road-metal surfacing up until the tarring varies greatly—from one to two years in Chemnitz to a few days in Heidelberg and Mayence. At Mannheim the tarring of surfacings rolled shortly before in the same year has not proved satisfactory. Supposing the road to have dried, most towns recommend tarring to be done from two to fifteen weeks after the finishing of the new road-metal surfacing.

As the most suitable time for tarring, the season from May to October is recommended, and by most engineers June, July, and August; dry weather being presupposed in all cases. When rain falls, the work has to be stopped until the road has dried again.

Thin coatings of sand are employed almost exclusively; coatings of stone dust or road dust being also used in addition in individual cases. This coating is only renewed at the places where tar is found to penetrate. Würzburg uses a thick coating of sand, Chemnitz fine granulite gravel and a double coating of tar. Darmstadt subsequently applies a little more sand. Individual towns apply the sand coating immediately after the tarring; others wait for from three to six hours up to one-and-a-half to two days.

The period from the finishing of the tarring of the road up to the opening for traffic varies greatly. Thirty towns open the road at once; at Brunswick and Crefeld, after three to ten hours; at Cologne at the earliest after two, and at the latest after eight hours; at Hagen, after four to six hours; at Berlin, after four hours, according to the weather. Fourteen towns open the road on the day after the tarring; three wait two days, and five wait three days when possible. Complaints about annoyance owing to odour or soiling have not been received in the great majority of towns; and no complaints were made as to injury to trees in roads.

In most towns there are no special specifications for the tar. Where they exist, they are confined to requirements as to the tar being as free from water as possible, obtained directly from the gas-works, and heated to at least from 50° to 70° in certain towns, and in others from 85° to 130°. In Mannheim there is the regulation that only tar as it comes from the gas-works may be employed, as the tests made with purified tar are not satisfactory. Cologne prescribes that the tar must be free from water—if possible, vertical-retort or water-gas tar—and must be a thin liquid of low specific gravity. The tar is not to be

distilled; and the readily volatile oils must be retained in it. The anhydrous tar of the Wiesbaden Gas-Works contains 19 per cent. of oil and 78 per cent. of pitch.

The durability of the first tarring varies greatly; ranging according to the amount of the traffic in each instance—in most towns up to twelve months. Stettin has repeated the tarring only after four years. On roads having a considerable gradient, the tar surfacing lasts only until the approach of frost. Then it is torn up by horses' hoofs and the grinding of braked wheels, and particularly when the road-metal surfacing is hard, and but little tar penetrates. The tarring is not renewed, as a rule, in the year of application, but almost everywhere in the following year.

Tarring twice does not hold better than once at Mayence. On the other hand, double tarring, using a layer of fine gravel 0·8 inch thick, rolled by a steam-roller, has lasted longer than two years under medium traffic without repair at Leipzig. In most towns tarring is repeated only once a year. In three towns the tarring of footpaths has not suffered from wear after one year, except, owing to frost, where distilled tar has been employed.

Most towns have at first done the tarring with manual labour. The statements as to the size of the gangs and the performances with simple manual labour vary from four to eighteen men and from 350 to 710 square yards per ten hours. On an average, 108 square yards of tarred surface may be reckoned per man in one working day in the case of a gang of five men, when half the roadway is tarred at a time. If the thoroughfare can be stopped, this increases the average performance to 144 square yards. The average wage is 4s. per day per man.

In the case of horse-drawn tarring machines, the daily performance for one of the labourers, including driver and stoker, is on an average 1200 square yards. The statements as to the size of the gang belonging to a one-horse tarring sprinkling machine range from five men, including driver and stoker (machinist), up to thirteen men; generally there are five to six men. The daily performance amounts to 3600 to 7800 square yards with a 10 to 14 hour working day, or an average of 500 square yards per hour.

The opinions as to the advantage of rolling the tarred and sanded surfaces are various. Several towns are for rolling after sanding, and this generally with the steam-roller; on the other hand, the majority of towns consider subsequent rolling unnecessary. The cost of a square yard of the first coating amounts to ¾d. to 3d. for roadways with manual labour, and 1d. to 2d. per square yard with machines, and to ¾d. to 2½d. for footpaths. The consumption of tar for a square yard of roadway varies between 2·51 lbs. (Breslau) and 4·82 lbs. (Würzburg). On an average, the consumption of tar for a square yard of roadway amounts to 3·4 lbs., and the cost for this to about ½d. The cost of the second coating of tar is given by one town as equal to that of the first; and by another town as half as much. Leipzig has carried out double tarring 0·8 inch thick under a coating of spalls, a 22-ton steam-roller being made use of; and a square yard costs 1s. 1d. (without bed). Repairs have not in two years been necessary. This method forms the transition to tar macadam, respecting which particulars are given.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The report of the proceedings at the meeting of the Edinburgh and Leith Gas Commissioners last Monday (given on another page) affords a further illustration of the trouble, which often appears to be unnecessary, to which public bodies are subjected by Government officials, who are, to all intents and purposes, omnipotent within their own spheres. They have a way of getting public bodies to "work in harmony" with them which is not productive of a spirit of amiability. The valuation of the undertaking of the Gas Commissioners has again gone up. Two years ago it was £99,767; last year it was £106,177; and it has now been fixed by the local Assessors at £118,650. Of the total sum, £112,307 has been allocated to Edinburgh, £3599 to Leith, and £2744 to Midlothian. The undertaking is too prosperous; the rise this year being due to the surplus of nearly £11,000 which was realized upon last year's working. It will be observed that the surplus anticipated this year is only £2084.

There was a report before the Commissioners by Mr. W. R. Herring, as to the sales of coke during the past year, in which it was stated that the production of coke amounted to 121,231 tons, and that of this quantity they used in connection with steam-raising, locomotive, and other general purposes at the works, 16,070 tons, while 25,921 tons were used in the furnaces for heating the retorts. The balance of 79,241 tons, available for sale, was disposed of as follows: 32,493 tons sold to local customers; 31,265 tons shipped abroad; and the remainder, 15,483 tons, added to stock. The average price obtained was 9s. 2d. per ton, as compared with 9s. 10½d. in the preceding year. Messrs. Ramage and Ferguson, who were mentioned as complainers by Bailie Pennell, used the coke in a patent furnace for producing gas for heating ships' plates. The Commissioners used at Granton 25,920 tons of coke in their own furnaces for producing fuel gas; and they were therefore able to judge by daily experience as to its quality for such a purpose. It must, however, be borne in mind that the furnaces at Granton were designed to use the average quality of coke which it was known the Commissioners would produce; and while every care was taken in selecting the coal that would produce a good serviceable coke, it could not be denied that there were coals—much more expensive to purchase—that would produce a superior coke to their average quality. So far as could be determined from a sample of the coke which Messrs. Ramage and Ferguson were using, it was a quality that the Commissioners could not afford to produce in bulk, as they would not obtain any better price on the average for their annual output.

The proposal to introduce stoking machinery into the gas-works at Perth met with strong opposition from the Trades Council of the city. A deputation from the Council recently paid a visit to the gas-works; and in their report to the Council they stated emphatically, that in their opinion, the introduction of new machinery was neither necessary nor expedient. It had been conclusively proved to them that the

present plant was not only equal to meet the requirements of the city at the present time, but was capable of producing more gas than was likely to be required by Perth in the next twenty years. The maximum make per day was 1,100,000 cubic feet; while the existing plant was capable of producing 2,000,000 cubic feet. The oldest part of the plant at present in use had only been in operation for nine years. The proposal was to shorten its life by five years; but it was maintained that, so long as the present plant was good for working purposes, and was gradually paying for itself, it should be allowed to remain until it was necessary to renew it. The machine which it was proposed to introduce had been on the market for only six years; and it would doubtless be subject to many improvements. Why not, the deputation asked, allow matters to remain as at present, and then they would have the benefit of those improvements later? Another reason for not proceeding with the scheme was that within the next few years revolutionary changes in the production of gas were anticipated. As to the argument that the introduction of machinery would lead to more humane conditions of labour, the deputies considered that this might be accomplished with the existing hand-worked appliances.

The Town Council on Thursday evening dealt with the subject. Councillor Wright, who was opposed to the proposal all through, considered that with the existing plant they had sufficient power to produce all the gas which would be required in Perth for a considerable number of years. He moved that the matter be delayed. Mr. Macpherson, the Convener of the Works Committee, moved that the scheme be adopted. He referred in sarcastic tones to the influence which the Trades Council had over the Town Council, in being able to induce them to toss aside a report by an expert and by their own Committee, who had specially inquired into the matter, in favour of a report by certain gentlemen who had no skilled advice whatever. It was wonderful, he thought, to find how strong outside influences could become when November was approaching. He maintained that the introduction of the machinery would mean a reduction of 1d. in the price of gas. Ex-Lord Provost Cuthbert, a former Convener of the Gas Committee, was of opinion that, in view of the heavy expenditure which had been incurred in connection with the gas-works, it was only by the introduction of labour-saving appliances that they could hope to reduce the price. He was not satisfied with the information submitted, however; and he moved that the matter be remitted back to the Committee, with the view of preparing a supplementary report showing the effect the improvements would have on the price of gas. This was carried, as against that proposed by Mr. Macpherson; but on a final vote, the motion of Mr. Wright, was adopted by twelve votes to nine.

The Banchory Gaslight Company, Limited, had a profit last year of £193, out of which dividend at the rate of 1s. 3d. per share has been paid. It was reported that a revaluation of the Company's assets had been made, with the result that the valuation had been reduced by £67. The price of gas was fixed at 6s. 9d. per 1000 cubic feet.

The Kelso Gas Company have reduced the price of gas from 3s. 4d. to 3s. 1½d. per 1000 cubic feet.

Stealing money from prepayment gas-meters has become so common an experience in Dundee that the prosecuting authority has taken exception to the system. At a meeting of the Gas Committee held this week it was reported that Mr. D. Dewar, the City Procurator-Fiscal, had sent a letter in which he pointed out that thefts from prepayment meters were becoming very common, and suggested that metal discs should be used instead of coins which he considered would do away with the temptation to steal. Mr. W. M. Burke, the Gas Treasurer, informed the Committee that he believed that such a system would not stop the thefts; that the discs would be stolen, and there would be a tendency to make resetters, because the discs would very likely be sold at such a rate as probably 12 for 6d. It was pointed out that in eight months 756 gas-meters had been broken open, and money stolen from them amounting to £150. Mr. Girrity said he observed that in one instance as much as 7s. 7d. was extracted from a meter; and he asked if the meters could not be more often cleared by the officials. Mr. Burke replied that the collections used to be made every three months, but that now they were made every six or seven weeks.

The incident with reference to the valuation of the gas and electricity undertakings belonging to the Dundee Corporation, which was referred to in my "Notes" on Sept. 20, has been amicably closed. On Monday, when the adjourned sitting of the Valuation Court was held, Mr. G. C. Brown, the Assessor, said he had much pleasure in stating that the valuations had been amicably settled. In the case of the gas, Mr. W. M. Burke, the Treasurer, had explained to him that he did not realize the importance of letting him have the figures early, and that the delay was putting him into a position of serious difficulty. He accepted Mr. Burke's explanation; and he was very glad to have the case amicably settled. The amount, in the case of the gas undertaking, had been fixed at £20,725. The claim by the Town Council was for £20,040. In the case of the electricity undertaking, the amount was fixed at £14,668, as against £12,733 asked by the Council. Bailie Johnston, who presided, expressed satisfaction that the little incident had been closed. One of the chief difficulties in the matter, it is explained, was in fixing the allowance to be made in respect of tenants' capital. This sum, in the Gas Department, in 1902-03, was fixed at £26,000, upon which the deduction as in lieu of interest was £975; in the following six years, the capital was fixed at £60,000, upon which the deduction was £3000; last year it was £100,000, with a deduction of £5000; and this year the capital has been fixed at £150,000, with a deduction of £7500. In the Electricity Department, the tenants' capital has been fixed at £66,000—a rise of £46,000.

There is a proposal on foot for the acquisition by the Corporation of Edinburgh of the site of the old gas-works in New Street, and the erection upon it of a new vegetable market for Edinburgh. The Markets Committee of the Town Council have had the subject before them, and have passed it on to the Town Council; while the Works Committee of the Gas Commission, on a preliminary consideration of the subject, have resolved to defer the matter till the Town Council have taken action. The area extends to 18,975 square yards.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 1.

Sulphate of Ammonia.

The market shows no sign of weakness at any point, and, though the end of a month has been reached, advancing prices continue to be paid for all available supplies. The further hardening of values has no doubt been occasioned by the appearance of some important new orders, and the closing quotations are: £12 12s. 6d. to £12 13s. 9d. per ton f.o.b. Hull, £12 13s. 9d. to £12 15s. per ton f.o.b. Liverpool, and £12 15s. to £12 16s. 3d. per ton f.o.b. Leith. In the forward position, there has been good inquiry, and business has been done for delivery up to the end of this year at prompt values; while for January-June, 1911, in equal monthly quantities, sales are reported at 2s. 6d. per ton less.

Nitrate of Soda.

In the early part of the week, the quotations for this article were raised to 9s. 6d. per cwt. for ordinary, and 9s. 9d. for refined quality, on spot; but buyers refused to follow the advance, and prices are again back at 9s. 4½d. and 9s. 7½d. per cwt. respectively.

LONDON, *Oct.* 3.

Tar Products.

The markets for tar products have been steady throughout the past week. Pitch still continues firm in England. There is no disposition on the part of makers to sell, as they feel confident that there is none too much pitch available, and that they will do better by waiting. On the Continent, buyers report that they are receiving offers from the Germans at reasonable terms for delivery over the first six months of next year. Benzol is steady, and there appears to be some improvement in the demand for this article. Makers advise that they have received offers at improved prices for next year's delivery; they having been offered 5½d. in buyers' drums east coast ports, but decline to quote anything under 6d. for January-June. Fifty-ninety per cent. benzol has improved in sympathy. Toluol is quiet. Buyers seem to be fairly well supplied; while makers are evidently quite easy, and are under no necessity to sell for the present. Solvent naphtha is steady, but orders are difficult to place. Heavy naphtha is quiet; and there are reports of rather low prices having been accepted for delivery all over next year. Creosote is quiet both in London and the North, but makers still look for better prices later on. Heavy oils are quiet, with not very much demand for them. Carbolic acid is steady; but the majority of makers decline to look at the prices offered. Naphthalene is quiet; but salts are in good demand. Tar is fetching good prices all round.

The average values during the week were: Tar, 18s. 9d. to 22s. 9d. *ex* works. Pitch, London, 37s. to 37s. 6d.; east coast, 36s. 6d. to 37s.; west coast, 38s. to 40s. Clyde ports, 35s. 6d. to 36s. 6d. Manchester, 36s. 6d. to 37s. 6d. Liverpool. Benzol, 90 per cent., casks included, London, 7d. to 7¼d.; North, 7d. to 7¼d.; 50-90 per cent., casks included, London, 7½d. to 7¾d.; North, 7¼d. to 7½d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3½d. to 4d.; North, 3⅛d. to 3¼d.; solvent naphtha, casks included, London, 1s. to 1s. 0½d.; North, 11d. to 1s.; heavy naphtha, London, casks included, 11d. to 11½d.; North, 10¾d. to 11d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2½d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. bags included. Anthracene, "A" quality, 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article has been steady during the past week, and buyers appear somewhat inclined to purchase for far forward into next year at something approaching the present market price. Actual Beckton to-day is quoted at £12 3s. 9d. to £12 5s., and for forward delivery £12 6s. 3d. to £12 7s. 6d. London 25 per cent. is £12 2s. 6d.; Hull, £12 15s.; Liverpool, £12 15s.; Leith, £12 15s., and for forward £12 17s. 6d. Middlesbrough is £12 15s.

COAL TRADE REPORTS.

Northern Coal Trade.

The demand for coal appears to be a little weaker, and thus the prices seem to show a slight ease. In the steam coal trade, best Northumbrian steams are 9s. 9d. to 10s. per ton f.o.b., second-class steams are 8s. 9d, and steam smalls are from 5s. 6d. to 6s. 6d.—the latter class being rather more plentiful. The collieries are working fairly well, but lack of steamers at times causes a day or two's idleness at some pits. In the gas coal trade, the demand now begins to show a more steady increase; and the deliveries on the long contracts are growing to be very full, and to take up a larger part of the output of some of the collieries. Prices of Durham gas coal vary from 8s. 9d. to 9s. 9d. per ton f.o.b., according to quality, for the usual classes; while for "Wear" specials, 10s. 3d. is now the current price. There is rather less demand for coals for the Mediterranean—many of the users having bought gas coals over the next few months; and they ask for concessions in the price. But the general demand increases; and there is now a slight stiffening in the values of good gas coals for winter delivery. One large sale, however, has been allotted to Durham and Yorkshire coal; but the price has not transpired. Coke is steady, and gas coke more plentiful—the latter being about 13s. to 13s. 6d. per ton f.o.b.

Scotch Coal Trade.

There is a slight improvement in the demand, particularly the foreign demand; but the disturbances in the labour market are leading to indecision in purchases. The prices now quoted are: Ell, 8s. 9d. to 9s. 9d. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The returns as to shipments are incomplete. So far as

they are made up, they show a total for the week of 327,183 tons—an increase of 3088 tons upon the previous week, but a decrease of 8845 tons upon the corresponding week of last year. For the year to date, the total shipments are given at 11,841,685 tons—an increase upon the corresponding period of 723,236 tons.

Compensation for Gas Poisoning.

At the Wrexham County Court last Friday, Margaret Jones, a domestic servant, claimed from Mr. John Settle, of the Royal Oak Hotel, Wrexham, 8s. per week compensation for injury sustained while in his employ. Applicant's case was that on awakening on the morning of the 16th of April there was a strong smell of gas in the room, and she had to put the bed clothes in her mouth and dress on the landing. She felt ill, and getting worse she decided to go home, and left on the 21st of April. She consulted Dr. Richard Evans, who instructed her to go home to bed. She had not been able to work since, and was still unwell. A plumber was sent for on the morning she complained of the gas, and he found that owing to the fusing of the electric wires there were leakages in the gas-pipe under the flooring boards in applicant's bedroom. Dr. Evans and Dr. Enoch Moss said they came to the conclusion that applicant had been poisoned by gas. For the defence, Dr. S. Edwards Jones said that he examined the girl on Aug. 22; and from his observations and the history of the case, he came to the conclusion that she suffered from anæmia and hysteria, and not from gas poisoning. Dr. Richard Williams said in his opinion the applicant had not suffered from gas poisoning. Defendant's housekeeper said the girl made no complaint to her before leaving; the mother being the first to say anything. The girl seemed very pale and weak when she was engaged, and had told witness that she left a former situation through ill-health. His Honour said he found that there had been an accident, and this led to an escape of gas, whereby the applicant suffered. He awarded her 7s. a week from the date of the accident to the 8th of August, and from that date until the 30th of October 3s. 6d. a week. He was of opinion that by the latter date she would have fully recovered.

Dorking Gas Company.—The half-yearly meeting of this Company was held last Tuesday—Mr. H. Young in the chair. The accounts presented for the six months ended the 30th of June showed a balance of £1869 available for distribution; and the Directors recommended the payment of dividends at the rate of 6 per cent. on the "A," "B," and "C" shares, and at the rate of 5 per cent. on the "D" shares. This would absorb £1337, and leave a balance of £532 to be carried forward. In moving the adoption of the report, the Chairman said the manufacturing results in the half year had been satisfactory. There had been a decrease in the quantity of gas sold, but this had been made up by economies in manufacture; so that the net result was about the same as in the corresponding half of last year. The report was adopted, and the dividends recommended were declared.

Fraudulent Use of Gas.

At the Tottenham Police Court last Thursday, Frederick Carter, c Junction Road, Tottenham, was summoned for fraudulently abstract ing gas belonging to the Tottenham and Edmonton Gas Company Mr. W. Windsor, who prosecuted on behalf of the Company, state that at one time there were two meters in the rooms now used by th defendant—one being rented by the occupier of a front room, wh required it for a gas-stove. This was subsequently disconnected whe a lodger left, but the service-pipe remained; and the complaint wa that the defendant procured gas from it, though he had a supply of hi own. Up till March last, sums of 5s., 6s., and even 10s. had bee collected from his prepayment meter; but subsequently the amount dropped to 1s. 1d., 7d., and 5d. The decrease attracted attention, an an inspector visited the house, and found that the defendant had, b means of an india-rubber tube, connected the disused pipe with a gas cooker in the front room. Upon being interviewed by the Enginee of the Gas Company (Mr. A. E. Broadberry), he said he thought th pipe was connected with the meter. It was estimated that if he ha consumed gas at the same rate as last year he was indebted to th Company to the extent of 15s. 6d. Defendant was called, and state that he was unaware that the gas was not registered. He explaine that the reduction in the consumption since March was due to the fac that his wife had been going out to work, and that he had not bee much at home. The Bench were of opinion that the connection coul not have been made without guilty knowledge; and they imposed a fine of 10s. and costs.

Sulphur in Coventry Gas.—The Gas Engineer and Manager o the Coventry Corporation (Mr. Fletcher W. Stevenson) has bee conducting experiments with the view of ascertaining whether there i any ground for certain complaints which have been made in regard t sulphur in the gas. He has lately reported the results to the Gas Com mittee, who have authorized him to obtain expert assistance.

Irlam Gas Supply.—The Urban District Council of Irlam, nea Manchester, have under consideration the question of securing contro of the lighting. At present the district gets its supply of gas from th Salford Corporation; and the District Council contemplate approach ing the Gas Committee to ascertain on what terms they will "sell out." The development of Irlam, consequent upon the erection of extensiv works on the banks of the Manchester Ship Canal, has led the Distric Council to make this new departure.

Suicide by Coal Gas.—Last Tuesday, a man named Boston, age 54, a painter, residing in Lower Adelaide Street, Northampton, wa found dead in bed; the room being full of gas. The bracket had bee torn down, and a rubber tube attached to the pipe. At the inquest o Thursday, evidence was given to the effect that the deceased had bee in trouble on account of his wife leaving him; but he had neve threatened to commit suicide. The Jury returned a verdict of "Suicid by gas poisoning while temporarily insane."

Sale of Northwich Gas Company's Shares.—A number of shares . the Northwich Gas Company were offered for sale by auction on the 7th ult. Fifteen ordinary shares of £15 each, fully paid, sold for £32 ach—establishing a record for this class of share in the Company. en preference shares of £10 each, fully paid, realized £11 8s. per hare.

A Gas Supply Failure.—In consequence of the failure of the gas upply, Billingborough, in Lincolnshire, was thrown into darkness on aturday night. Naturally, the inconvenience was principally felt by ne tradesmen; and many business places had recourse to candles. It reported that a similar failure was experienced a few weeks ago; and . is believed that serious leakage has occurred in the mains.

Sale of Coke at Coventry.—The question was raised at the last neeting of the Coventry City Council by Mr. Halliwell as to whether t was correct that the Gas Engineer and Manager (Mr. Fletcher W. tevenson) prohibited dealers in coal and coke from selling coke at a ower price than 16s. per ton, while he himself was selling to factories n the city at less than this. The Chairman of the Gas Committee Mr. Batchelor), in reply, said this was so. He explained that the ixed price was maintained so as to prevent undercutting; but he said ome private buyers took as much as the largest dealers, or they possibly would import their coke.

Cost of the New Halifax Water-Works.—The Halifax Borough Treasurer (Mr. G. H. Fry) has issued a report on the abstract of accounts for the year ended March 31. Dealing with the water-works accounts, he states that the capital expenditure on the Walshaw Dean reservoirs at the close of the financial year was £339,930. Of this amount, only £289,199 had been authorized; and the balance was included in the Parliamentary Bill now being promoted by the Corporation. He adds that the minutes of the Council show that the delay in applying for this balance has been agreed to by the Local Government Board. The interest and sinking fund for the year with respect to the Walshaw Dean scheme was £15,333, or only £1442 less than the total deficit on the Water-Works Department for the year.

Sentence on the Bogus Gas Collector.—In the last number of the "JOURNAL," a case was reported in which a man named Atwell, aged 24, was charged before Mr. Cluer, at the Old Street Police Court, with committing a series of ingenious robberies from prepayment gas-meters in the districts of the three London Gas Companies. He was committed for trial, and was brought up before Mr. R. Wallace, K.C., at the County of London Sessions, last Tuesday. It was stated that there were forty cases against the prisoner in all parts of London, and that in one instance he left a serious escape of gas, which might have brought about an explosion. He had also undergone eighteen months' hard labour for a similar series of robberies, when he posed as a gas company's employee in order to get into the houses. Mr. Wallace sentenced the prisoner to 21 months' hard labour, and said that his age alone saved him from penal servitude.

Fatality at the Redheugh Gas-Works.—At the Gateshead Police Buildings last Friday, an inquiry was held into the circumstances attending the death of Ralph Oliver Bruce, aged 36, a coal tipper at the Redheugh works of the Newcastle-on-Tyne and Gateshead Gas Company. Thomas Jones, a locomotive driver in the service of the Company, said he found deceased lying beside the retort-house on the previous evening. He was injured about the chest, and died immediately afterwards. While witness had been bringing three empty waggons along from the retort-house, two of them left the line. It was then that witness found the deceased; and he thought he must have been struck by the waggons. The Jury returned a verdict of "Accidental death." Mr. T. Hardy, the Company's Chief Engineer, expressed sympathy with the relatives of the decased.

Accident at the Exmouth Gas-Works.—As workmen at the Exmouth Gas-Works were about to resume after dinner last Tuesday, an alarm of fire was raised from the meter-house. It appears that three men were at work there finishing a connection of pipes with the new gasholder. A pipe leading to the smaller holder was opened up; and a bladder was placed in the pipe to cut off the gas while a connection was made. Whether a defect in the rubber bladder was the cause or not, is not known; but there was an escape of gas, which became ignited. The flames spread rapidly; and the meter-house was soon ablaze. The men rushed out; but all of them had received burns. The fire brigade was well assisted by the gas employees, about a score of whom were busily engaged covering the connecting pipes with tons of earth to keep the fire from the holder. The fire in the meter-house was got under, and then attention was turned to a pipe pit, where the gas was burning furiously—forced back from the holder. Earth was however, shovelled into the pit until the flame at the open pipe was extinguished.

Cirencester Gas Company, Limited.—At the annual general meeting of the Company last Wednesday, the Directors reported that the business continued to be progressive. The sale of gas in the year to the 30th of June was greater by upwards of 1,300,000 cubic feet than in the preceding year; while owing to improved working, and in some measure to the better quality of the coal received, the increase in the make of gas was effected with a saving of nearly 170 tons of coal carbonized. The net profit was £3104. Interest on the debentures and the usual interim dividend had been paid, and the Directors recommended a further dividend at the rates of £12, £6, and £8 8s. per cent. on the several classes of shares—making £11, £5 10s., and £7 14s. per cent. for the year. They also recommended that a further sum of £300 should be carried to the depreciation account. There continues to be a steady increase in the demand for prepayment meters; and the number in use has now reached 802. The works, plant, and mains of the Company have been kept in good order by the Manager (Mr. E. M. Beecham) entirely out of revenue. Expense has been incurred on new purifying plant; but the Directors said it had been completely justified, and the improved method of working had resulted in great economy in labour and saving of expense.

The "Electrician" Printing Company have just published a diagram by Mr. R. Livingstonem (author of the "Mechanical Design and Construction of Commutators," and "Mechanical Design and Construction of Generators,") showing an easy method of calculating deflections in shafts and beams.

The Telephos Domestic and Street Lighting Company, Limited, was registered on the 27th ult., with a capital of £50,000 in 5s. shares. The object is to carry on the business of manufacturers of, and dealers in, "telephos" gas-switches, automatic gas lighting and extinguishing apparatus for street-lamps, &c. Among the first Directors are Sir James Heath, Bart., of Leamington, and Mr. A. E. Broadberry, of Tottenham.

Owing to a fault in a feeder at the Southport electricity works, on Sunday, the 25th ult., the electric light failed in one district of the town. It was not until about a quarter to nine that the defect was temporarily remedied and light restored. During the period of unexpected darkness, it was necessary to use candles at the various places of worship in the district; while the Infirmary was also lighted by the same means for about three hours.

We have received from Bullers, Limited, of Tipton and London, a pamphlet issued by them dealing with explosions of gas in electric-light boxes. In it are given short accounts of explosions which have taken place during the past seven years; and the advantages of the patent ventilated junction-box for underground cables, which the Company have brought out, in conjunction with the Managing Director (Mr. E. J. Chambers), for the prevention of these accidents, are set forth.

In a neat booklet bearing the title of "Congenial Warmth," the Cannon Iron Foundries, Limited, furnish particulars and prices of their radiators. Special attention may be directed to the "Torrid" radiator, shown on p. 10, which is a new production. It is fitted with luminous burners; and there is no flame-contact with cold surfaces, so that perfect combustion is secured. No flue is required for this radiator. The patent "Radio" pattern, which is also new, is fitted with an automatic gas-valve to maintain an even temperature and economize gas, and also with an automatic air-valve. Like the "Torrid," it can be placed in any position, as no flue is required. The other radiators shown are the Company's well-known types.

At a recent meeting of the Gas Committee of the Belfast Corpora tion, the tenders of the following firms for the supply of gas-meter were accepted: Messrs. Parkinson and W. & B. Cowan, Alder an Mackay, and Thomas Glover and Co.; for stoves and cookers, those o the following firms: Messrs. John Wright and Co., Arden Hill an Co., Fletcher, Russell, and Co., R. & A. Main, Wilsons and Mathie sons, Cannon Iron Foundries, and Richmond Gas Stove and Mete Company.

A domestic servant named Jennie M'Kay, a native of the North o Ireland, was found dead in her bedroom at the residence of her em ployer, Mr. Fred Grammer, of Cheadle Heath, near Manchester; an the evidence adduced at the inquest indicated that the girl had brough about her death through want of knowledge of how to manipulate gas-tap. It was stated that the girl, who came from Dungiven, had on taking up her duties, to be instructed as to the operation of gas taps. The next day but one she was found dead in bed with the gas turned full on. The Coroner said it was clear from a letter found in the girl's possession that she was perfectly contented and happy in her situation. It was evident that, not being accustomed to gas-jets she had, on retiring, first turned out the gas and then turned on the tap again. The Jury's verdict was "Accidental death."

The detailed report issued by the Directors of the Mannesmann Tube-Works, Düsseldorf, sets forth that in July a beginning was made with the manufacture of seamless gas-tubes by the Company's new process, and it is thought that in a few months this will be an important branch of the business. It is much cheaper and better than the welded process now generally employed, and confidence is expressed that it will eventually become an even more important trade than the seamless steam-tube business, which was begun about a dozen years ago. The turnover of the German works during the year covered by the report was 37,673,588 marks, against 35,292,637 marks the previous year; and that of the entire Mannesmann group 61,921,375 marks, against 57,044,677 marks. The present capital of the German Company is 22½ million marks, which is being increased to 30 million marks; and there are in addition loans to the value of 6½ million marks. The year's net profit was 4·7 million marks; 12½ per cent. dividend is again being paid; and the outlook is considered satisfactory.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

Gas Manager. Abercarn Gas Department. Applications by Sept. 22.
Assistant-Manager (South America). No. 5294.
Representative. "Gas Works," c/o Streets.
Stoker. Chertsey Gas Company.

Situation Wanted.

Prepayment Meter Installations. No. 5295.

Plant, &c. (Second Hand), for Sale.

Retort Mouthpieces and Retort-House Governor. No. 5293.

Meeting.

Danish Gas Company. London Agency. Oct. 25. 2.30 o'clock.

Stocks and Shares.

Aldershot Gas and Water Company (by Auction). Oct. 11.
Barnet Gas and Water Company (by Auction). Oct. 11.
Bognor Gaslight Company (by Auction). Oct. 25.
Dorking Water Company (by Auction). Oct. 18.
Grays and Tilbury Gas Company (by Auction). Oct. 25.
Great Yarmouth Water Company (by Auction). Oct. 11.
Harrow and Stanmore Gas Company (by Auction). Oct. 11.
Southend Water Company (by Auction). Oct. 18.
Tendring Hundred Water Company (by Auction). Oct. 25.

TENDERS FOR

Coal.

Lancaster Gas Department. Tenders by Oct. 13.

Retort-Bench, &c. (Dismantling and Rebuilding), Retorts, Alterations, &c.

Barnsley Gas Company. Tenders by Oct. 11.

Retort-House Governors.

Barnsley Gas Company. Tenders by Oct. 11.

Tar-Towers, &c.

Barnsley Gas Company. Tenders by Oct. 11.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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All Communications, Remittances, &c., to be addressed to Walter King, 11, Bolt Court, Fleet Street, London, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

JOHN W. LEITCH AND COMPANY,
MILNSBRIDGE CHEMICAL WORKS,
near HUDDERSFIELD.
The Manufacture of
PURE BENZOL FOR GAS ENRICHMENT
a speciality.

O. G. C. S.

"**GET THAT ADVERTISING MAN** DOWN," was the remark of a Gas Company's Chairman. It meant much.

J. P. VINALL,
186, Haverstock Hill, London, N.W.
'Phone—3842 P.O. Hampstead.

BROTHERTON & CO., LIMITED. Offices: City Chambers, Leeds. Correspondence invited.

READ HOLLIDAY AND SONS, LTD.,
HUDDERSFIELD,
Are prepared to Supply
BENZOL, TOLUOLE, NAPHTHA, AND CREOSOTE
in large Quantities.

Enquiries Solicited.

AMMONIACAL Liquor wanted. Brotherton and Co., Ltd., Ammonia Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia. Brotherton and Co., Ltd., Chemical Manufacturers, Works: Birmingham, Leeds, Sunderland, and Wakefield.

KRAMERS AND AARTS WATER-GAS PLANT.

K. & A. WATER-GAS COMPANY, LTD.
89, VICTORIA STREET, S.W.

R. & G. HISLOP,
GAS ENGINEERS, RETORT BUILDERS, CONTRACTORS, &c.

RETORT SETTINGS, COAL-TESTING PLANT, BOILER FIRING.

Communications should be addressed to
Underwood House, PAISLEY.

PATENTS AND TRADE MARKS PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "Dacolight London." Telephone: 2886 Holborn.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
Read Holliday and Sons, Ltd., Huddersfield.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

AMMONIACAL Liquor wanted. Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.
Telegrams: "Chemicals."

"**GAZINE" (Registered in England and** Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

SULPHURIC ACID—Specially pre-pared for Sulphate of AMMONIA and BENZOL Recovery Plants. John Nicholson & Sons, Ltd., Hunslet Chemical Works, Leeds. Tele.: "Nicholson, Leeds." Telephone: (Two lines), Nos. 2420 and 2421.

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Aug. 23, p. 548.

M.H. (Methane Hydrogen) **GAS PLANT, LTD.,**
19, Great Winchester Street, LONDON, E.C.

The M.H. GAS PLANT produces at will:—
METHANE HYDROGEN GAS from Coke, Tar, Steam, and either Benzol or Tar enrichment.
BLUE WATER GAS from Coke and Steam.
CARBURETTED WATER GAS from Coke, Steam, and any Crude Oil.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, College Hill, London, E.C., and 25, Bridge End, Leeds.

TAR WANTED.
Telephone: Central Manchester, 7002.
Telegrams: "UPRIGHT."
Apply, THOMAS HORROCKS,
Albert Chemical Works, BRADFORD, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

AMMONIA. Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: Oldbury, Wednesbury, and Stafford.
Address Correspondence and Inquiries to Oldbury, Worcs.
Telegrams: "Chemicals, Oldbury."

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

IT is Worth Your While to Buy Direct from the RELIANCE LUBRICATING OIL COMPANY GUARANTEED ANTI-CORROSIVE LUBRICANTS—viz., Motor Waggon Oil, 1s.; Motor Car Oil, 1s. 6d.; Engine, Cylinder, and Machinery Oils, 1s.; Axle Oil, 10½d.; Exhauster Oil, 10d.; Special Cylinder Oil, 1s. 4d.; 650 T Cylinder, 1s. 9d.; Special Engine Oil, 1s. 4d.; Gas Engine and Oil Engine Oil, 1s. 6d.; Refrigerator, 1s. 9d.; Renown Engine Oil, 11½d.; and Astral Disinfectant, 2s. 6d. per gallon. Barrels free, carriage paid. Solidified Oil, 25s. cwt.
The Reliance Lubricating Oil Company, 19 & 20, Water Lane, Tower St., London, E.C. Agents wanted.

COAL TAR wanted, Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

AMMONIA Waste Liquor Disposal. Purification Plant.
Results Guaranteed. No Working Costs.
John Radcliffe, Chemical Engineer, East Barnet.

CITY and Guilds—Courses in Gas En-gineering and Supply (over 100 Passes and 6 Medals in Two Years), Structural Engineering and Heating and Ventilating (two new subjects) for the 1911 Examinations.
Correspondence College Company, Dept. W. 26, Green Street, Cambridge.

CITY and Guilds—Mr. Cranfield's Cor-respondence Classes in Gas Engineering and Gas Supply are now re-forming. Eleven Years' Experience in Training large numbers of Gas Students. Last Session's Examination results exceptionally good. Assistance ample, individual, and private.
Address, 11, Avondale Place, Halifax.

ASSISTANT-MANAGER

MATLOCK AND DISTRICT GAS COMPANY.

APPLICANTS for above Appointment are THANKED and informed that the POSITION HAS NOW BEEN FILLED.

AUTOMATIC Meters—Young Man, with long Experience in above, desires POSITION with a Provincial or Suburban Gas Concern having a growing Prepayment System.
Address No. 5295, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, for the Winter Months, a good STOKER, used to Shovel Charging.
Apply to the Manager, Gas-Works, Chertsey.

REPRESENTATIVE required to intro-duce and push important article used in all Gas-Works. Must have Good Connections and be Good Salesman.
Please write, stating Qualifications, District, and References, to: "Gas-Works," care of Streets, 30, Cornhill, E.C.

ASSISTANT-MANAGER wanted for South American Gas-Works. Modern Practical Experience in Gas Manufacture and Distribution essential. Three Years' Engagement. Passage free. Salary, £500; free Residence. Single Man preferred.
Apply, by letter, stating Age, whether Married, Qualifications, previous Experience, and whether speaking Portuguese or Spanish, with *copies* only of Testimonials, to No. 5294, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ABERCARN URBAN DISTRICT COUNCIL.

GAS-WORKS MANAGER.

THE above Council invite Applications for the above Position.
The person appointed will be required to Devote his Whole Time to the duties of the Office, and to carry out such duties as shall from time to time be assigned to him.
Full Particulars may be obtained from the undersigned.
Applications must reach the undersigned on or before the 11th of October next.
Canvassing, either directly or indirectly, will be deemed a Disqualification.
Dated the 22nd day of September, 1910.
T. S. Edwards,
Clerk to Abercarn Urban District Council.
24, Stow Hill, Newport, Mon.

FOR SALE—Complete Gas-Making PLANT, including New Gasholder and Steel Tank, 10,000 Cubic Feet capacity, ready for delivery, with Condensers, Scrubber, Purifiers, &c. Erected complete in England for £1200. Detailed Plan and Specification submitted.
TWO PURIFIERS, 12 ft. by 8 ft. by 5 ft. deep. Three Purifiers 5 ft. 6 in. square, complete with Four-Way Valves and Connections. Re-Erected cheap for immediate Sale.
GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.
STORAGE TANK, 18 ft. long, 13 ft. 6 in. wide, 6 ft. deep, of ⅜-inch thick Boiler Plate. Also CAST-IRON TANKS. Inquiries Solicited.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

CORPORATION OF LANCASTER.
(Gas Department.)

TENDERS FOR GAS SLACK.

THE Gas Committee are prepared to receive TENDERS for the Supply of Rough GAS SLACK, to be delivered on the Gas-Works Siding, Lancaster, in such Quantities, and at such times, as may be required during a period of Twelve Months, commencing delivery Jan. 1, 1911.
Sealed Tenders, endorsed "Gas Slack," giving full Particulars of the Slack offered, must be delivered to T. C. Hughes, Esq., Town Clerk, Lancaster, not later than Oct. 13 next.
Any further Information and Forms of Tender may be obtained on Application to the undersigned.
C. Armitage,
Manager.
Gas-Works, Lancaster.

FOR SALE—100 Tangyes Self-Sealing Inclined RETORT MOUTHPIECES, 16¾ in. by 24¾ in.; also 12-inch Milne RETORT-HOUSE GOVERNOR, nearly new.

Address No. 5293, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BARNSLEY GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the following:—

Contract No. 1.—For PULLING DOWN and DISMANTLING existing Bench, Settings, and Furnaces, and RE-BUILDING BENCH containing 5 Through Arches, 5 Settings of Eights (Horizontal), and 5 Through Furnaces on the Regenerator Principle; also ALTERATIONS to SUBWAYS, &c.

Contract No. 2.—New IRONWORK for 5 Through Settings of Eights, 21 in. by 15 in., including RETORT-HOUSE GOVERNORS, TAR TOWERS, and ALTERATIONS to existing Foul Mains, &c.

Specifications and Plans can be inspected at the Gas Office, Pontefract Road, Barnsley, upon payment of £1 in each case, which will, after the Directors have entered into a Contract upon the Tenders received, be returned to the Tenderer, provided he shall have sent in a *bonâ-fide* Tender and shall not have withdrawn the same.

Tenders to be addressed to the Chairman, endorsed "Tender No. 1" or "No. 2," and delivered at the Gas Office not later than Oct. 11 next.

The Directors do not bind themselves to accept the lowest or any Tender.

W. W. Hutchinson,
Secretary and Manager.

Gas Offices, Pontefract Road,
Barnsley, Sept. 28, 1910.

SOUTH BARRACAS (BUENOS AYRES) GAS AND COKE COMPANY, LIMITED.

NOTICE is Hereby Given that the Directors have declared an Interim Dividend at the rate of 4 per cent. per Annum for the Six Months ending June 30, 1910 (free of Income-Tax), payable on and after the 15th inst.

TRANSFER BOOKS WILL BE CLOSED from the 1st to 14th inst. inclusive.

By order,
W. Upton,
Secretary.

1, East India Avenue,
Leadenhall Street, E.C.,
Oct. 1, 1910.

DANISH GAS COMPANY.

NOTICE is Hereby Given, that the FIFTY-SIXTH ANNUAL ORDINARY GENERAL MEETING of this Company will be held at the Offices of the Company's London Agency, Millbank House, Westminster, on Tuesday, the 25th day of October next, at 2.30 p.m., for the following purposes—viz.:

1—To receive the Report of the Directors and the Accounts for the Year ended June 30, 1910.
2—To Declare a Dividend.
3—To elect Auditors for the ensuing Year.
4—To submit to the Shareholders resolutions authorizing the Directors to Purchase and Cancel Ordinary and Preference Shares of the Company as and when they may deem desirable.

By order of the Board,
H. G. Warren,
London Agent.

London Agency: Millbank House,
Westminster, S.W., Sept. 29, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 500 £10 "C" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.

NEW ISSUE OF £3500 "C" CONSOLIDATED STOCK,

AND

£3500 FOUR PER CENT. CONSOLIDATED PREFERENCE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
BARNET DISTRICT GAS AND WATER COMPANY.

NEW ISSUE OF £10,000 "D" CAPITAL WATER STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
GREAT YARMOUTH WATER-WORKS COMPANY.

NEW ISSUE OF £4000 NEW ORDINARY STOCK,

AND

£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 1000 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 18, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Trustees of Chas. King, Esq., decd.
DORKING WATER COMPANY.

80 £10 FIVE PER CENT. "B" PREFERENCE SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 18, at Two o'clock, in Lots.

Particulars of the Auctioneers, as above.

By order of the Directors of the
TENDRING HUNDRED WATER-WORKS COMPANY.

(Supplying Harwich, Parkeston, Dovercourt, Walton-on-Naze, Frinton-on-Sea, and adjacent places.)

NEW ISSUE OF 351 £10 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
GRAYS AND TILBURY GAS COMPANY.

NEW ISSUE OF 400 £10 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
BOGNOR GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £4000 ADDITIONAL ORDINARY CONSOLIDATED STOCK "A"

AND

£2000 FOUR-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

MUNICH INCLINED CHAMBER FURNACES.

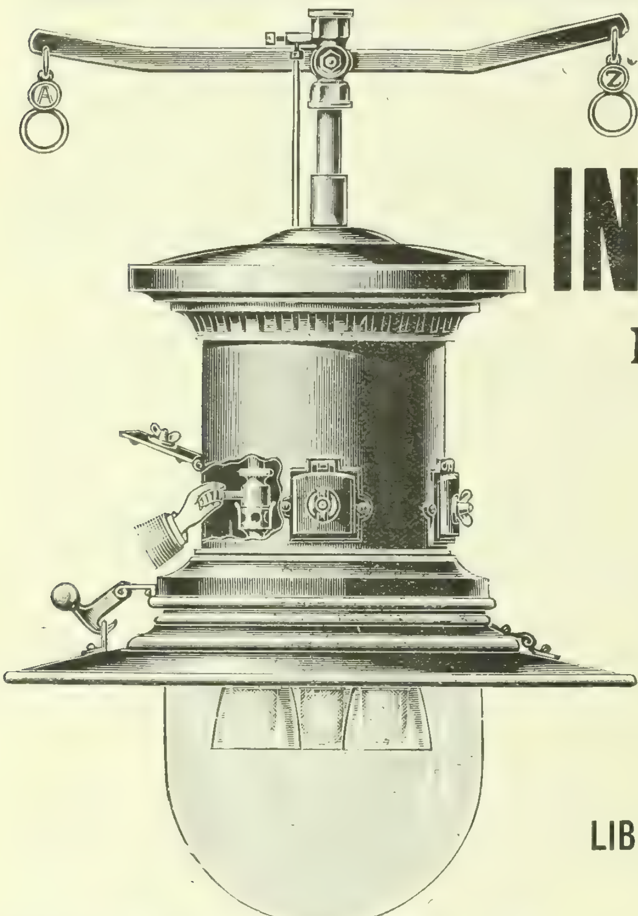
List of Munich Chamber Furnaces in Operation and under Construction:—

TOWNS.	No. of Settings.	Coal capacity per 24 hours.	No. of Chambers.	TOWNS.	No. of Settings.	Coal capacity per 24 hours.	No. of Chambers.
Munich, Kierchstein	5	48·5 Tons	15	Rome	20	350 Tons	60
Munich, Moosach (1st Order)	6	117 ,,	18	Paris, Genevilliers	20	272 ,,	60
Munich ,, (2nd Order)	6	117 ,,	18	Leipsig, Connewitz	8	156 ,,	24
Hamburg, Grassbrook (1st Order)	10	195 ,,	30	Hanau	8	110 ,,	24
Hamburg ,, (2nd Order)	14	310 ,,	42	Regensburg	5	87 ,,	15
Berlin, Tegel	27	526 ,,	81				

For Particulars and Tenders apply to:

THE COKE OVENS AND BY-PRODUCTS CO., LD.,

ST. STEPHENS HOUSE, WESTMINSTER, S.W.



"OVEE"

INVERTED LAMPS

For Ordinary Pressure.

One-Light		- -	19/-
Two	,,	- -	31/6
Three	,,	- -	40/-
Four	,,	- -	51/-
Five	,,	- -	60/-

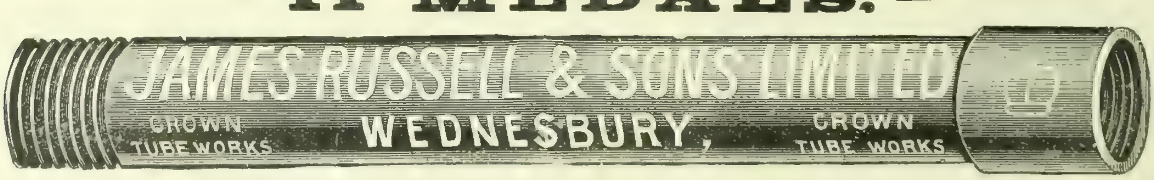
LIBERAL TERMS TO WHOLESALE AND GAS-WORKS.

"OVEE" LIGHT CO., 52, CORPORATION ST., MANCHESTER.

SMOKE ABATEMENT EXHIBITION, GLASGOW.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS

—11 MEDALS.—



MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON:	MANCHESTER:	BIRMINGHAM	LEEDS:
108, Southwark Street.	33, King Street West.	14, Colmore Row.	6, Mark Lane, New Briggate.

GRAETZIN LIGHT.

MOST IMPORTANT!

Latest Development:

600 C.P. LOW PRESSURE LAMP.

1000 C.P. LOW PRESSURE LAMP.

GAS REGULATION on the TOP of the LAMP.

All Goods are unapproachable for economy and durability.

Ask Wholesalers for Catalogue and Prices.

THE GLENBOIG UNION FIRE-CLAY CO., LTD.

GLENBOIG FIRE-BRICKS AND GAS-RETORTS.

Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

TRADE MARKS. J STAR WORKS * GLENBOIG D — GLENBOIG — GARTCOSH — CUMBERNAULD

The Glenboig Trade Marks are imitated, and the Glenboig Name unfairly used by Makers of a lower Class of Goods, which, when sold under their own name, command much lower prices.
The Genuine Brand, Stamped on the Goods, is the only Reliable Guarantee to the Purchaser.

GAS-RETORTS, FIRE-BRICKS, BLOCKS, &c., &c.

The SPECIAL BRICKS used in the Construction of Gas Furnaces for Heating Retorts.

GLENBOIG BRICKS

Works: GLENBOIG, LANARKSHIRE.
Offices: 48, West Regent St., Glasgow.

57 Prize Medals and Diplomas of Honour.

Highest Award wherever exhibited.

The GLENBOIG BRICKS, BLOCKS, AND RETORTS combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, Leadenhall Street,
London, E.C., September 21st, 1909.

Dear Sirs,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·70%
" " " 1050° C.	4·76%
" " Total	8·46%
Volume shrinkage at 100° C.	10·7 %
" " " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. 3362° F.

(SEGER CONE 36.) (New Scale CONE 38.)
(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire ability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Oct. 4, 1910.

THE JOURNAL OF GAS LIGHTING WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXII. No. 2474.] LONDON, OCTOBER 11, 1910. [62ND YEAR. PRICE 6d.

"NICO"
THE
ORIGINAL
ıverted Incandescent
as Burners
Are the ACME of
fficiency, Simplicity,
rability and Economy.

THE "NICO"

PAGE OF SPECIALITIES.

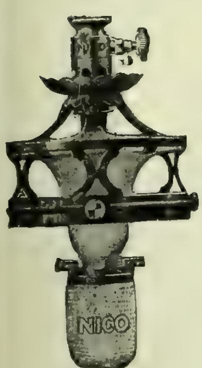
"NICO"
MANTLES
(Inverted and Upright)
ARE
Universally used and recommended as being the **best** for Brilliancy and Lasting Power.

Have you seen the New 'NICO' Catalogue for Season 1910-11?

It is the most complete and comprehensive List of "NICO" Inverted Burners, Mantles (Inverted and Upright), Gas-Fittings, Glassware (Inverted and Upright), and Accessories ever compiled).

Kindly send for a Copy if not already received.

LEADING LINES.



No. 6 Burner.
andard "MEDIUM" Size.

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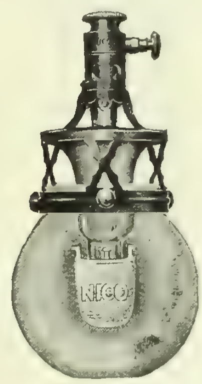

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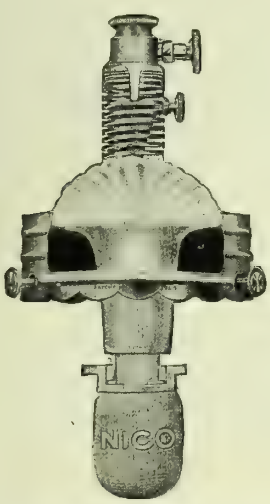

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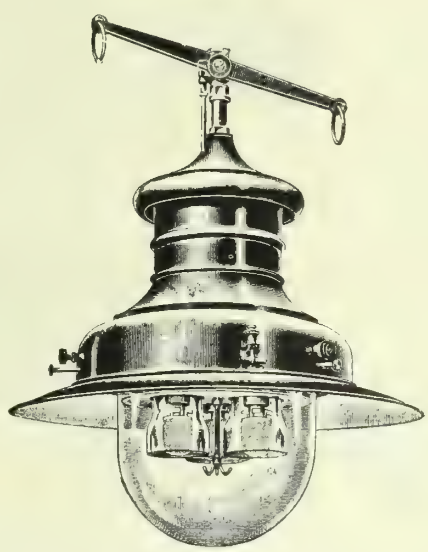

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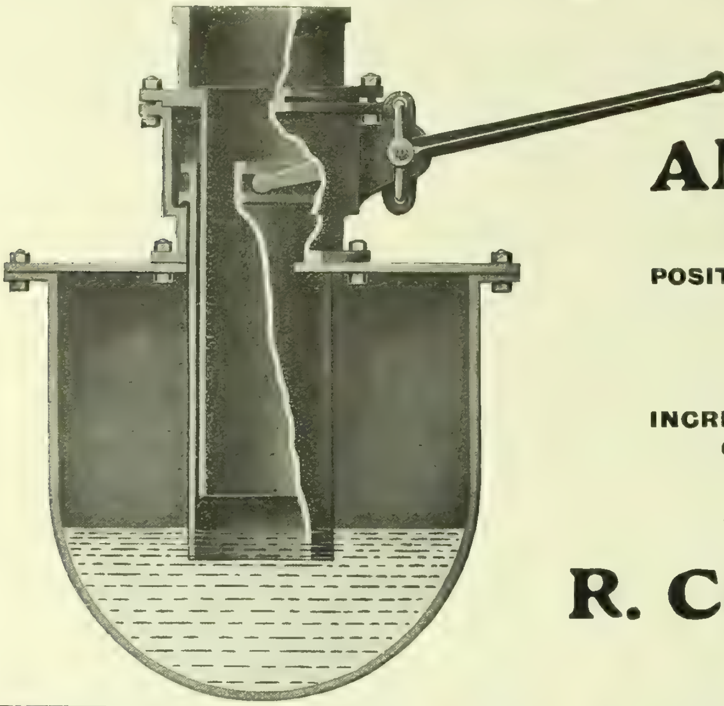

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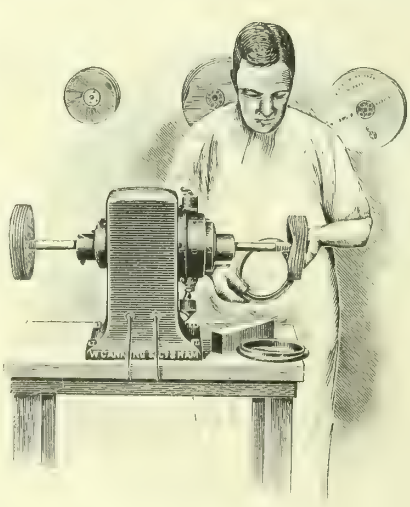

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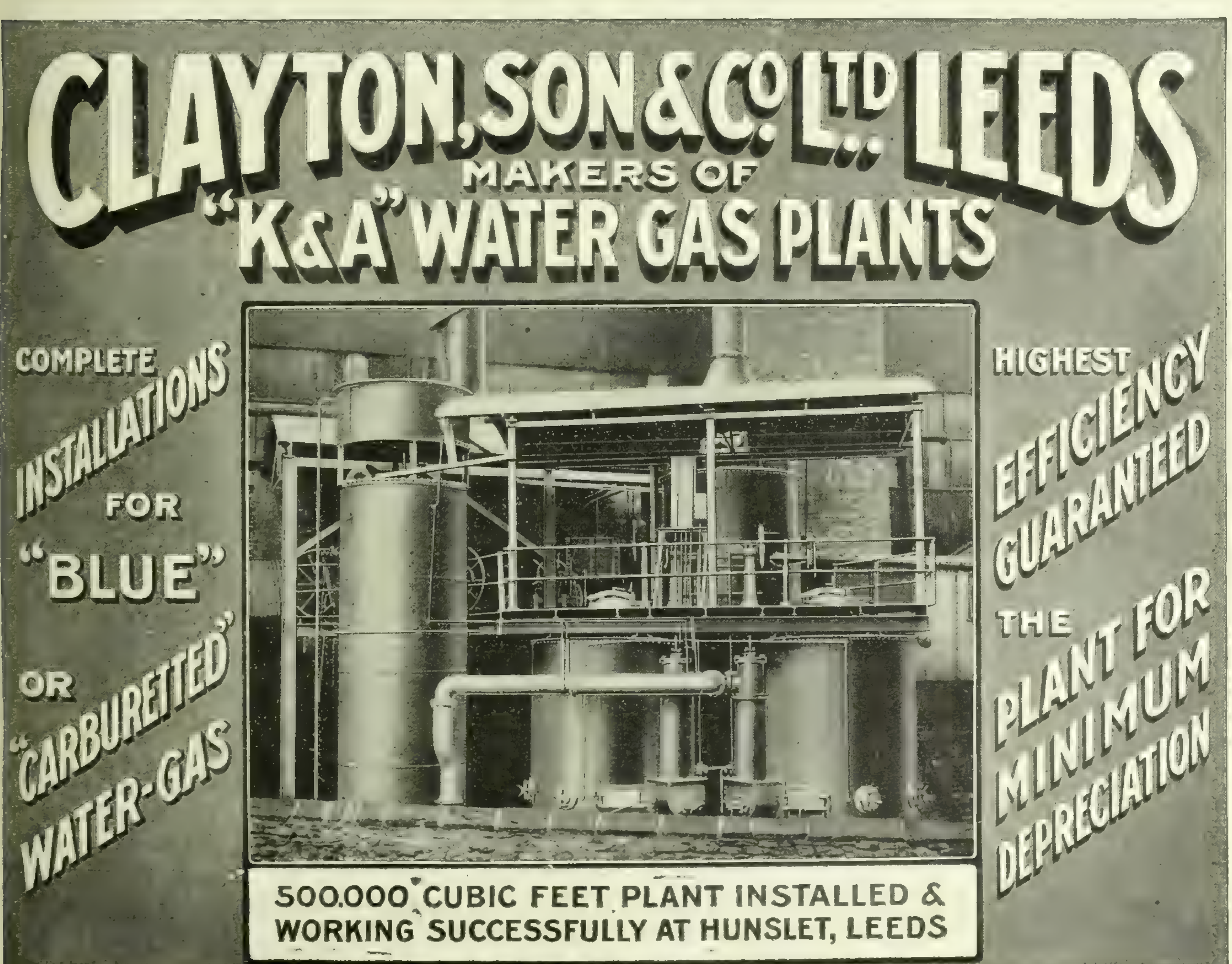

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CONTENTS.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2474.——TUESDAY, OCTOBER 11, 1910.

EDITORIAL NOTES—GAS, &c.

German Friends.

THE past week has been a remarkable one in the annals of the gas professions of two nations, between which nations there are ties that cannot, or rather must not, be violated. The affinities between them are great. One has only to move and live for a short space with such men, representative of all that makes Germany great, as those members of the German Association of Gas and Water Engineers who were last week the guests of the gas profession and industry of this country to learn this, and also to realize that all our aspirations, all our feelings, occupy a common level, and that progress and the well-being of mankind at large are at the apex of the ambitions of both nations. Such receptions, such open and generous welcome—south first, then north—as were experienced last week, do much to efface misconceptions, and to bind together great peoples. Nations after all are only composed of units; and every unit filling the position of gas engineer and manager in a city or town is the centre of considerable influence in the community. Not only nationally, but industrially, cultivation of good friendship in this way does immense good. Technical intercommunication is encouraged. The merest survey of all that makes the world's gas industry what it is to-day must assure every British gas engineer that it would not have been what it is without the inestimable advantages that Germany has given it with liberal hand, and every German gas engineer that it would not have been what it is without the bold engineering conceptions and embodiments and the commercial ardour that have been shown in this country. We cannot, in the cause of progress, do without our German friends, nor they without us; and the closer the friendship, the greater the flow from one to the other of all that is beneficial in the common interest.

The German friends who were able to join in the visit last week had thrown open to them every part of some of the largest of our gas-works; and all serviceable information has been willingly and freely given them. That, too, has been the unvarying experience of the British gas men who have visited Germany to learn of their fellow practitioners there. In the large British works that have been inspected during the past week, the visitors have seen much showing differences of method, but all directed to the one common end of economical production; but though they saw differences in plant and in practices, they found no differences in the warmth of the reception and in the liberality of the hospitality accorded them by the Institution of Gas Engineers, the Gaslight and Coke, the South Metropolitan, and the Croydon Gas Companies, and the Edinburgh and Glasgow Corporations. Had these Companies and Corporations vied with each other for supremacy in the degree of welcome and hospitality, not one could have succeeded better than they did. It was all well done; and the gas profession of Great Britain have the satisfaction of knowing that the friendship that formerly existed in the gas industry of Germany is as the result rooted to-day deeper than it has ever been before. We congratulate the two Presidents—Mr. Alex. Wilson and Herr Direktor H. Prenger—the Reception Committee, hosts, and all who took part great or small in the happy work, upon the unalloyed success of the week. Deserving names are too many to mention; but we know it will not create any invidiousness if we give prominence to three who specially distinguished themselves among the workers—Mr. J. W. Helps, Dr. Rudolf Lessing, and Mr. Walter T. Dunn. Glorious weather, too, prevailed throughout the week. Had it been specially selected, the choice could not have been better.

In other columns we have attempted—the occasion we think deserves it—to place on record a fairly comprehensive account of a unique visit and a unique course (for a single week) of gas-works inspection and pleasure. There we may leave the enjoyable task, with before us the pleasant concluding note of Herr Prenger: "We beg to thank you all "for what we have been shown, and for all the kind attention that has been showered upon us. Be assured we take "back with us the most pleasant recollections; and the "memory of it all will remain with us for many years."

Parliament and the Standard Burner.

IN the instalment of our review of the Gas Acts this week, we have introduced a reference to the Standard Burner Bills, as passed by Committees of both Houses of Parliament, and now awaiting final acceptance at the hands of the House of Commons. It will be seen that there are only four Companies who, from one cause or another, left the ranks of the promoting Companies, and so reduced the number to 43, representing (through the three stations included by the British Gaslight Company) 45 areas of gas supply. But the Bills are standing at this point: They have passed through all the formal stages, and have been submitted to most searching investigation by two Committees; and still discontented with the waste and inconvenience they have occasioned, the opponents have obstructed their third reading, and thus the crowning point of Royal Assent.

In our opinion, the opponents are not gaining anything by their action. When the Bills come up for third reading, what will be the attitude of the House generally in regard to them? They were strongly supported by members of the Government and the Board of Trade on second reading; and having been referred, at the express desire of responsible members of the Government, to the investigation and judgment of a Committee of the House, the Government will support the verdict of the Committee, and therefore the third reading. This is customary; and the gas industry's own legislation affords precedent. When the Worthing Gas Bill was before the House in 1907, subsequent to consideration by a Committee, an attempt was made to eliminate certain land clauses that had been the bone of contention before the Committee. On that occasion [the report will be found in the "JOURNAL" for May 7, 1907] Mr. Emmott, the Chairman of Ways and Means, said "it would be a serious "matter to interfere with Committee work by upsetting a "decision come to after such long and careful inquiry as "had been made into this scheme." He added that "there "was no precedent for a Bill which had been passed by a "Committee being rejected by the House; and he hoped "the House would pause before they created one in this "case." The House did pause; and so the House will do again. It will rest upon the opponents of the Standard Burner Bills to show cause why there is anything to differentiate these measures from all others sufficient to subvert the custom of the House, annul all the work expended upon the Bills, and to create a precedent that the authorities of the House are of opinion would be highly dangerous.

That is one serious difficulty those ranked in hostility have to surmount. Another is the amount of precedent that has been created not only in past sessions, but in the present one, for the application of the "Metropolitan" No. 2 burner in testing. The House has not once been challenged during the session, except on these joint Bills, on the subject of the new standard burner; and yet the House has time and again during the session given their approval to measures containing provision for the use of the burner. Above all things, a legislative assembly in its acts should be logical and consistent; and certainly Parliament would not be one or the other if they now disapproved of the jointly promoted Standard Burner Bills. Excluding all count of Provisional Orders, there are at least eleven gas companies and eight local authorities who, in their separate Acts, have had power conferred on them this session to use the "Metropolitan" No. 2 burner for gas-testing. We may name them. In the case of gas companies, the power has been obtained by Bishop's Stortford, Brighton, Bristol, Dunblane, Exmouth, Farnham, Garnant, Gowerton, Great

Grimsby, Havant, and Wicklow. In local authority Acts, the No. 2 burner has been prescribed in the cases of Egremont, Falkirk, Glasgow, Kirkcaldy, Little Hulton, Mallow, Middlesbrough, and Middleton. Prior to this session, it was specified in something like 100 Acts and Provisional Orders. Why was not opposition to the burner raised in the House on all the measures promoted by the companies and local authorities named above; and why were not the verdicts of Committees challenged in the case of all the contested enactments specifying the burner prior to the present session?

The opponents of the joint Bills are inviting the House to indulge in quick changes of legislative front; and this the House will assuredly decline to do on the grounds that there is no precedent for a Bill passed by a Committee being rejected, that to do such a thing would be a serious matter in connection with Private Bill Committee work, that Parliament and the Board of Trade have created much precedent in the matter of the application of the "Metropolitan" No. 2 burner as a standard, that they cannot now go back upon their acts, that the prescription of the burner is just, and that it is a proper burner with which to obtain uniformity in testing for the illuminating power of gas. To refuse to concede the burner now would be to create greater disuniformity than ever.

Lighting Efficiency at Low Pressures.

Little or nothing is heard in these days about improvements in the vertical type of incandescent burner. Whether there is merely a marking of time in relation to them, or whether we have reached the limit of their susceptibility to advance in point of efficiency, is not a matter we need here stop to discuss. The fact remains that we now hear little or nothing of progress in regard to them; and inverted gas-burners are practically sweeping all before them. They are monopolizing the efforts of those who devote themselves to new gains either of efficiency or of movement to perfection, the public like them, they are economical, and they aid decorative and useful effects. They are retaining street lighting against the fierce attacks of the electricity supply industry with metallic filament lamps; and much to their vexation, the competitors find they can only beat the inverted gas-burner by doing the lighting at unremunerative rates. In recent numbers of the "Journal," there has been indication of the successes of the makers in marking progress in the efficiency, and in other respects, of the inverted burner. Defects have been discovered, and remedied; and much has been done in connection with the design of burners to prevent tarnishing of the fittings to which the burners are attached. Their useful range for service has been much extended; and burners are being constructed so that their regulation can be effected at any time. There are burners now, regarded as quite ordinary ones, by which an efficiency, at district pressures, of about 30 candles per cubic foot of gas consumed can be obtained. But the whole of this increase must not be attributed to the burner itself. The normal pressures in gas distribution systems have been raised; and to this some of the higher efficiency of the inverted burners must be conceded. In these days, in stating efficiencies, the pressures at which the testing was carried out ought to be quoted. However, there is progress all round; and a good thing it has been for the high-pressure system that it has won fresh laurels. Otherwise, under the conditions of to-day with low-pressure burners, there would be no justification for putting in compressing plant merely to gain the old efficiencies that were considered excellent in their day. So considerable has been the advance that we have given up thinking, much less talking or writing, of anything being finite in connection with gas lighting.

Professional Auditors and Certain Views.

Sheffield deserves exemption from congressess and conferences for some years to come. Within the space of about six weeks, the city has welcomed within its borders the British Association, the Trades Union Congress, and lastly the Institute of Chartered Accountants. Sheffield no doubt feels highly honoured that there should have been such a raid upon its hospitality by bodies more or less influential, but all seeking to make progress in one or other direction. At the moment, two or three points in the proceedings of the Institute of Chartered Accountants arrest attention. The President of the year is Mr. William Plender, a member of a firm of City Accountants eminent in the financial world, and associated with a number of companies whose affairs come periodically under review in our columns. The address of Mr. Plender showed him to be a man of broad view on financial matters generally; and in respect of current questions affecting finance, he stood free of any party bondage, and above party consideration, and viewed them one by one from the standpoint of the shrewd and independent financial expert. We sympathize entirely with his opinion that it would be better for the country if the makers of legislation would take greater counsel with the expert before framing new laws—framed now in some cases with an utter disregard of the consequences. The point fits in well with the one made in our article last week on "Legislation and Economy," in regard to the revision of the General Gas Acts. "Legislation," remarks Mr. Plender, "has a tendency to become too "parental, to lessen the scope for individuality, and change "the fundamental laws of competition, which in the past "have been healthy incentives for enterprise and inventive-"ness. Not only has legislation in connection with the gas industry had "a tendency" to become too parental of late, but the tendency has for years been an acute actuality; and not only so, but the conceptions and the ultimate formulations of legislation applied to a competing industry have had a disuniformity that has worked disadvantageously to pre-existing industry. In both respects, the burden has been imposed upon the gas industry—wasting much substance and time—of attempting with more or less success, to obtain rectification, and practical and just conditions. Therefore before there is any revision of general gas legislation, it is to be hoped that the Legislature will see fit to take—will see the wisdom of taking—counsel with those who know well from intimate experience the needs of the industry internally and in relation to the requirements of those it serves. Holding the view that this is the proper course in the interests of wise legislation that shall assist, and not be oppressive to, the economical working of industry, we can freely subscribe to Mr. Plender's view that "changes in legis-"lation require to be carefully inquired into by those whose "training and experience qualify them for the purpose, "and the probable financial and economic effects of legisla-"tion considered and appreciated before a change is made "which is irrevocable."

There is another remark in the address which reminds of recent provisions in gas legislation. The "chartered ac-"countant," observed the President, "follows capital on "behalf of shareholders whose capital has been expended." The professional accountant has a just cause of grievance in connection with the auditing of the accounts of numerous statutory and joint-stock enterprises. On the borders of that particular province, the professional accountant has had operating against him all sorts and conditions of men, some of whom are no more qualified to make a thorough and satisfactory examination of a company's accounts than many men engaged in the humblest of callings. The Acts under which numbers of statutory companies carry on their industry and trading make no provision for the appointment of professional auditors; and the shareholders are left to elect whom they choose. All too frequently they are the nominees of the directors; and oftentimes these are the men who have been most generous in the encomiums used in proposing a vote of thanks to the directors for their services. Influence and favouritism go a long way in securing appointment. Yet many of the men so appointed are neither qualified for auditing by training in connection with the enterprise concerned or by training in the art of accountancy for the positions they occupy; and it is by sheer good luck, or through at the helm a board of directors and a staff above reproach, and not by their own knowledge or skill in accountancy, that they escape a position that would bring upon them the reverse of honour. In a measure, there is some responsibility resting upon directors in countenancing such appointments, though, *de facto* and *de jure*, the appointments are the work of the shareholders. But there is no getting away from the fact that boards of directors can, and do in many cases, influence the selection of auditors. But a change is being made in this matter, through many boards of statutory companies realizing that the open door to incompetency is no certain protection either to shareholders or to themselves. It is found a growing feature, therefore, in the Acts of Parliament of, in some cases even long established, companies that provision is made for the election of auditors who are members of the recognized organizations of professional accountancy; and the provision also, as i

rule, exempts professional auditors appointed from being shareholders, though not objecting to them being so. If they are shareholders, so much the better, though it would be hard to make it compulsory on the professional auditor that he should hold shares in all concerns whose financial affairs it is his duty to check and certify. Such clauses for some sessions now have appeared in Gas Acts; and this applies to the present session. There is one difficulty in the case of gas or other companies who have old-standing auditors, and that is the invidiousness of proposing the change during their tenure of office. This is got over in the Act of one prominent Provincial Gas Company this session, by the provision that only chartered accountants shall be appointed upon the vacating of office by present holders who may not be professional accountants.

But though we write thus favourably regarding the change, it is present in mind as we do so that the names of eminent firms of auditors have been seen upon the prospectuses of certain companies that, from the very outset, have not been above suspicion, and that have eventually proved themselves to be nothing but clever, and often successful, designs for public plunder. Such firms may have lent their names in perfect ignorance of the value and nature of the concern; but we cannot altogether hold them blameless, for their names stand as a sort of guarantee in the eyes of the public, and that is exactly what the promoters of such concerns desire. The eminence and the respectability of the firm of auditors are to them excellent, and yet for the end in view cheaply acquired, tools. It is due both to their reputation and to the public that firms of position in the accountancy world, and indeed all firms whatever their status, should take every precaution to keep themselves aloof from this sort of thing. The whole of their work is covered by the one word "protection;" and the spirit and meaning of that word in its fullest sense should spread through and influence the whole of their professional acts.

A Touching Incident.

In connection with the visit of the German Engineers last week, there was a touching tribute on their part to the memory of Sir George Livesey, who in the German gas profession held the regard and admiration of a considerable number of friends. Tuesday was the second anniversary of the death of Sir George; and early on Wednesday morning the President of the German Association of Gas and Water Engineers (Herr H. Prenger), accompanied by the Vice-President (Herr F. Kordt) and the General Secretary (Dr. Karl Bunte), with the President of the Institution of Gas Engineers (Mr. Alexander Wilson) and the Hon. Secretary (Mr. S. Y. Shoubridge), journeyed to Nunhead Cemetery, and, in the name of the German Association, placed a wreath on the grave of our departed leader and friend. Wreaths were also there from the South Metropolitan and South Suburban Gas Companies

High-Pressure Lighting in Westminster.

Considerable interest has been created by the special article published in the "Journal" for Sept. 27 on the low-pressure inverted-burner lamps in the streets of Westminster. Much inquiry has resulted, and not a few have made journeys to London to inspect what has been done. There has now been a commencement with the high-pressure lighting—Victoria Street being in lighting with twenty-four 1800-candle power lamps. The Institution of Gas Engineers have consequently a good gas lighting exhibition round about their offices—high-pressure inverted lighting in the main street in front, and in certain streets rearward low-pressure lighting.

The Control of Exhibitions.

Interesting and useful as the exhibitions held at the Agricultural Hall, Olympia, Earl's Court, and elsewhere in London and the Provinces are acknowledged to be, those who are compelled, for the purpose of keeping their names before the public, to take part in them are beginning to consider whether they are not becoming far too frequent, and whether they are productive of a sufficient quantity of remunerative business to compensate for the expenditure they entail. Recognition of the advisability of controlling exhibitions was, we believe, one of the causes of the formation of the Society of British Gas Industries; and evidence has lately been afforded that firms engaged in other branches of engineering are impressed with the desirability of following in their footsteps. It is felt that a greater measure of success might easily be secured at exhibitions if the traders immediately concerned had a more distinct voice than they have at present in the general arrangements, especially in regard to the dates for having the displays, instead of these matters being entirely in the hands of private promoters. These views were expressed at a representative gathering of machine tool makers and factors held at Olympia on the closing day of the recent Engineering Exhibition, at which it was unanimously resolved to form a society "for the purpose of dealing with the question of shows and exhibitions;" and a Sub-Committee was appointed to settle details. Temporary offices were secured at No. 22, Henrietta Street, Covent Garden, and Mr. Herbert Page was appointed Hon. Secretary *pro tem.* The Sub-Committee held a meeting early next day; and Mr. Page is now actively engaged in circularizing engineering firms with the object of ascertaining their views as to the advisability of forming the suggested society, and holding a general meeting of members of the tool trade—say at Manchester some time during the forthcoming exhibition in the city. It is felt that only by the co-operation of the whole of the trade can success be secured. The movement concerns a by no means small section of our readers.

Gas v. Electricity at Torquay.

The controversy as to the respective merits of gas and electricity is being carried on with some vigour at Torquay. Stimulated by the advent of a new Engineer, the Corporation Electricity Committee are extending the area in which electricity is used for street lighting, and are generally displaying a more aggressive attitude. On their part, the Gas Company have not been idle. The costliness of public lighting by electricity was commented upon at the recent half-yearly meeting of the Company, and since then a pamphlet has been issued in which the advantages of gas for lighting and heating are described, and attention is drawn to its merits, not only on the ground of efficiency and cheapness, but also from the hygienic point of view. Now the Electricity Committee are to take the field with a reply written by their Engineer, in which it is sought to disprove the statements of the Gas Company. They also propose to open a show-room in the town, and to advertise. As the Chairman of the Committee told the Town Council last week, the electricity undertaking owes something to the newspapers for the free advertisements it gets; and now the newspapers are to receive a little in return in the way of advertisements which are to be paid for. In spite of the great advantage which the electricity undertaking enjoys in the control of the public purse and the public lighting, the Torquay Gas Company have succeeded in more than holding their own in the fight; and they will no doubt be found capable of meeting the new situation which the more active policy of the Corporation has created.

Labour Leaders and their Followers.

Keen interest was manifested in South Wales recently on the question of whether or not the Miners' Federation would prove to have the support of the majority of the members. It will be recalled that in connection with a local dispute the leaders recommended that those thrown out of work should be financially supported from the funds of the Federation and by levy, according to rule; but a section of the members were strongly in favour of all the workmen in the coalfields giving notice to stop work in support of the Cambrian Combine—the collieries where the dispute was in progress. The leaders were thus placed in a difficulty; and, as a way out, they advised the taking of a ballot on the question of which policy should be adopted—*i.e.*, whether the leaders should lead or be led. The voting was duly taken; and the result proved to be a victory for the Executive of the Federation. That is to say, a substantial majority was recorded in favour of the policy of granting financial support to the Cambrian Combine workmen from the funds of the Federation and by levies on the members. The figures were: For a levy, 73,345, and for a stoppage, 42,817; so that the majority in favour of taking the advice of the Executive was a large one. Out of 150,000 members of the Federation, about 116,000 recorded their votes, which means that about 23 per cent. did not express an opinion either way. Though, generally speaking, the public interest in the ballot, of course, centred round the question of whether or not it would result in a strike, the importance of the

outcome as affecting the position of the Executive in regard to the members of the Federation was recognized by those who are specially concerned with organized labour under present-day conditions. For a time, at any rate, matters in this respect will probably go on more smoothly again; but employers must have had their confidence in the ability of the leaders to answer for the members of the Federation severely shaken by recent events. By now everyone is heartily sick of the state of unrest in the coalfields which has done so much for many months past to upset industrial affairs in South Wales; and one would like to be able to say that the outlook was clear once again of serious labour troubles. This, however, is at present impossible. The ballot referred to is against a general strike; but there is still the Cambrian dispute outstanding, and even that is far from being the only cloud on the horizon.

Miners in Conference.

While this undisturbed condition of affairs is causing so much anxiety in South Wales, the Miners' Federation of Great Britain have been holding their annual conference—which took place last week in Edinburgh. Practically every mining district in England and Scotland, we are told, was represented at the gathering; and it was announced from the platform at the opening of the proceedings that the delegates, who numbered 167, were present on behalf of upwards of 600,000 miners. Mr. E. Edwards, M.P., was President; and in the course of his address he dealt with various matters of interest to his hearers. The first thing he advocated was that more care should be exercised in the employment in mining of men who were inexperienced; and he urged that in these days of technical education, money spent in the mining villages on education should be spent in directing the minds of those who were to follow the industry to what were the main features of danger in a mine. Next he referred to the subject of working men inspectors. These, we agree with the President, were questions to which the conference might profitably direct their attention, "because he could not conceive anything more ennobling, any higher function that anybody could fulfil, than seeking to reduce the terrible death-roll, and to save human life." Mr. Thomas Burt, M.P., followed with a remark that "it was almost criminal, in his opinion, where a question could be argued, to appeal to force in the shape of a strike or a lock-out." But, at the same time, he expressed the opinion that strikes were sometimes inevitable, even in these days; and it was a weapon they could not abandon. Why, however, should there ever be a question that could not "be argued?" So long as the Miners' Federation confined themselves to dealing with such problems as those referred to in the President's address, and to furthering by every possible means the level-headed policy of conciliation, there could be no reason on anybody's part to disagree with them. But when it comes to advocating the nationalization of mines, there is not, outside the Federation, likely to be so unanimous a feeling as to the wisdom of the policy of the organization. This is the resolution on the subject which the conference passed without any dissentient voice: "Realizing it is necessary that some very drastic action should be taken, we move that our leaders organize meetings nationally with a view to bringing about the nationalization of the mines, believing it to be the principal means by which the worker can improve his condition."

East Hants Gas Company, Limited.—The prospectus of this Company, the capital of which is £30,000, was issued yesterday. We may possibly have something to say next week in regard to the undertaking; but meanwhile we advise our readers to exercise the strictest caution in investing in it.

Wood-Stave Insulation Joints.—These joints have been substituted for rubber insulations on certain mains of the Metropolitan water system at Boston (Mass.), to reduce electrolytic action. Tests of a 48-inch rubber gasket joint, which had been in service four years, showed considerable electrical leakage, and upon removal was found to be black and hard in spots, with a cinder like appearance as if it had been carbonized. The positive section of the joint contained numerous pittings $\frac{3}{8}$-inch in depth. A wood-stave joint which was substituted for the rubber joint stopped the further flow of electrical currents. These joints, which were used on all new pipe-lines laid during the past year, according to the last annual report of Mr. Dexter Brackett, the Chief Engineer of the Metropolitan Water-Works, were placed at 500-feet intervals. The pipe sections at the joints differ from the ordinary form only in the bell end, which is cast without a lead groove. Pine staves are used. The cost per joint varies from £2 11s. 10d. for a 60-inch pipe to 18s. $1\frac{1}{2}$d. for a 12-inch one.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 152)

The Stock Exchange was last week furnished with a first-class factor to awake it to life and action, in the form of an actual Continental Revolution. The most singular thing about it was the small effect it had on the markets, and the rapidity with which they resumed their normal levels—a welcome evidence of latent strength. So that markets for the most part closed as well as they opened, and in some sensitive lines even better. The tone on Monday was variable. Misgivings over the Rubber Market certainly had a dulling influence within its sphere of influence. But Government issues were firm. Consols rose $\frac{1}{4}$, Railways were bright and advancing, and Americans were a little better. Tuesday being the New Year's Day of the Hebrews, business was decidedly limited; but things were steady mostly, though the protraction of the labour dispute irritated Rails. Wednesday was perturbed by the Portuguese drama—the Foreign Market being naturally the centre of weakness—but soon became more calm. Consols touched $79\frac{15}{16}$; but Rails were firm. Thursday was not at all a bad day, and business was much more active. Consols recovered their set-back; and Rails were cheerful and quite confident of a settlement. The Rubber Market gave better signs. On Friday, the activity of business was well maintained, and the general tone was quite good, in spite of some little Friday realizations. The leading markets for the most part were firm, though the Foreign Market had not quite settled down; and the speculative lines, headed by Rubbers, were cheerful. On Saturday, the tendency was good, aided by the quiet state of things in Lisbon. Consols rose $\frac{1}{8}$. In the Money Market, the supply was fully equal to all demands, and rates, both for short loans and for discount, eased steadily down. Business in the Gas Market was quieter, and more than usually restricted to two or three undertakings. Unmoved by the fall of a dynasty, everything was very firm, and a few moderate advances in quotation were scored. In Gaslight and Coke issues, the ordinary was quite steady, changing hands only within exactly the same range of prices as in the week before—$106\frac{1}{4}$ and 107. In the secured issues, the maximum realized from $87\frac{1}{4}$ to $88\frac{1}{4}$, the preference 105 and $105\frac{1}{2}$ (a rise of 1), and the debenture from $80\frac{5}{8}$ to $81\frac{3}{4}$. South Metropolitan was also unchanged; all transactions being within $121\frac{1}{2}$ and $122\frac{3}{4}$. The debentures marked $80\frac{1}{2}$ and $81\frac{1}{2}$. Nothing at all was recorded in Commercials. Among the Suburban and Provincial group, Alliance and Dublin was done at $89\frac{1}{4}$ (a rise of 1), and Brighton and Hove ordinary at $156\frac{3}{4}$ to 158. This was all that was done in London; but on the Provincial Exchanges, Liverpool "A" changed hands at 221 (a rise of 1), ditto "B" at 163, and Newcastle at 102—a fall of $\frac{1}{2}$. In the Continental companies, Imperial was quiet at from $187\frac{1}{2}$ to $188\frac{1}{2}$, and Union was marked at $98\frac{1}{2}$. Among the undertakings of the remoter world, Buenos Ayres debenture was done at $97\frac{1}{2}$, Monte Video at $12\frac{3}{4}$, Oriental at 139, Primitiva at from $7\frac{1}{4}$ to $7\frac{1}{2}$, ditto preference at from $5\frac{3}{16}$ to $5\frac{11}{32}$, and ditto debenture at $97\frac{1}{2}$ and $98\frac{1}{2}$.

ELECTRICITY SUPPLY MEMORANDA.

A Mistake of the Times—Lost without Undue Cutting—Life of Metallic Filaments—Folly—Stripping Gas to Benefit Electric Lighting—The "Telephone" System of Charging.

There is one egregious mistake the electricians are making at the present time; and it is that they will persist in comparing, in public lighting, the new metallic filament lamps with the old vertical incandescent burner, instead of the newer forms of inverted gas-lamps such as are being used in Westminster and South London, and will soon be in Finsbury, Hackney, Bethnal Green, and Stoke Newington, and probably in other London boroughs. But we hope that even electricians will not be so blind as to continue to live in the bliss that arises from their error, or indifference to actualities. The "Electrician," in their very proper enthusiasm for the electrical cause in the matter of street lighting, have been canvassing electrical engineers for information as to what they are doing in this regard. But they have only published the views of eight borough electrical engineers; and the tale they have to tell is much about the same as a twelvemonth ago. There are two things that particularly strike one about the published responses; and they are that the correspondents are all engineers of electricity undertakings of local authorities who have also control of the street lighting, and that not one of them makes comparison of the metallic filament lamp with the inverted gas-lamp as adapted for street-lighting purposes. We suggest a little more extended inquiry in future. Perhaps then some interesting information will be gathered as to why a difference exists in the matter of the patronage of metallic filament lamps for street lighting purposes by local authorities who own electricity supply and by those who are not influenced by ownership of either the gas or the electricity supply.

Concerning the question of costs, the initial expense of converting gas-lamps to metallic filaments appears to be somewhat high. Mr. George Wilkinson, of Harrogate, speaks of £800 for converting 500 lamps; and we have seen quotations considerably higher than this. It would not cost nearly so much per lamp as these figures indicate for converting from vertical burners to inverted

ones (providing the lanterns were in good order), with a greater resulting efficiency. As to running costs, a significant remark is made in the communication of Mr. H. D. Munro, of Exeter, when he says: "Experience goes to show that a better average light than is obtainable from low-pressure gas mantles can be given by electric metal filament lamps at a cheaper rate, without *unduly cutting* the price of the supply." We take it that Mr. Munro is referring to the upright mantle; and, if so, we are bound to say that his experience does not coincide with our own. But it is the deliberate use of the words "unduly cutting" that is interesting. It shows that there is a cutting of the price; and that the cutting is necessary in order to enable the metallic filament lamps to make any sort of showing as against gas in the public lamps. Therefore, as there is no cutting of price in the case of the private consumers, on the point of economy gas wins hand over hand. About this price-cutting, Mr. Wilkinson, of Harrogate, tells us that the gas-lamps which he is converting (this is an old, old story by the way, and we believe has been published before in the "Electrician") used to cost the Corporation, including everything except labour, cleaning, and lighting, 17s. per lamp per annum, whereas the Electrical Department can supply the Corporation at 11s. 2½d., including lamp renewals and everything excepting cleaning and lighting. Mr. Wilkinson does not say anything about undue cutting of prices; but as we gather the street lamp metallics are supposed to be of 55-candle power, it may be taken that the consumption of energy per hour is 70 watts. The lamps are extinguished at about 12.30. The lighting hours in a year from dusk to 12.30 number 2355; and therefore at least 165 units of electricity per lamp would be required in the time. Assuming the number of hours mentioned represent the average life of the metallic filaments, and that 3s. 9d. only has to be spent on renewals from the 11s. 2½d., this will leave 7s. 5½d. for the electricity, which, on the foregoing figures, equals 0·5d. per unit. This is what has to happen to compete with gas for public lighting; and yet the "Electrician" protests against gas people claiming that gas is, using modern burners, cheaper than electricity for lighting purposes! Now at Harrogate, the Corporation are going to pay 17s. per annum for the metallic filament lamps; and the difference between this sum and the 11s. 2½d. is to be devoted to paying off the cost of conversion. If all the difference is devoted to this purpose, it will take five-and-a-half years to discharge the £1 12s. per lamp, or in the total £800, expended in making the change, not counting anything for interest and depreciation. As to the comparative photometric tests published by Mr. Wilkinson, we may set against them the sale by the Gaslight and Coke Company of illumination in Westminster under penalty for deficiency. The photometrical tests of gas-lamps by central station engineers always show remarkable vagaries. But there we can afford to forgive them, seeing how they have to cut and work in order to show an apparent economical front to their own masters.

The communications in our contemporary also boast about the life of metallic filament lamps; and there is great talk about their "average life." It is necessary to speak of the "average," which seems to generally be placed at something like 2200 hours. In relation to the life of the lamps, the cost has to be remembered. There are electricians who speak of the renewal of a mantle as being something analogous to the renewal of a metallic filament lamp, forgetful that the one to street-lighting authorities costs two or three pence, against as many, or more, shillings in the case of the metallic filament lamp. Mr. Christie, of Brighton, is of opinion that "the average life of the best makes of these lamps is not so good as it might be; and he thinks the high efficiency of a little over 1 watt per candle power might be sacrificed to a small extent with advantage both to the lamp-making industry and to the user if a longer life could be assured." Mr. H. Cameron, of Penarth, states that the average life may be put at between 1500 and 2000 hours; so that there is disagreement as to what the lamps will actually accomplish in the way of an active existence. But Mr. A. Dimmack, of Swindon, shows how erratic is the life record of his lamps, by giving the following table of failures:

Between	0 and 110 hours	27 lamps
,,	100 ,, 200 ,,	23 ,,
,,	200 ,, 500 ,,	61 ,,
,,	500 ,, 1000 ,,	59 ,,
,,	1000 ,, 2000 ,,	76 ,,
,,	2000 ,, 3000 ,,	62 ,,
,,	3000 ,, 5000 ,,	45 ,,

The way that the metallic filament lamp is replacing electric arcs in the street is illustrated by Mr. A. C. Cramb, of Croydon, who states that he has scrapped 255 450-watt and 650-watt alternating enclosed arc lamps; and their place is now occupied by metallic filaments. Even the much-lauded flame arc is making but poor headway what with high-pressure and other high-power gas-lights, and what with people's preference, if they use electricity, for metallic filament lamps. The "Industrial Supplement" of the "Electrician" has brought out, as it has done before, a "special" on flame arcs. We have been through the material in the pages, but cannot find any notable improvement in flame arcs to talk about. Indeed there seems on this occasion to have been some difficulty in filling up the space of the supplement, as no less than five columns are devoted to a "tragedy" in two acts headed "Gushem's Gas Arcs." Gushem is supposed to be a successful draper, but weak on the point of safety of his premises and his employees. With the horrors of Clapham and Accrington so near at hand, and with a proper appreciation of the uses to which columns designed for technical matter should be devoted, one can hardly imagine the editor of an electrical paper permitting such foolery as this being published. But simultaneously with the endeavours of one of the technical papers of the electrical industry to advance interests and business by sportive means, the gas-lamp makers are running their works and men at high speed; while at a gas-works recently, a fitter came in to see whether there was a job going, as he had been discharged, through slackness of work, from the local electricity supply undertaking. Are there many more electric lamp fitters swelling the ranks of the unemployed?

There has frequently been protests in these columns against the unfair treatment of gas by some local authorities who have control of the street lighting. They do their utmost to depreciate, through the public lamps, the value of gas as an illuminant, and to do all they can to make the electric lighting look worth the money; or they operate to save on gas, in order that they may equalize things a bit, owing to the heavy expenditure on electric lighting. A protest from a correspondent has appeared in the "Bristol Times and Mirror" against the poorer lighting than formerly of Bristol streets furnished with gas-lamps. According to him, the local authority have been effecting savings by introducing, a year or two ago, smaller gas mantles, and by abolishing bye-passes. The gas-lamps, he also says, are now lighted half-an-hour later and extinguished half-an-hour earlier than previously. But why this economy in a city like Bristol? The correspondent thinks the Corporation should be emulating the authorities of London by putting in inverted gas-burners on the low-pressure system in the side streets. But (let him have his own say) "instead of this, the great majority of the streets of the city, or, in other words, the 'gas lighted' streets, appear to be starved for light, and every little saving that can be effected by reducing illuminating power, or the foolish practice of very late lighting, &c., that I have referred to, is adopted, to weigh against the abnormal cost of electric lighting in the centre of the city. This is a matter for the working classes, especially on two grounds—that of sensible economy and of comfort." Diminishing the expense of gas lighting to help to pay the abnormal costs of electric lighting may seem clever to the responsible authority, but it is not politic.

It will have been noticed in the reference last week to the alteration of the tariff of the Metropolitan Electric Supply Company that it has been decided by them to, in addition to the higher flat-rate, adopt the "telephone" system of charging. But contrary to the practice of Marylebone, the Company have resolved to charge, beyond the fixed rate per quarter, 2d. per unit for a specified number of units in the quarter, and 1d. per unit for consumption in excess, instead of a level 1d. for all units. In a comment on the subject, the "Electrician" rather thinks that, if there is to be modification of the "telephone" system of charging [to talk of modification suggests that householders are not falling over each other in their eagerness to come under the system], it would be better to abandon the fixed quarterly charge, and merely to charge a predetermined number of units per quarter at a higher figure—say, 6d. per unit; all units in excess being at 1d. The tariff struggles of the electricity industry have afforded much diversion to onlookers, and to the central station managers much perplexity; and apparently the end is not yet. Defending the St. Marylebone system, Mr. A. Hugh Seabrook has written to our contemporary to say that the difficulty of its proposal "would be (as was found in the maximum demand system of 8d. and 1d.) that the consumer does not know when he is getting off the 6d. units and on to the 1d. ones. Practically no consumers ever read their meters, although we endeavour to get them to do so. When the consumer has paid his annual or quarterly charge under the 'telephone' system, he then knows that the whole of his units supplied are at 1d. each." So there is disagreement between Mr. Seabrook and our contemporary. The latter, however, stick to their point. They do not see that "the consumer would have any difficulty in appreciating a tariff in which a predetermined number of units were charged at a higher price. If, for example, the first 30 units in a quarter were charged at 6d., the consumer would know that he would have to pay 15s. before getting on to the penny rate. It might, of course, be a stipulation that the consumer would have to pay for this number of units in any case as a minimum, though it is doubted if this would be the wisest course to adopt. It will be seen that the payment of a predetermined number of units in this way is much the same as the 'telephone' tariff, only the consumer pays when he has had the units, instead of paying to a large extent in advance."

Illuminating Engineering Society.—The date provisionally fixed for the opening meeting of this Society for the coming session is Tuesday, the 8th prox.; and it is expected that the first two papers to be taken will be on "The Present Status of Gas Lighting," by Mr. F. W. Goodenough, and on "Recent Progress in Electric Lighting," by Professor E. W. Marchant.

More Gas Publicity.—In the "JOURNAL" last week, attention was called to a very effective page advertisement by the Gaslight and Coke Company in the first Woman's Supplement to "The Times." The second number, issued last Saturday, contains another, equally good, illustrating and emphasizing in a few appropriate sentences the convenience of gas for the lighting and warming of billiard-rooms.

GAS AT THE MEDICAL EXHIBITION.

There was held last week at the Horticultural Hall, Vincent Square, Westminster, the sixth of the series of London Medical Exhibitions organized by the "British and Colonial Druggist"—a fixture which, by reason of the number of doctors who attend, forms an eminently suitable occasion for urging the claims of gas to attention on just those grounds which are likely to appeal to the profession. It is customary at these exhibitions to find the Gaslight and Coke Company in possession of a stand; and it was pleasing to note this year proved no exception to the rule. Conveniently placed (with plenty of wall space above, on which was a handsome banner setting forth the favourable opinions regarding gas which are so extensively held among medical men), the Company's stall contained a very attractive selection of gas-fittings, with switches for lighting and extinguishing purposes. There was also a counterbalanced medical and dental bracket, with upright incandescent burner. In the heating department, a Wright "Druid" stove was shown, in armour bright finish; and a Richmond "Bavarian," in green enamel, with a boiling-burner on top. There was an "Avon" water-heater; and a nice little model of a Wright gas-steam radiator. In the way of smaller goods was noticed the "Q.B.K." quick boiling-kettle, which is fitted with an iron jacket, to keep the bottom off the stove and so cause all the heat to circulate round the body. By this means it is claimed that a kettle boils in one-third less time than under the ordinary plan, lasts twice as long, and retains the heat for a considerably greater time. The principle can also be adapted to saucepans. In other directions, too, gas was well represented in the exhibition; for, in addition to the Gaslight and Coke Company's stand, there were three other stalls immediately connected with the industry. The Telephos Company demonstrated their well-known system of switches for gas lighting and extinguishing at one excellently appointed stand; while next to them there was an imposing display by the Clark's Syphon Gas-Stove Company, Limited, whose new season's patterns of heating apparatus were noticed in the "Journal" on the 27th ult. (p. 839). In addition to these, there was a stall on which Messrs. James Stott and Co. displayed their patent gas-governors for burners, cookers, and fires. Altogether, therefore, the gas portion was by no means the least prominent in a representative exhibition of goods likely to be of interest to the medical profession.

GAS ACTS FOR 1910.

[Third Article.]

Continuing our notice of the measures promoted this session by statutory gas companies, we have next before us the Standard Burner Bills, as amended in Committee. On the title page, they are described as Acts; but they yet await third reading and Royal Assent. From the first schedule of No. 1 Bill, the Brentford and Wandsworth Gas Companies have dropped out; and from the first schedule of No. 3 Bill, the Gloucester and Newport (Mon.) Companies. Therefore the promoters now number 43, instead of 47; and the number of districts referred to (the British Company dealing with three of their stations) is 45, instead of 49. The names of the promoting Companies now stand as follows:

No. 1 Bill: Croydon, Hastings and St. Leonards, Ilford, Liverpool, Maidenhead, Scarborough, Swansea, and Torquay.

No. 2 Bill: Berkhampstead, Bournemouth, British (Potteries, Trowbridge, and Holywell stations), Cambridge, Chigwell, Loughton and Woodford, Faversham, Harrow and Stanmore, Hatfield, Hemel Hempsted, Herne Bay, Newmarket, Ormskirk, Prescot, Radcliffe and Pilkington, Reading, Shrewsbury, Tunbridge Wells, Waltham Abbey and Cheshunt, West Kent, and Worthing.

No. 3 Bill: Aberdare and Aberaman, Bath, Exeter, Godalming, Guildford, Hampton Court, Ipswich, Mid-Kent, Plymouth and Stonehouse, Richmond, Romford, Southampton, Walton-on-Thames, Weston-super-Mare, and Wolverhampton.

It is proposed that the Acts shall come into operation on Jan. 1 next; and that, from that date, the "Metropolitan" No. 2 burner shall supersede the present test-burners of the promoters. The conditions and method of testing are defined by each Bill. The only change in the terms of No. 1 Bill is the addition of a clause providing that "the testing-place of the Liverpool United Gaslight Company at their works at Linacre shall be a prescribed testing-place for the purposes of the Gas-Works Clauses Act, 1871." And in No. 3 Bill, there appears this new clause: "Nothing in this Act contained shall, unless otherwise agreed between the Mayor, Aldermen, and Burgesses of the Borough of Richmond, Surrey, and the Richmond Gas Company, apply to or affect the Borough of Richmond in the County of Surrey." [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The Great Grimsby Gas Company by their Act have secured the extension of the limits of supply so as to embrace Ulceby, North Killingholme and South Killingholme, and Aylesby, Habrough, Healing, Immingham, and Stallingborough. In the new limits a sum of 6d. in excess of the ordinary price of gas may be charged; but this is not to be taken into account in calculating the dividends. The additional capital powers granted are to the extent of £120,000, of which not more than £40,000 may be raised by way of preference shares. The new auction clauses apply to the issue of this capital. Borrowing powers to the extent of one-third are, as usual, allowed. Provisions as to reserve and special purposes funds are included in the Act. Lands are scheduled for use for gas and other storage purposes. The standard illuminating power of the gas is to be 14 candles, tested by the "Metropolitan" No. 2 burner. In provisions relating to the Directors, it is observed that "the continuing Directors may act notwithstanding any vacancy in their body, but so that if at any time the number of the Directors of the Company holding office shall be less than five, the Directors shall not, except for the purpose of filling vacancies and allotting shares to any proposed director or directors, act so long as the number is below such minimum." The appointment of a Managing-Director is provided for; and the Directors are given authority for fixing the remuneration of the Secretary. Any future auditors of the Company are to have professional status as such. Protection is given to various local authorities and companies. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Shirebrook and District Gas Company have obtained the desired extension of their area of supply. Now it includes the parishes of Cuckney and Norton, the remainder of the parish of Warsop not included in the area of supply of the Company as defined by their Act of 1899, and specified parts of Bolsover. The provisions of the Mansfield Gas Act of 1878, and of the Mansfield Corporation Act of 1901, so far as they relate to the part of Warsop now annexed by the Shirebrook Company, are repealed. The Warsop District Council are invested with the right, at any time after the expiration of twelve years from Dec. 31 next, of purchasing, with the consent of Parliament or the Local Government Board, and by giving six months' notice, the portion of the Company's undertaking in their area. The provisions of the Bolsover Gas Order, so far as they relate to the parts of the parish of Bolsover included in this Act, are also abrogated. The Act is heavily padded with clauses for the protection of railway companies and local bodies. By the Act the Duke of Portland also retains his right to construct gas-works or electricity generating stations in the parishes of Cuckney and Norton, but a condition is that, in the event of his Grace undertaking such supply, he will first purchase the portion of the Company's concern in the district in question, but the agreed or arbitration price is "not to include any consideration for loss by severance, or any consequential loss." Then the Duke has also arranged that the price to be charged by the Company for gas supplied and for gas meters and other fittings within either of the parishes is not at any time to exceed the lowest current rate for the time being charged in any other place situated within the limits of supply of the Company. [*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, and Co.*]

We may also commence to-day the review of the Acts of local authorities dealing wholly or in part with gas supply. Two of the measures originally noticed have gone—that of the Bishop's Stortford Council, and that of the Hoyland Nether District Council; the first having been sacrificed by the Council themselves, and the second rejected by the ratepayers.

The Bradford Corporation Act confirms the agreement entered into between the Corporation and the Trustees under the will of the late Sir Henry W. Ripley for the purchase of the private gas-works belonging to the estate. But the Corporation are not, unless authorized by Parliament so to do, to manufacture gas on any lands vested in them under the agreement. The arranged purchase price is £15,000; and power to borrow this sum is granted among the other money powers included in the present Act. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Act of the Egremont District Council confers upon them powers for the transfer of the undertaking of the Egremont Gas Company and of gas-pipes (in the prescribed area) of the Cleator Moor District Council and Whitehaven Rural Council. Agreements for the various purchases are scheduled. The first shows that the consideration for the sale of the Egremont Gas Company's undertaking is £6500, and such sum as shall be agreed upon, or, in default of agreement, fixed by arbitration, as the price of the coal, coke, gas, lime, and residuals. The price to be paid to the Cleator Moor Council is £579 10s. 7d.; but the transaction with the Whitehaven Council only involves the sum of £10. The power of the Cleator Moor Council to supply gas within the Council's limits is repealed. Protective clauses are given in the case of the Wyndham Mining Company, Limited, and their co-owners, and to the London and North-Western and Furness Railway Companies. Power is also included to construct a new road and to stop up another; and compulsory purchase authorization for land is also accorded. The prepayment meter clause appears in the ordinary form. The limit prescribed for the price of gas is 5s. 6d. per 1000 cubic feet. The old 10 and 15 per cent. discounts clause appears. The prescribed standard of illuminating power is 14 candles, tested by the "Metropolitan" No. 2 burner. Power to borrow the sums necessary for the purchase of the concern and land is granted; as well as £8057 for new works, and £500 for cookers, engines, stoves, and meters. The repayment term allowed for loans for works purchase and new works is thirty years, for the money required for land forty years, and for that to be spent on cookers, engines, stoves, and meters ten years. [*Parliamentary Agents: Messrs. Hargreaves and Crowthers.*]

THE VISIT OF THE GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

[Brief Descriptions of the Works Inspected Appear on pp. 117-122.]

REVIEW OF THE WEEK'S PROCEEDINGS.

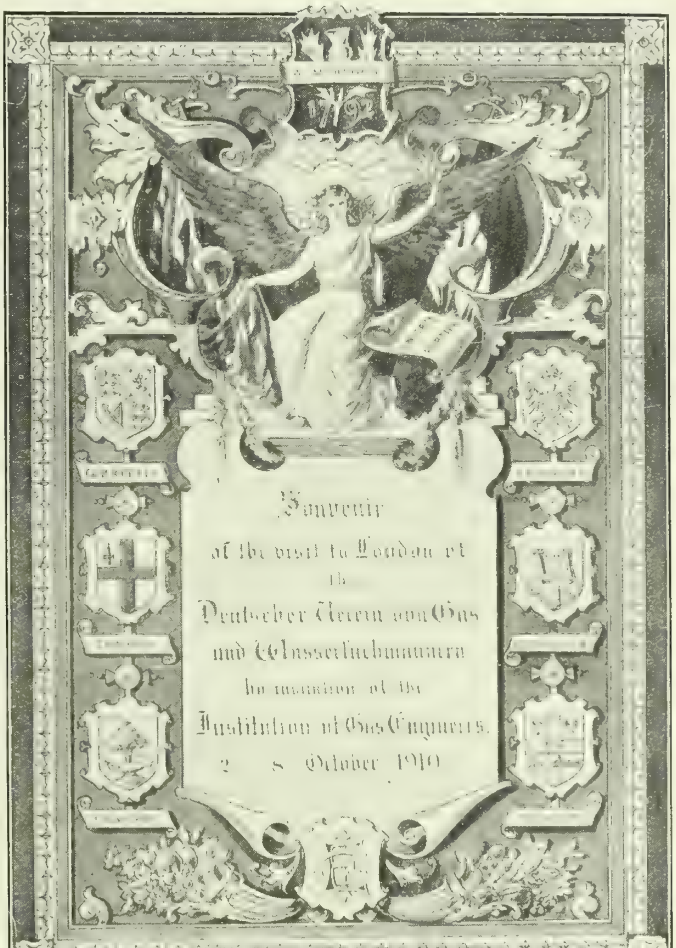
The visit of the German guests of the gas profession and of the gas industry of Great Britain has ended; and they have left our shores with their friendship intensified and the ties of a common interest strengthened. They came to learn; and they have not been disappointed. They came expecting a cordial welcome; and it has been such that they have left us feeling a oneness with the British gas profession and interest that memory will not allow to be obliterated. Their coming was referred to in last week's issue; and the names of the guests, from the President of the German Association (Herr H. Prenger), the Vice-President (Herr F. Kordt), and the General Secretary (Dr. K. Bunte), through the alphabetical list of representatives of ordinary members, were also then recorded, though four of those named were unfortunately in the result unable to make the journey.

As the mind is cast over the doings of the week, the programme was so full, the events so numerous, that the circumstances of the six days present a mass of matter to be recorded that is almost bewildering; and the task of even lightly sketching it all—with a due sense of its worthiness, both in view of the occasion, and of the thorough manner in which those who took the prominent part of hosts spared neither pains nor expense to perform the honours in royal and loyal way—seems almost an impossible one But the attempt has to be made; and any deficiency must be attributed to the whirl of the week's doings. The first half was spent in London; the greater portion of the second half in Scotland.

AT THE BECKTON, KENSAL GREEN, AND FULHAM GAS-WORKS.

Monday morning broke in a manner that gave fine promise for the week. The weather prophets had been in pessimistic mood; and their predictions of bad weather seemed likely to be verified when the rain storms and succeeding slowly moving clouds of Sunday evening were watched as something unpleasantly ominous. But Monday morning changed this; and as the visitors, with the President of the Institution of Gas Engineers (Mr. Alexander Wilson), the ex-President (Mr. James W. Helps), one of the Vice-Presidents (Mr. R. G. Shadbolt), the Honorary Secretary (Mr. S. Y. Shoubridge), and several other members of the Reception Committee (see p. 19 of the "Journal" last week), were boarding the thirty or so motor-cars that had been chartered for easy locomotion, the sun was shining generously, and the spirit of cheerfulness abounded. The Secretary (Mr. Walter T. Dunn), who seemed to be wanted by everybody, and had details and answers for all in readiness at the tip of his tongue, at last succeeded in getting all comfortably seated to commence the prepared programme. The Gaslight and Coke Company were properly the hosts of the daylight hours of the first day; and Beckton was the first objective. The party were soon whisking past the Abbey, the Houses of Parliament, along the Thames Embankment, through the busy City streets, and then (it was a sort of transformation scene for the visitors) into the depths of East-end life, through Commercial Road East, Limehouse, Poplar, past the great docks, catching a glimpse of the Stepney works of the Commercial Gas Company, and then along the Barking Road, through Canning Town, till at length the Beckton Road was reached, and beyond the extensive wastes of flat low-lying land were seen the numerous shafts of the great chemical and gas bye-products works of the Gaslight and Coke Company, and hard by them the works which, for magnitude, occupy the premier position among the gas-works of the world. The visitors passed first into the tar and ammonia works; and there they were met by Mr. T. Wilton, the Manager. But among the first cars came others, containing the Governor of the Company, Mr. Corbet Woodall (whose name is as a household word among Continental engineers), colleagues of his on the Board, and the chief officials. In the crowd were noticed the General Manager (Mr. D. Milne Watson), the Chief Engineer (Mr. Thomas Goulden), the Secretary (Mr. Henry Rayner), and the Engineer and Manager of the Beckton station (Mr. J. N. Reeson). There were also the Engineer of the Distribution Department (Mr. H. S. Reeson), the Controller of Gas Sales (Mr. F. W. Goodenough), and—well, there must be some limit to the naming even of all those whose sole duty on earth for the time being appeared to be to interest, instruct in practices, and entertain those who had travelled to this country for these very purposes.

Placed on view were many noble-looking samples of the products of the far-famed works, the plant and processes of which were next to be examined. The manufactures here are much too numerous for mention; and the plant by which the tar, ammonia, and cyanogen products are made, too extensive for description. The visitors were aided greatly in their inspection by the excellent "Handbook" on the works to be visited, prepared (at the request and at the expense of the Reception Committee) by Dr. Rudolf Lessing, and in constant evidence during the week. The visitors glanced at the pitch-beds with an aggregate capacity of 30,000 tons, at the stills for the distillation of 18 million gallons of tar annually, storage tanks for many purposes were pointed out, and anthracene, naphtha, and light oil plant was viewed. The buildings in which the distillation of benzol, toluol, and naphtha (about 120,000 gallons a year) is carried on were next inspected, as was the one where the manufacture of napthalene in various forms is conducted, to the extent of about 2000 tons annually. The plant for the manufacture of anthracene and anhydrous ammonia was examined, as were also the stills for the distillation of carbolic acid with a capacity of 2000 tons annually. Some 41 steam-boilers came under notice, as well as the ammonia stills and saturators capable of manufacturing 24,000 tons of 25 per cent. sulphate of ammonia annually. The sulphuric acid plant was inspected; and the men's dining-hall claimed interest.



From the Front of the Cover of the Souvenir, Designed by Mr. F. D. Marshall.

All were pleased. Such an extent of tar and ammonia products works impressed the visitors with the magnitude of the Company's operations; and among those who had known these and the Beckton works in days under a different *régime*, there was expressed a view, well put by one of the visitors, that in years past the place and plant looked as though they were begging for an owner, but now they look like someone's property. The statement may seem a little overdrawn; but it is expressive of the policy of proper upkeep and order that rules in the works of the Company to-day. While going round the works, it was learned that among the company present was Mr. Clarke, the Vice-President of the Brisbane Gas Company. And it was also seen (as proved to be the case) that the visitors would during the week be under an obligation to Dr. Lessing, Dr. H. G. Colman, Mr. A. F. P. Haymann, and Mr. H. F. Andressen, for their work as interpreters throughout the visit. By this time several additional visitors representing London gas supply had joined the party—specially welcomed were the South Metropolitan Gas Company's Chief Engineer (Mr. W. Doig Gibb) and the Secretary (Mr. F. M'Leod).

Once more the motor-cars were mounted, and a few minutes' run brought the visitors to the low-level line on the Beckton Gas-Works. Mr. Reeson and his Deputy (Mr. A. H. Solomon) shared with the Governor the honour of showing the members the plant

for conducting the vast operations of these works. Time would not permit of a perambulation through Beckton on foot; hours upon hours, and not minutes, being required for any such proceeding. But prevision had thoughtfully arranged for trucks, with seats and handrails, to draw the visitors from the low-level railway to the high-level line which runs, horseshoe fashion, from pier to pier, passing *en route* through the several retort-houses, which have to be numbered for convenience in locating them and giving them some sort of a designation. There is not going to be any attempt at description of the works here. Beckton cannot be described in few words; and such brief outline description as appears elsewhere is nothing more than a hasty view from the distance. The trucks were mounted at the entrance to the works; and there, on a large tablet attached to the office, something was learned of the origin of the works which may not have been known before by some who saw it. It was seen by them that Mr. F. J. Evans was the first Engineer; and that he laid the foundations of this huge creation of works for gas manufacture. The party were soon on their way up the incline leading to No. 2 pier; and the operation of unloading coal by means of hydraulic cranes and grabs was inspected. It was remarked that nothing in a small way is done here; it is all bulk work. Travelling upon the high-level line, a view was obtained of all sorts of plant—storing, pumping, and condensing; and then on the overhead line the visitors were taken through retort-house after retort-house, some at work, some not, and one under complete internal reconstruction. From the height the party looked curiously at the forest of ascension and arch pipes that met their view as they entered one house after another. They also looked curiously at the sight on the working stages. In one of the houses (No. 5), which contains some 300 retorts, the train stopped with its living burden; and the "burden" watched the operations of West's compressed air pusher and scoop. On went the visitors, making a call at No. 1 pier, and seeing some other parts of the buildings and plant *en route*. Then the tour through the upper part of the retort-houses was resumed. No. 12 house was seen to be in process of reconstruction—to contain, when finished, 44 settings of tens. Here the visitors were invited to descend and examine the constructional work—an opportunity of which they availed themselves with alacrity. They were soon inside as well as outside the settings, and took very keen interest in thus being able to examine the work as in the hands of British retort-setters. Altogether, they had seen houses capable of producing 58 million cubic feet of gas per day. Several other parts of the plant were inspected, from the distance, on again mounting the "train." But descent was made to specially visit the carburetted water-gas plant, which is capable of producing 14 million cubic feet per day. The visitors saw the first sets of such plant that were constructed on the return of Mr. Corbet Woodall and the late Mr. G. C. Trewby from their memorable visit to America to investigate the system. These were the first sets erected in this country; and in this same house they have been extended by additional sets to the aggregate capacity mentioned. But the Governor pointed out that Mr. Goulden is going to carry out some extensions there from one end of the house, by putting in (he was understood to say) three new double sets and a large additional boiler power. Then he will work backwards, and the original sets will be replaced. The party got back to the entrance of the works, where there was a review of some 32 locomotives, and the horses attached to the works. The visitors admired the display, and remarked upon the excellent condition of the locomotives and the horses, as well as upon the pride the men obviously took in their charges.

A Luncheon.

Here we were at "Blackleg Square." This is the original name of the barrack-like buildings that were put up by the Company in those turbulent times in the eighties. Fortunately, they were not required; and ever since then the places have been put to use that savours more of peace than of war. In one of these buildings lunch was to be served; but before this was done, the visitors made a raid on the lavatories, for the purpose of restoring the natural aspects of their faces. High-level railways through live retort-houses, where dust and smoke prevail, while all right for trucks containing coal, are not the most suitable places for a number of gentlemen arrayed in faultless attire. But everyone took it as an inseparable part of the day's outing; and soon normal aspects were restored, and some of the party were spending the few minutes' interval in making use of the Beckton Territorial rifle-range—competing against the Honorary Colonel (the Governor of the Company); the works band the while playing the National Anthem of Germany. They were highly complimented on their performances during luncheon and after.

The interior of the building in which the visitors were entertained was gaily decorated for the occasion—the German and British flags being mingled together in a fashion signifying close and friendly relations. At the back of the Governor's chair, too, were photographs of King George and the Emperor of Germany. To the right and left sides of the Governor sat Herr Prenger and Mr. Alexander Wilson—the two Presidents.

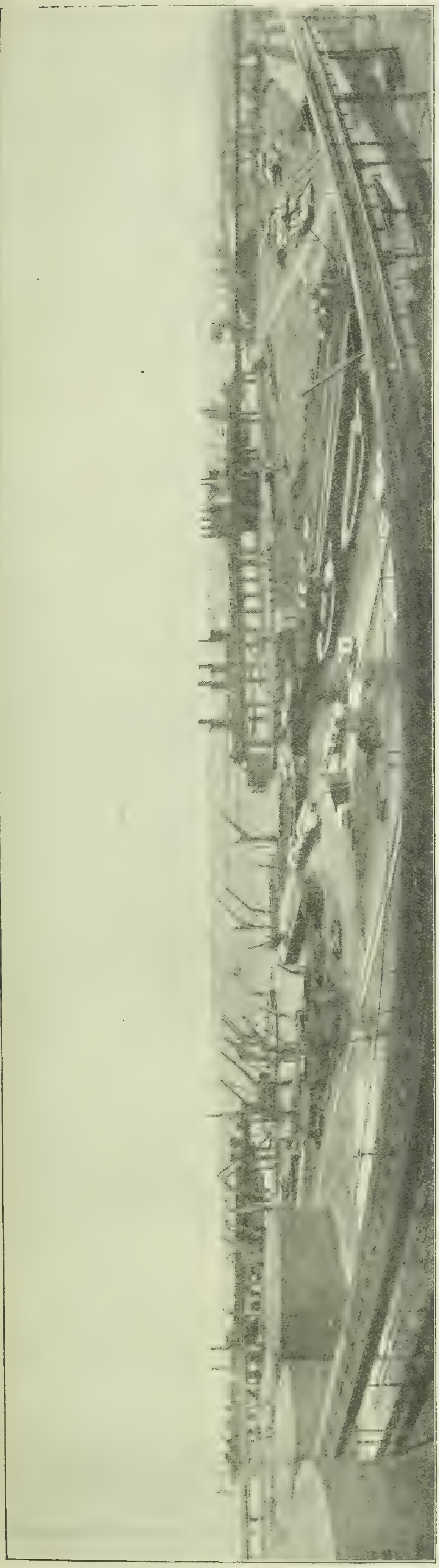
The luncheon was excellent; and after the long morning's outing, it was vastly enjoyed. Subsequently, the assembled company settled down to the exchange of a few complimentary speeches and toasts.

Speeches at the Luncheon.

The Governor said that one or two toasts must be drunk before separating. This gathering was to have been held earlier in the year,

A GENERAL VIEW FROM THE RIVER OF THE BECKTON WORKS OF THE GASLIGHT AND COKE COMPANY.

[Photographed by Mr. J. N. Reeson, Engineer of the Station.



THE PIERS AND HIGH-LEVEL RAILWAY AT THE BECKTON WORKS.

but was postponed by reason of the death of our late King Edward, of honoured memory. None of those present would forget the kind and gracious words in which their friend Professor Bunte wrote and expressed his sympathy, and that of the German Association of Gas and Water Engineers, with the British nation and the members of the gas profession in their loss, at the same time offering to postpone the visit. This incident was one of those things they, as British subjects, would remember a long time. But "The King is dead; live the King." He asked them to drink to the health, long life, and prosperity of George the Fifth, the nation's present gracious King.

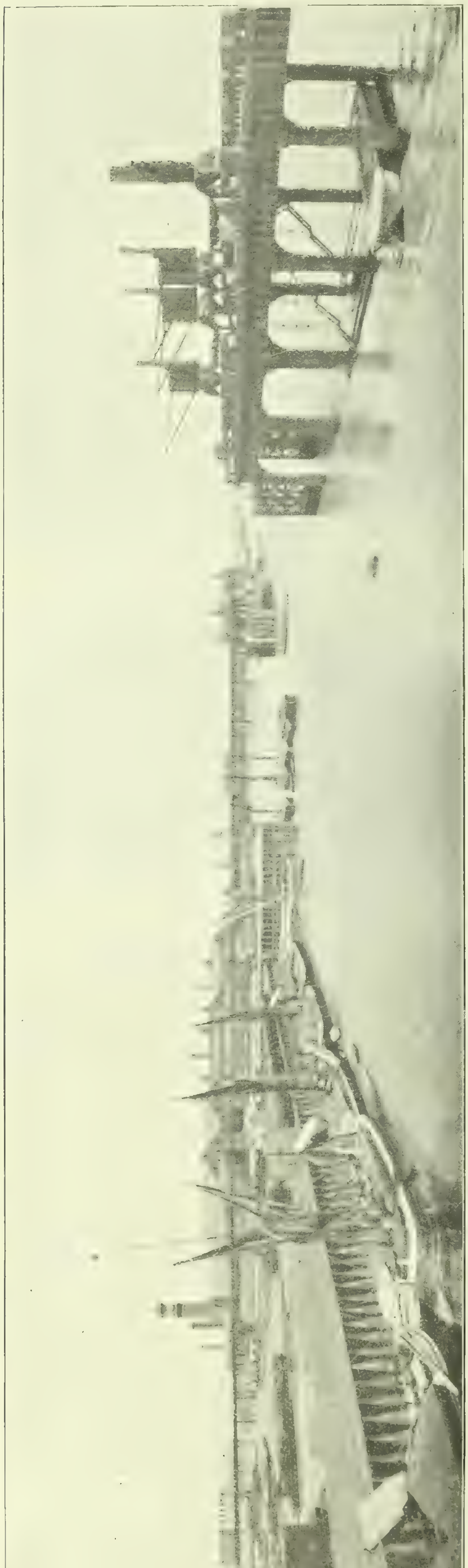
Most heartily was the toast honoured, and the National Anthem sung.

The GOVERNOR said he had next to ask those present to drink to the health of the German Emperor. It was, he remarked, difficult for them nowadays to realize that the mighty empire over which he reigned had no existence within the lives of most of those there assembled; that it was a creation of but yesterday. Even the Kingdom of Prussia they regarded, from the standpoint of their British Royal institution, as a modern creation. When, however, there was no German Emperor, when there was no King of Prussia, there was still the House of Hohenzollern, willing and able to give a strong lead in the people's struggles. The Kaiser was at the head of the most magnificent army the world had ever seen probably in numbers, and certainly in training and equipment. He is a soldier by birth and choice. But the army had never been used except for the purposes of defence and for the protection of the Empire. It had never been used—great as the temptation might well have been—for aggression. Germany was, as it were, the "strong man armed" who kept his house in peace. The Emperor was not merely master of a great army, but he had a care for the commerce, industry, and manufactures of his people. He had spoken freely to his people of the aims he would have them keep before them; and these aims had always been high, noble, and worthy of a great nation. He (the Governor) felt that when the story of the Emperor came to be told in the days to come, his name would hold high place among the kingly men and manly kings of the great race from which he came. He gave them "The health and long life of the German Emperor."

With great heartiness the toast was drunk.

The GOVERNOR remarked that he had now to invite them to drink "Prosperity to the German Association of Gas and Water Engineers." He said the Directors of the Gaslight and Coke Company did not dwell upon the fact that their guests were members of a technical institution; this would be rather the lot of those who would be entertaining the visitors that evening. The Directors welcomed them as men engaged in the same industry with themselves, and as citizens of a kindred race with whom they were glad, and all good Britishers were glad, to cultivate relations of greater amity and friendship. They remembered with keen satisfaction the hospitality which had been extended to them and to their officers when they had visited Germany in search of information. He remembered attending one gathering of the German Association. Immediately on his arrival at about nine o'clock at night he was taken to a conversazione where there was capital music and much good fellowship; and his recollection was that the festivities did not close—there were interludes for serious work—for some 48 hours, when he left by train at eleven o'clock at night. [Laughter.] Talking it over with a friend who happened to be the President of the Association, he (the Governor) said he had been trying to discover an explanation of the method upon which the meetings were conducted; and he had come to the conclusion that they were run in the interests of the younger members of the profession—because every annual gathering must kill off a large percentage of the older men. [Laughter.] Their friends had just inspected the Company's Beckton works; and he had an uncomfortable feeling that they would go away with a sense that, after all, while it was all very big, it was somewhat commonplace. It must, however, be borne in mind that the works were built about forty years ago. They were commenced about the same time that he came to London as a young man, but yet old enough to take charge of one of the largest of the undertakings then supplying gas to the Metropolis. What was done at that period was the last word in gas-works construction and in the science and art of gas making. It was now somewhat out of date. At a period less than half that which he had just mentioned—that was to say, only some fifteen years ago—the late Mr. Edward Drory and he (the Governor) were laying down the lines of the large works at Mariendorf. These works placed the name of Edward Drory high among engineers; and many were the pilgrimages made to Mariendorf to see the inclined settings with which he had equipped them. The pilgrimages to Berlin continued, but the old shrine was deserted, and homage paid at that set up by Ernst Körting. The vertical had replaced the inclined. Somewhat of the same thing had been happening here. As their methods had become out of date, they had been engaging in the work of reconstruction, of which they had seen something that morning. Their practices were not exactly those of the latest German works; but he did think that, from the point of view of economical working, there was little to choose between them. He had mentioned these little episodes because they marked the fact that gas engineering had not stood still; the march of progress had not by any means finished. They were on the road to improvements—not simply in retort-house work, but throughout the works and in the utilization of gas; and the improvements were sometimes of a very striking character. In them, he was quite sure the German Gas and Water Association would take their part. They knew that the gas industry in one country could not prosper without the other prospering also. Therefore they most sincerely wished the German Association every possible success; and he coupled with the toast the name of Herr Prenger, the worthy President.

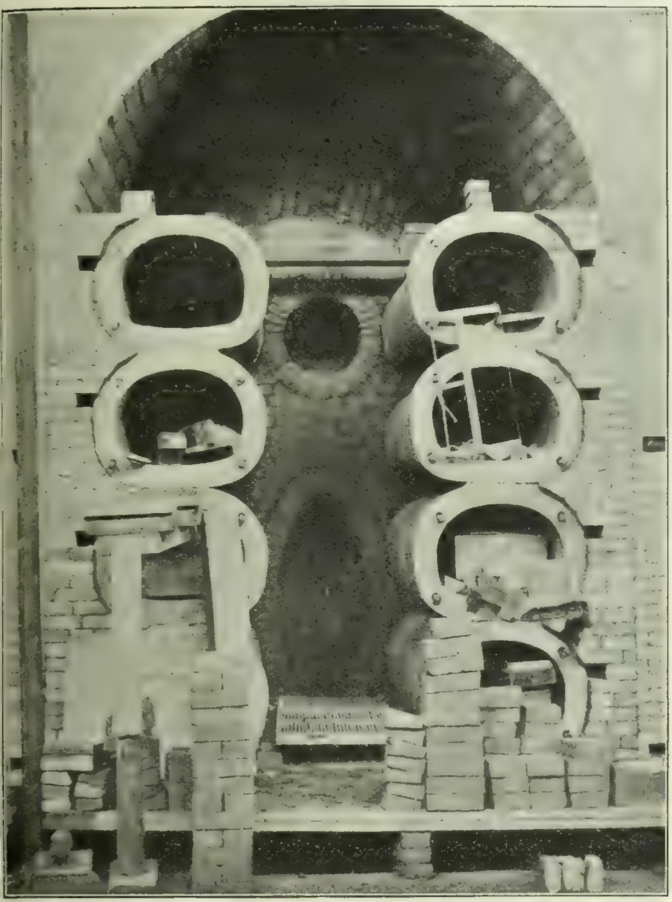
Herr PRENGER acknowledged the toast. He spoke in German; and his speech was afterwards translated by Dr. Lessing. He said his best thanks and those of the members generally of the German Association were due to the Governor and Directors of the Gaslight and Coke Company for the very kind reception they had given them, and for the high tribute Mr. Woodall had been good enough to pay to the work of German gas engineers. He (the President) must say they had that morning enjoyed themselves immensely, and had greatly appreciated all they had seen. What they had witnessed at the lunch, in the way



VIEW SHOWING THE LARGE EXTENT OF PIER ACCOMMODATION AT BECKTON.

ANOTHER GENERAL VIEW OF THE BECKTON WORKS.

of a beautiful generosity, exceeded anything that might be seen on the Beckton works. They had to go through these vast works not in the way usually adopted on such occasions. It had really been impossible for them to study anything, seeing that they had to go through the place in an express train in order to get any idea at all of the extent of the operations. At the conclusion of their inspection, they were impressed by the parade of locomotives and horses; and at that moment he should like to have called out "Woodall to the front." Mr. Woodall had jocularly referred, in conversation, to the German invasion that morning; and, seeing the German flags all over the works and on the piers, he (the President) might have been forgiven if he had thought the invasion had been completed. But he took it as a sign of co-operation between British and German engineers; and he asked and advised his countrymen and his British colleagues to pull together and work together to attain the great object of getting the best efficiency and the highest econony in the gas industry. An example of how this was to be done had been seen that very morning. In the Beckton works they saw how work on the largest scale ought to be done. The President concluded by calling for three "*hochs*" for the Governor and Directors of the Gaslight and Coke Company.



Construction of New Beds of Ten Retorts at the Beckton Works of the Gaslight and Coke Company.

His request was heartily complied with.

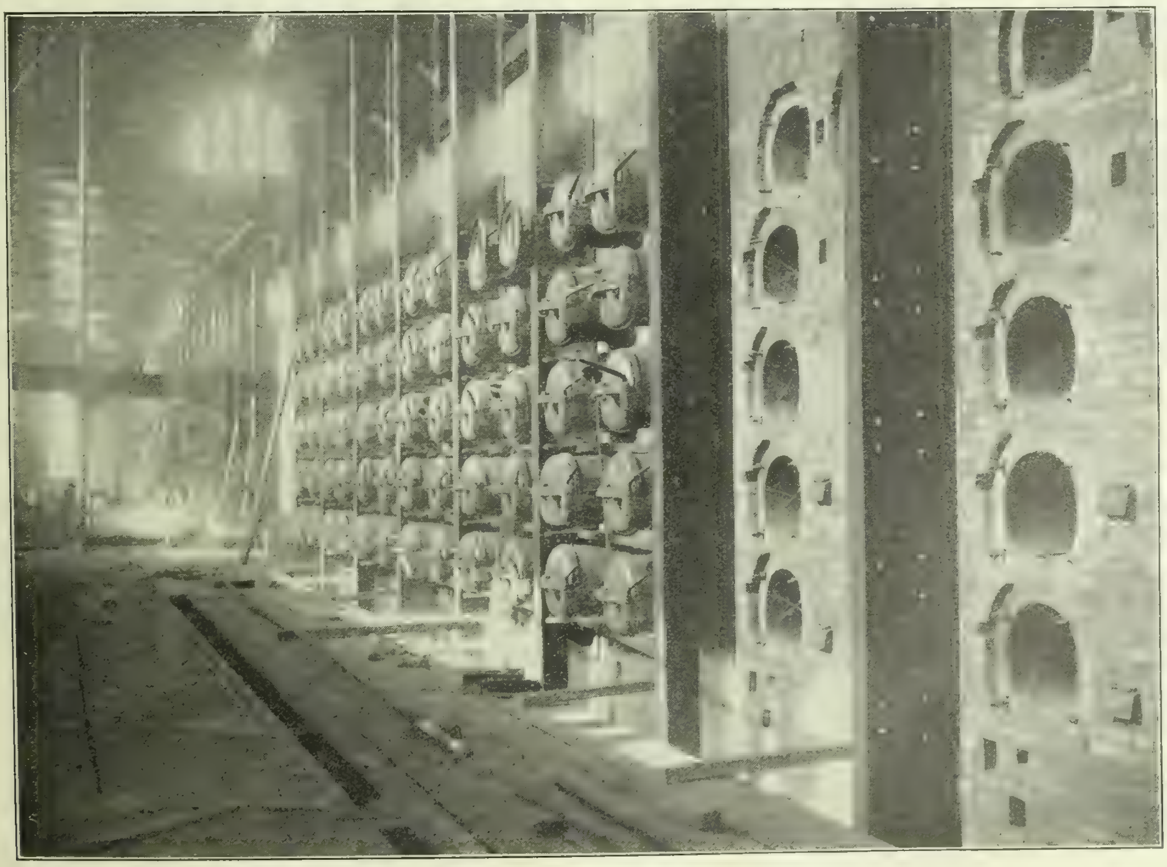
The GOVERNOR observed that their allotted time had now expired; and all he could do was to thank Herr Prenger for his kindly toast to those present who represented the Gaslight and Coke Company.

THE WOODALL-DUCKHAM SETTINGS AT KENSAL GREEN AND THE FIDDES ALDRIDGE MACHINE AT FULHAM.

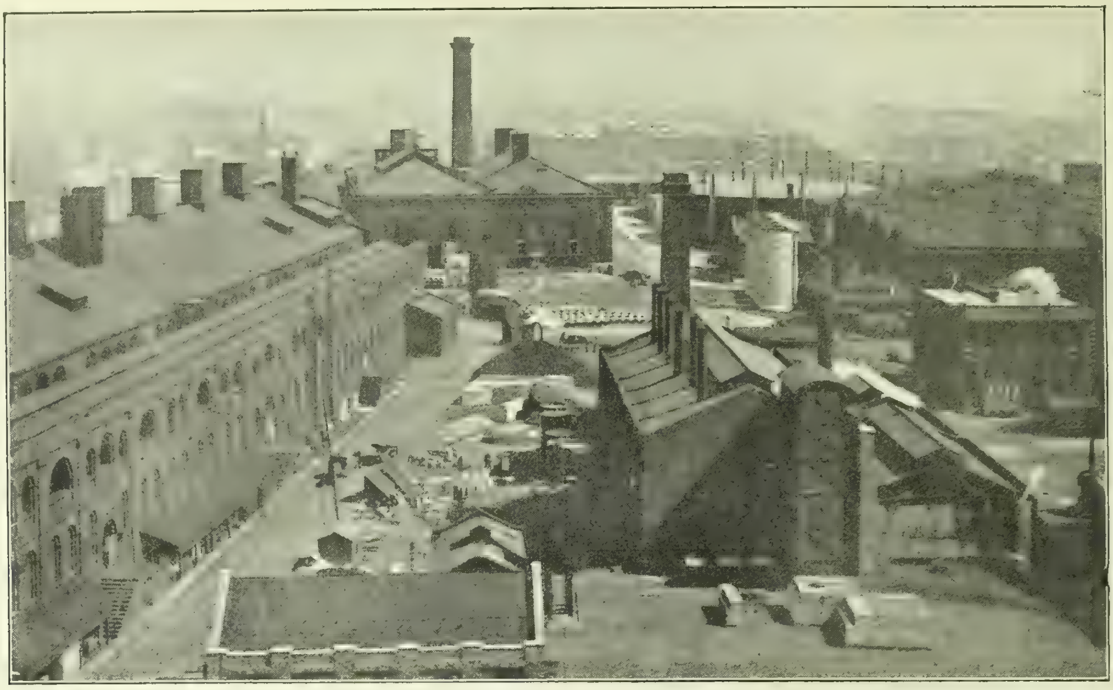
The motor-cars were again requisitioned; and soon the visitors were flying over the roads from Beckton—the long procession of cars making quite a spectacle for the denizens of the East-end. This time the visitors were able to see by contrast the differences between the East and the West; for from out of the gloomy and drab conditions of the East-end, they were driven, passing *viâ* Euston Road, into the pleasanter conditions of the West-end. The Kensal Green station of the Gaslight and Coke Company was reached about three o'clock; and the greater part of the time there was spent inspecting, from ground-level to charging-floor, the Woodall-Duckham system of continuous retorts. This was probably the first time the majority of the visitors had seen the continuous vertical system in any shape or form, and therefore their interest was great—more especially coming as they did from the country of the birth of the Dessau intermittent system. Mr. C. A. Cunnold, the Works Engineer, was kept busy answering the many inquiries of the visitors—inquisitive and painstaking in obtaining information—from the charging-floor in the roof of the house down to the exit of the coke below. They were interested in seeing the attendant simply standing curiously watching the visitors as they strolled about the plant that he had in charge, while silently the charging mechanically continued above and silently the discharging continued below. It was learned that the following are the results of one of the latest tests of the plant, made from Aug. 12 to 18 with Aldwarke Main washed nuts:—

Total coal used	315 tons.
Total gas made	4,154,000 cubic feet.
Gas made per ton	13,187 ,, ,,
Candle power	15·35 English candles.
Calorific value	136 calories gross.
Dry coke and breeze sold per ton of coal carbonized	11·38 cwt. = 56·9 per cent.

Hard by the installation were set out some specimens of one of the retorts; showing how, section by section, they taper outwards from top to bottom. There was not time to do more than make a hasty survey of other parts of the works; and then the visitors were soon again on the motor-cars, and whirling away to the



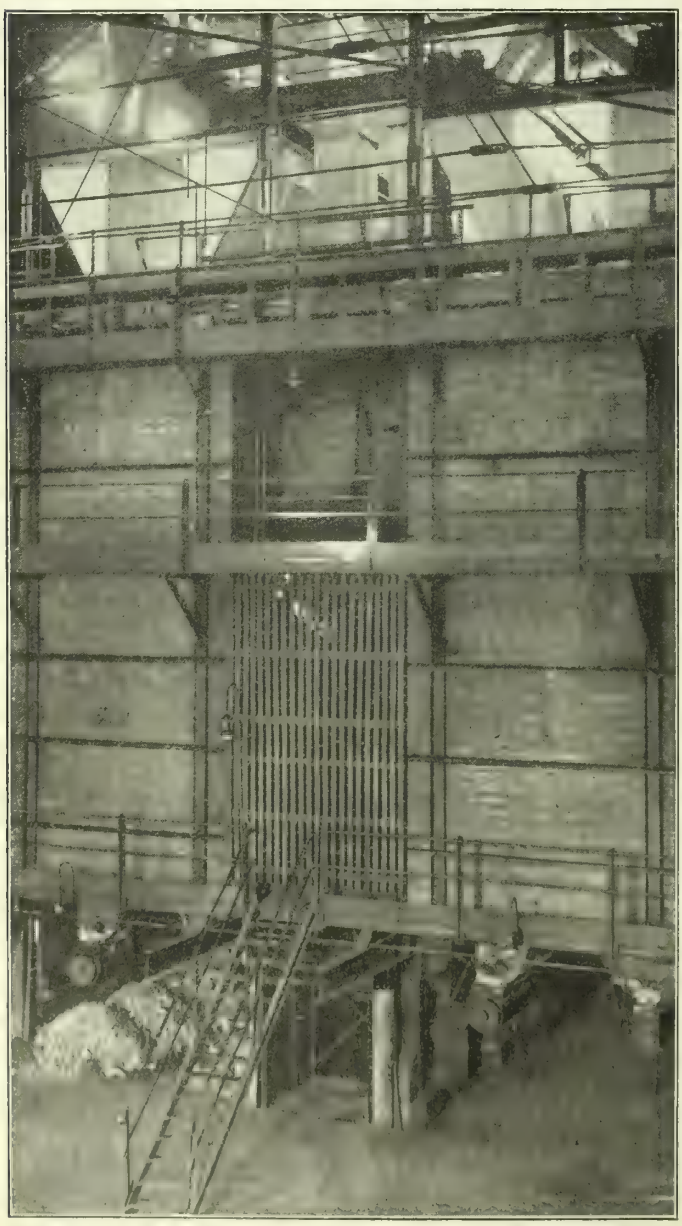
New Settings of Ten Retorts at the Beckton Works of the Gaslight and Coke Company.



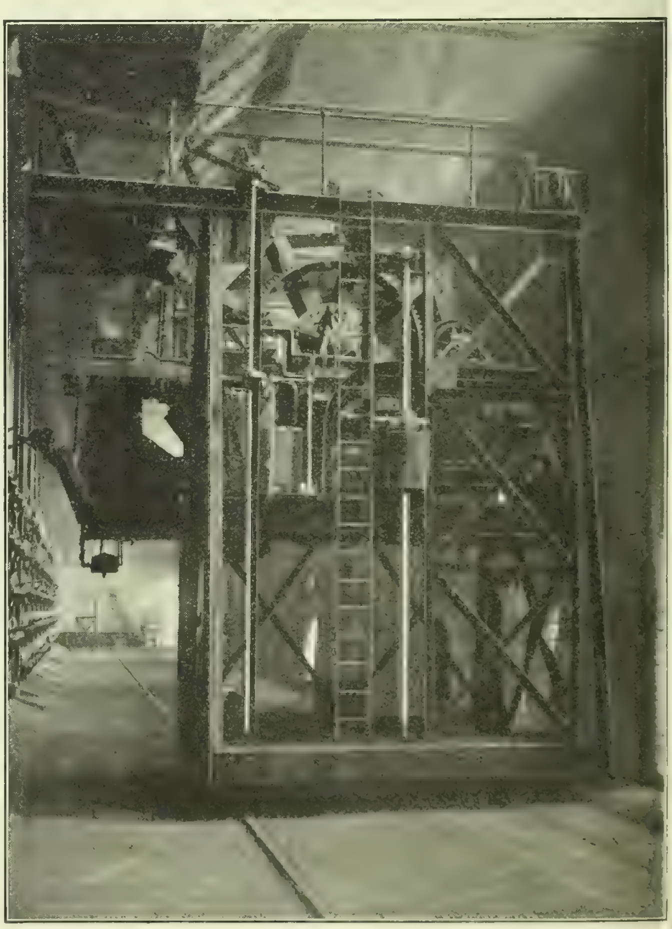
A General View of the Kensal Green Works of the Gaslight and Coke Company.

Fulham station—the Governor and all the chief officers of the Company still in attendance on their guests. On arriving, it was found that another prominent worker in the gas industry had made time to run in and greet the visitors. This was Mr. H. E. Jones; and Mr. R. S. Gardiner, erstwhile Secretary of the Imperial Continental Gas Association, had taken the opportunity of coming to meet some of his old friends. At Fulham, the special feature of most interest to the visitors that Mr. J. W. Randell, the Engineer-in-Charge, had to show, was the Fiddes-Aldridge machine dealing with a house containing 22 settings of ten retorts. Mr. Goulden gave the information that the machine (which was putting in 10½ cwt. charges, with carbonizing going on for eight hours) was doing very cheap work. The visitors were highly interested in its operation, and moved from one side of the bench to the other and back again so as to see the simultaneous charging and discharging from both points of view.

Before the station was left, tea was served. Very soon afterwards the motor-cars were again boarded; and, well pleased with the day's outing, the visitors and their escorts of the Reception Committee arrived at the Westminster Palace Hotel just before half-past five. It was a laconic statement of fact that one of our friends was heard to make when he said "the whole thing



End View of the Woodall-Duckham Settings at the Kensal Green Works of the Gaslight and Coke Company.



Fiddes-Aldridge Machine at the Fulham Works of the Gaslight and Coke Company.

had been jolly well organized." There is a ring of sincerity about the remark; and certainly it was the truth.

INSTITUTION OF GAS ENGINEERS' BANQUET.

The Institution of Gas Engineers had in the evening their opportunity of entertaining their guests, and this they did in right regal manner, at the Hotel Cecil. The event was a big success. The President of the Institution (Mr. Alexander Wilson) was in the chair; and to the right and left of him sat respectively the President of the German Association (Herr Prenger) and the Vice-President (Herr F. Kordt). To the right-hand side of Herr Prenger were Mr. Corbet Woodall, Dr. O. Knublauch, Mr. J. A. F. Aspinall (President of the Institution of Mechanical Engineers), Mr. James W. Helps, Dr. Karl Bunte, Mr. H. E. Jones, Herr A. Müller, Mr. Thomas Goulden, Herr K. Pfudel, Mr. W. B. Smith (Sub-Convener of the Glasgow Corporation Gas Committee), and Mr. W. Doig Gibb. To the left-hand side of Herr Kordt sat Herr Hasse, Mr. W. T. Reid, Herr K. Heidenreich, Mr. Balfour Browne, K.C., Herr G. Möllers, Mr. Charles Hussey (Chairman of the Croydon Gas Company), Herr H. Zollikofer, Mr. H. Birchenough, Herr J. Elster, and Mr. W. R. Herring. The Reception Committee and several ordinary members of the Institution were present. The tables were beautifully decorated; and at the back of the President appeared in prominent characters the word "Wilkommen." The expressed sentiment was greatly appreciated by the visitors.

After dinner, toasts and music occupied the remainder of the evening. Most efficiently Dr. Lessing again acted as interpreter from German into English and *vice versâ*.

The CHAIRMAN, in proposing "The King," remarked that as the meeting between the British gas engineers and their German friends was due, at this particular time, to the dire calamity that befel this country in the lamented death of their late King, he need hardly refer to what all recognized, and that was the loss incurred by the whole British nation and the civilized world. But King George now claimed and had their homage; and they wished him long life and prosperity, and the health to maintain the best traditions of his race. They hoped he would be long spared to continue the good work so well taken up by his father, which had added so materially to the maintenance of the peace of the world.

Very heartily the toast was drunk, and equally so was the one next proposed by

The PRESIDENT, with the remark that, having toasted with loyal honours King George, he would now ask all present to accord the same honours to the Emperor of Germany. Closely allied to their own King by the ties of blood, he could call him in more than the ordinary sense "cousin." The Emperor represented, and held sway over, an immense dominion; and he ruled over a great people.

The PRESIDENT said that, in calling upon Mr. Helps for the next toast, he would ask those present to remember that, in the ordinary course of events, Mr. Helps would have sat in the chair which he (the President) occupied. It was right, therefore, that their friend should have the opportunity on this occasion of proposing the toast of "The German Association of Gas and Water Engineers."

Mr. HELPS said he must thank the President most sincerely for the courtesy and self-sacrifice that he had shown by asking him (Mr. Helps) to undertake this very pleasurable and important duty of proposing the toast of "The German Association of Gas and Water Engineers." He appreciated deeply the President's action in this matter. Might he also express the great regret with which the Council came to the conclusion that the proper course was, through the circumstances the President had mentioned, to postpone the visit of their German friends to England, to which they had all looked forward so long. Happily, the postponement, so far as he could judge, had not interfered with the success of the meeting. He was glad to see that so large a number of their German friends had been able to pay a visit to England. The Institution of Gas Engineers wished the number had been larger, and that it had included the names of others whom they would have been most glad to welcome there that day. Among British engineers, the names of some of the absentees were as household words. He alluded to Professor Bunte, Herr Körting, and others. To Professor Hans Bunte their congratulations were extended, upon the honour conferred upon him of being raised to the rank of a Privy Councillor. They were all met that day because they were interested in the same concerns; and their main object was the progress and benefit of the great gas industry, without envy, or without fear of competition among themselves. But, as citizens of Great Britain, they greeted their German friends, because they felt that they would like to have some opportunity of showing how very much they appreciated the great cordiality and kindness with which they had always received them when visiting Germany in the capacity of gas engineers. Whether they went as representatives of their own technical body or as deputations from their individual companies and corporations, they had always received the greatest hospitality and courtesy; and every facility had been given them to study, under the most pleasurable and favourable conditions, the works which had been the object of the visit to Germany. British gas engineers rejoiced to see their friends here, and to be in a position to personally and collectively tender their grateful thanks for what they had done in the past. The memories would ever live of the visits paid by the Institution to Berlin, when opportunities were afforded for seeing the emblems of the skill of the great engineers at Mariendorf, Tegel, and Oberspree. He thought he must ask those present to excuse him if he ventured to lay claim for a moment to a feeling of pride that this country was foremost in the development of the gas industry in Germany. When it was remembered that London was lighted by gas as early as 1807, that until 1826 illumination by means of oil was almost universal throughout Germany, and that it was the Imperial Continental Gas Association which built the first gas-works at Hanover in 1826, in which year the same Association obtained the concession for lighting Berlin, he thought his hearers would see that he was perfectly justified in entertaining the feeling of pride to which he had alluded. He was glad the first manager at Hanover was Herr L. Drory, the founder of a family whose name had been so long and so honourably associated with everything good in connection with the gas industry of Germany. Berlin was lighted by gas in 1826—the well-known avenue of the Unter den Linden being the first thoroughfare to be lighted; and it was so successful that the principal newspaper of the day referred to it in most glowing terms, remarking that the brilliant lighting of the streets made Berlin as great a pleasure to those who saw it by night as to those who saw it by day. Those who knew Berlin would concede that it was now the most brilliantly lighted city in Europe. He thought it would also be agreed that the remarks of the newspaper alluded to were as true now as ever they were; for in no town could one see such a lively and stirring sight as in the early hours of the morning. [Laughter.] With regard to the progress of the gas industry in Germany, it might be interesting to know that when the first works were built in Berlin—the Gitschinerstrasse works—the total make of gas in 1826 was only 2 million cubic feet; but in the past year 1650 million cubic feet were made at the works. When gas supply was first introduced through the whole length of the Friedrichstrasse—the principal business street of Berlin—a 6-inch main was considered amply sufficient; while to-day a 30-inch one was barely enough, and mains as large as 42 inches in diameter were not unknown in Berlin. England had had, as he had claimed, a great deal to do with the initiation of the gas industry in Berlin. Though it was true that Murdoch and Winsor were born in this country (some claimed that Winsor's name should be spelt with a "z," and that he was born in Germany), it was also true that for a considerable number of years the progress of the gas industry had been due to no small extent to the energy and thoroughness, and also the scientific ability, with which German gas engineers had faced the many difficulties which had presented themselves to engineers generally in the past. Though it was perhaps true that anyone wishing to know what was best in gas practice had to come to England, it was equally true that the student was rapidly outstripping his teacher, and that anyone wanting to know what was the latest and the best with regard to the progress of gas engineering, did not think he had done the correct thing unless he had paid a visit to Germany. And those who went always came back feeling they had learnt something which they must put into practice for the good of their works, and of the industry generally. All honour, then, to such men as Siemens, von Oechelhäuser, Körting, Drory, Schilling, Bueb, and others; and what could they say to add lustre to the name of Baron von Welsbach, without whose invention of the incandescent mantle improved and more economical processes of manufacture, such as the vertical retort, would have availed little in the efforts of gas managers to combat the fierce onslaughts of electricity to oust the gas industry from its position in lighting. They owed, too, a deep debt of gratitude to those who had attacked the great problems of carbonization in Germany. In this country, gas engineers had taken their share in continuous carbonization in vertical retorts; and they did feel that, though it was said that there was nothing new under the sun, and while the German scientists had done so much work in connection with this matter, the whole gas profession owed a debt of gratitude to England. He wished to repeat how delighted they were to see their visitors. They hoped they had all enjoyed themselves and their visit. All those present had but one object at heart, and it was to do all that was possible to further the interests of the great industry which they loved to serve; and, in addition, they wanted to do something in a small way, as engineers and scientists, to assist as far as possible in the maintenance of peace and good-will among the nations. He wished to couple with the toast the name of Herr Prenger, of Cologne, whose work in connection with vertical retorts was well known. They would like, too, to specially unite with the toast the name of Dr. Karl Bunte, the worthy son of a great sire.

Herr PRENGER (who was received with great applause) warmly thanked the Institution of Gas Engineers, in the name of the German Association of Gas and Water Engineers, for the invitation with which they had honoured them; and, further, he thanked Mr. Helps personally for the appreciative words he had addressed to him. The members accepted the kind invitation with pleasure, and with the conviction that they would be received with open arms and have a hearty welcome. They knew they were coming to the mother-country of the gas industry; but they had also come convinced that they would find not merely technical colleagues, but, if he might say so, dear friends, with whom they were working together. At the present day, things moved very rapidly; and in the gas industry especially development and progress had been so great that it was no longer possible for one person unaided to keep abreast of them. Then it became more than ever necessary to form associations for the purpose of meeting one another. Every day brought new discoveries. Mr. Helps had dealt in a charming manner with German work in this direction. He had shown himself to have a good knowledge of Berlin, and especially of Berlin at night—[laughter]—this, of course, referred only to his acquaintance with the public lighting of Berlin. The members of the Association were very pleased to meet their English colleagues in order to interchange views and experiences. He greatly desired and hoped that the visit would serve to further their common work; and he asked his colleagues to show their concurrence with him in this wish by hearty applause.

The German visitors cordially complied with Herr Prenger's wish.

Herr KORDT, in proposing "The Institution of Gas Engineers," thanked the Institution and especially its President (Mr. Wilson) for their kind invitation, which the German Association had accepted with pleasure. The visit would have taken place earlier if it had not been for the lamentable occurrence of the death of King Edward. He would express to all his sincere thanks. It would have been impossible for his colleagues and himself to have been received in a more friendly and charming manner. Sometimes, when they read the newspapers, they were apt to believe there was tension between the two countries; but an Englishman going to Germany or a German coming to England observed nothing of it. Such discord between the two peoples would never serve any useful purpose; it had never yet happened that they had waged war against each other. The visitors had come to England the more gladly because the English had been their instructors in the

gas industry; and they still came to learn. It was due to the energy of the English Gas Associations that the consumption of gas here had attained such great proportions; and the visitors must take for their example the energy of English gas engineers in promoting the use of gas. Gas must not be regarded as a privilege accorded to the wealthy and middle classes, but as something to which the poor, and even the very poorest, were entitled. There was no envious opposition in their work, but a friendly rivalry prevailed everywhere. Therefore he asked his colleagues to join with him in drinking the toast of "The Institution of Gas Engineers and its President, Mr. Wilson," with a "*Hoch!*" "*Hoch!*" "*Hoch!*"

The PRESIDENT: In reply to the toast so eloquently proposed and so heartily responded to, allow me first to add my words of welcome to those of Mr. Helps. I have had the pleasure on two occasions of visiting Germany; and the memories of the visits are very pleasant indeed. The attention with which our party was received, and the readiness to show us all the splendid plants in the various works visited, left us with a deep feeling of indebtedness. In addition, the extreme kindness of all those whom we met made me personally feel that, though a Scotsman, I had still much to learn of real hospitality and the true methods of entertaining strangers. Herr Kordt has referred to tension that is supposed to exist between Britain and Germany, and, on the part of the business and general community of his country, disclaims any idea of complications that might arise, and derides the idea of two such civilized and enlightened peoples, with many ties of old-time friendship between them, coming into conflict. We can assure Herr Kordt and his friends here that we equally deplore every act and every utterance which tends in any way to cause friction between our nations. We hold with him in the wish that each country will prosper in its own way, and that the two countries and their people will long continue on the terms of the warmest friendship and amity. Herr Kordt further said that the only rivalry that now exists between the gas engineers of Germany and Britain is a friendly one, as to which nation will do most, by invention and research, to improve the *technique* of gas engineering and manufacture. With him, we would do honour to the many great engineers and chemists of both countries who have assisted, in their day and generation, in improving our systems of working, and in bringing new methods and appliances into use. There need be no envy between us in this good work; and we give the fullest credit and honour to the gas engineers and chemists in Germany for the great work they have done in recent years in connection with the problems of gas manufacture and purification. There is one matter that I would like to touch upon before I sit down, and that is the great part the gas industry is likely to play in the crusade against the smoke evil. The governing bodies of our large towns and cities are beginning to realize the danger to public health and the immense loss caused to every community by the present barbarous methods of using raw coal for heating purposes. The work of the Smoke Abatement League, though earnest and beginning to bear fruit, has been very much like a voice crying in the wilderness of smoky chimneys. We view with pleasure and hope the increasing interest which is being taken in this great and important question by the municipalities of our large cities. In Glasgow at the present time the Corporation, who have only just completed a large and costly sewage scheme for the purification of the River Clyde, are taking up the purification of the air in a practical and business-like way. They are being nobly assisted by the Press in arousing interest in this difficult problem. We have every hope that, as they have succeeded in so many other directions, they will also carry this scheme through to a successful issue, and obtain for the citizens of St. Mungo their proper share of sunshine and pure air, with all their attendant blessings. As the purveyors of gas, which is at the present time the only really efficient and economical substitute for coal for domestic use, we must do all we can to help forward the good cause. We must, in addition to doing all in our power in the way of producing the most suitable gas at the lowest possible cost, take up the work of educating the public in the proper and beneficial uses of gas; and we are waiting with interest the proposals of the Publicity Committee of the Institution of Gas Engineers as to how this educative work is to be best carried on. If the Institution, the gas companies, and the corporations of our large towns will unite in a friendly and effective way in this great crusade, we can look forward with hope to the time when the smoke and fog fiends will cease to trouble and devastate our cities and towns. I beg to thank you, Herr Kordt, for the kind and eloquent manner in which you have proposed this toast, and you, gentlemen, for the hearty way in which you have received it.

Mr. CORBET WOODALL proposed the final toast—"Kindred Associations." In the course of his remarks, he said that science was worldwide, and knew no geographical boundaries; but the societies for the promotion and advancement in knowledge of science had a local habitation. No scientific society could, however, stand alone—such societies were formed by men of like pursuits or inclinations who joined together to increase their knowledge and advance their usefulness and value. But when their particular science came to be applied, it was seen how immediately they were brought into contact with other branches of science not clearly within the range of their own society. Hence the same men were members of many societies. For instance, he might take their own industry. The Institution of Gas Engineers properly represented the gas industry in this country, and the science pertaining to that industry; and it spoke with authority in regard to gas questions in England. But when the members, as gas engineers, came to apply their science, they found that they had to erect great buildings, construct composite works, and build railways and bridges. Under these circumstances, they felt they had some claim to be included in the membership of the Institution of Civil Engineers; and many of them were members of that body. Those present had been visiting a London gas-works that morning, and they had seen considerable works designed by different people (largely by his friend Mr. Goulden); and they had at the end a parade of some thirty locomotives. They also saw a great number of engines and pumps, and so forth; and the designing and construction of these would lead Mr. Aspinall to say that those who designed such works were entitled to be members of the Institution of Mechanical Engineers. They saw, too, the chemical factory, employing some 400 or 500 men, in which there were made (he was afraid to say how many different) products, the results of the distillation of coal. This was purely a chemical industry; and naturally the association between their industry and that of the chemical societies was very close. Therefore they were obliged to take their share in the work of the chemical societies, and look on what was being done at home and abroad with regard to that branch of science. So they might go the whole round. They had to sink wells in order to obtain water for the supply of their works; but they had to consult the geologists with regard to operations of that kind. Therefore he said that while science knew no bounds, societies did. One advantage accruing from this fact was that they had kindred societies in different countries of the world; and with these they had, he was glad to say, an ever-increasing sense of brotherhood. They had that evening with them their brethren from Germany; some time ago they had a similar visit from their brethren from France. One of the advantages attaching to these kindred societies in different countries was that they enabled them to unite as one for the promotion of the industries with which they were respectively associated. He coupled with the toast the name of the President of the Institution of Mechanical Engineers, Mr. Aspinall.

Mr. ASPINALL, in the course of his reply, remarked that it was perfectly true, as Mr. Woodall had said, that no scientific society could stand alone. He ventured to think that probably Mr. Woodall would agree that the Chemical Society, the Institution of Mechanical Engineers, and the Institution of Electrical Engineers had been the greatest of helpers to the Institution of Gas Engineers. It might possibly seem an anomaly that the Institution of Electrical Engineers was a great help to the Institution of Gas Engineers. But surely it was that healthy competition in the supply of light that first started those great efforts to improve the gas industry which had resulted in the growth of the demand by the public for the best possible illumination. When they came to look at the mechanical side of the question, there was hardly a thing, as Mr. Woodall had pointed out, in the way of machinery which was not, in some way or another, associated with the gas engineer; and when they came to see the use which was made nowadays of gas-engines, it illustrated in a forcible way that combination between the two societies was necessary for mechanical progress. The gas-engine was in large measure due to a German; but it had now reached a stage which was far beyond what he anticipated. It had, however, to go much further before it could compete with the large powers of the steam-engine. That these powers would be reached, no one could doubt; but at present they seemed to be a long way off. On the other hand, while there were difficulties with the large powers with the reciprocating gas-engine, it was only recently that Mr. Humphreys introduced to them what had become known as the Humphrey pump; and in this he (Mr. Aspinall) thought they had the triumph of the gas engineer. He supposed some genius would next spring up, and show the way to get rid of the difficulties encountered with gas-engines of large power. But he would no doubt have to pass through a great deal of hard work before he perfected the large-power gas-engine. This reminded him of something that was said by Professor Schwartz, of Manchester, the other day, when talking to some of his students. He said that one must not expect everybody to be a genius, and that the fact of the matter was that the best work of the world had been done perhaps in the proportion of 10 per cent. by inspiration and 90 per cent. by perspiration. [Laughter.]

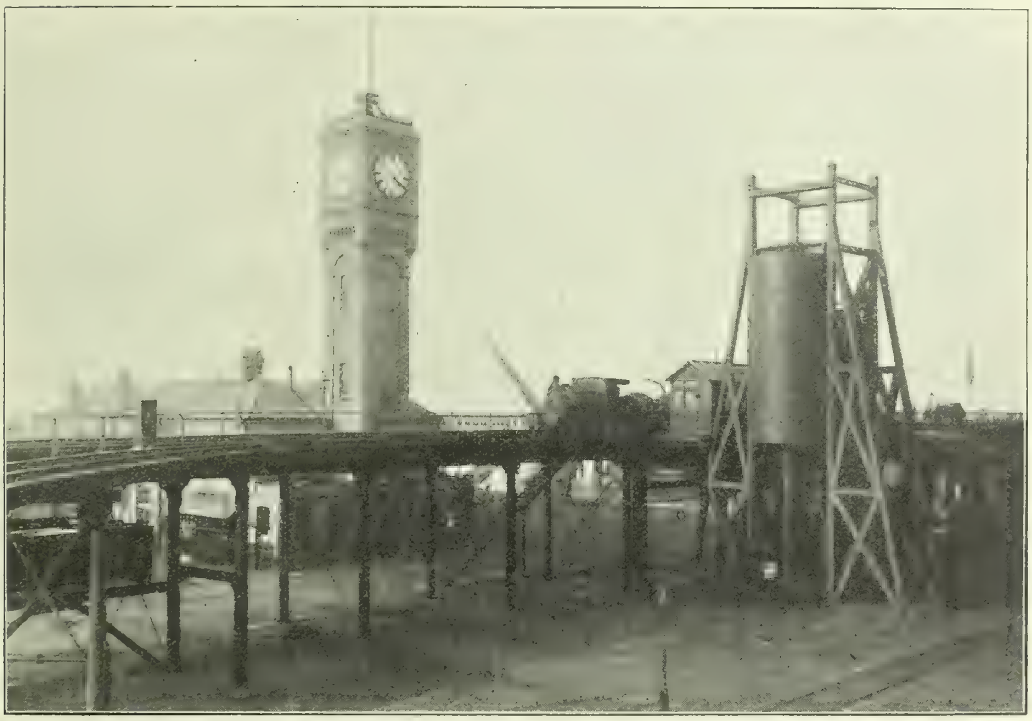
The PRESIDENT, before the proceedings concluded, called attention to a *souvenir* prepared in a very tasteful and artistic manner by Mr. F. D. Marshall. He said that Mr. Marshall had given them something which all would treasure and keep as a memento of the visit. They desired to express their thanks to him. They must also specially thank Dr. Lessing, who had done so much to add to the enjoyment of the evening by his interpretations of the speeches.

"God Save the King" and the "Watch on the Rhine" brought to a close a most happy evening.

AT THE EAST GREENWICH GAS-WORKS.

On Tuesday morning the weather was again all that could be desired; and though a full day had been passed through on Monday, the whole of the visitors were fresh and ready to undertake the day's programme without delay from the appointed time. Let us say here that (apart from the splendid arrangements in every detail made by the Reception Committee and by Mr. Dunn, the visitors themselves, by their eagerness not to transgress time arrangements in any way, contributed much throughout the week towards enabling everything to "go like clockwork." Discipline and punctuality are exemplary traits of our German friends; and they admire it in others. That by the way, however. The great works at East Greenwich of the South Metropolitan Gas Company and those of the Croydon Gas Company were to engage respectively Tuesday morning and afternoon. This time the journey from the Westminster Palace Hotel took us across the river *viâ* Westminster Bridge; and the visitors were able to see something of the southern side of London, but not the best neighbourhoods. A little detour would have wasted time, all of which that was available was required to view the great works that are under the care of Mr. Tysoe. As the works were approached, that great monument to the engineering courage, conception, and skill of Sir George Livesey —fit memorial to a large heart and energetic and fertile brain— the 12 million cubic feet capacity holder, came into sight, with lifts fully inflated, the top ones rising above the standards. The holder that took precedence of all holders for magnitude until lately, and now stands second largest in the world, riveted the eyes of the German visitors. Some marvelled, others admired; all realized they were in front of the work of a leader among men. We had first to inspect the tar and chemical works of the Company; and at the entrance gate the cars pulled up. There stood Mr. Charles Carpenter, Sir George's successor in the chair of the Company, waiting to receive the members individually. Also representing the Board, were Mr. Frank Bush, Mr. John Ewart, and the Employee Directors—Mr. Henry Austin (about

The Temperley Transporters for the Loading of Barges from the Pitch Beds at the East Greenwich Works of the South Metropolitan Gas Company.



A View in the East Greenwich Works of the South Metropolitan Gas Company.

Coal-Unloading Pier at the East Greenwich Works of the South Metropolitan Gas Company.

to retire), Mr. W. H. Cupit, and Mr. James D. C. Hunter. The Chief Engineer (Mr. W. Doig Gibb) was there, as was also the Secretary (Mr. F. M'Leod). All the station engineers (in addition to Mr. Tysoe, whom we were glad to see in improved health), were present: Mr. A. F. Browne, Mr. J. F. Braidwood, Mr. W. D. Hunter, Mr. T. S. F. Gibson, and Mr. C. Franks. The visitors had been presented with a leather-bound book, with gilt-edged leaves, printed in German, splendidly illustrated, and containing a special plan, describing, with excellent care and in detail, the Company's undertaking and its East Greenwich works. The book will be preserved as a memento of the visit. In all directions, every particular in the arrangements for the visit had been thoroughly studied, so that nothing should be wanting to ensure success. The organization was described as magnificent by one German friend; and it was. One little point in illustration. A handy card in German or English as required was handed to every one of the party. This had the complete route to be followed figured upon it, and the name of the plant against the figure; and large corresponding figures met the eye, by simply following the arrows plentifully placed about the works.

The company were soon under the charge of Mr. S. S. Field, the Manager of the Ordnance Wharf Tar-Works. This is work that the German visitors are able to specially appreciate; and Mr. Field patiently went several times step by step over the operations and processes followed in their tar distillation for the edification of the inquiring visitors. There was much admiration expressed for the compactness, cleanliness, and general condition of all the plant; and Mr. Field must have been proud of the commendation of such competent critics. They were also much taken with the oil-burning under the boilers. Interest was not easily exhausted at this early stage; but there was time to be considered, and so a move was made to the pitch bays at the side of the river, from which, by a Temperley transporter, the pitch is loaded into barges in the river. The working was greatly admired. We will not go into any detail here over the plant, as it is described in outline elsewhere. But there were still other parts of the tar-works to be seen; and the visitors, as they passed along, inspected in order an oil-still, another tar-still, the tar storage-wells, the laboratory, creosote plant, benzol still, and anthracene plant. They left the Ordnance Tar-Works fully impressed with the excellent practices under which they are conducted.

A short spin by motor-cars brought the party to the East Greenwich Gas-Works; and the cars, by the way, were very useful later in getting from one part of the works to the other. The great gasholders again came in for attention; and mental calculations were being made by some of the engineers of the smaller German works as to how long the contents of the 12 million cubic feet structure would enable them to meet their needs at the present time. With them the work was "fine"—a favourite expression, and frequently heard during the week. The blowers used in the interests of proper and sufficient distribution were next inspected; and it was observed that these are being shifted under cover outside the house in which they have for a long time found habitation, and extensions are also being made. From here the coal jetty was visited; and the excellent river frontage of the works was seen. Mr. Carpenter had so arranged matters that there should be demonstration at every stage; and here it was seen how the coal was raised by crane and grab, and then sent away along the high-level railway from which branches sweep into all the retort-houses. From this point the route mapped out took

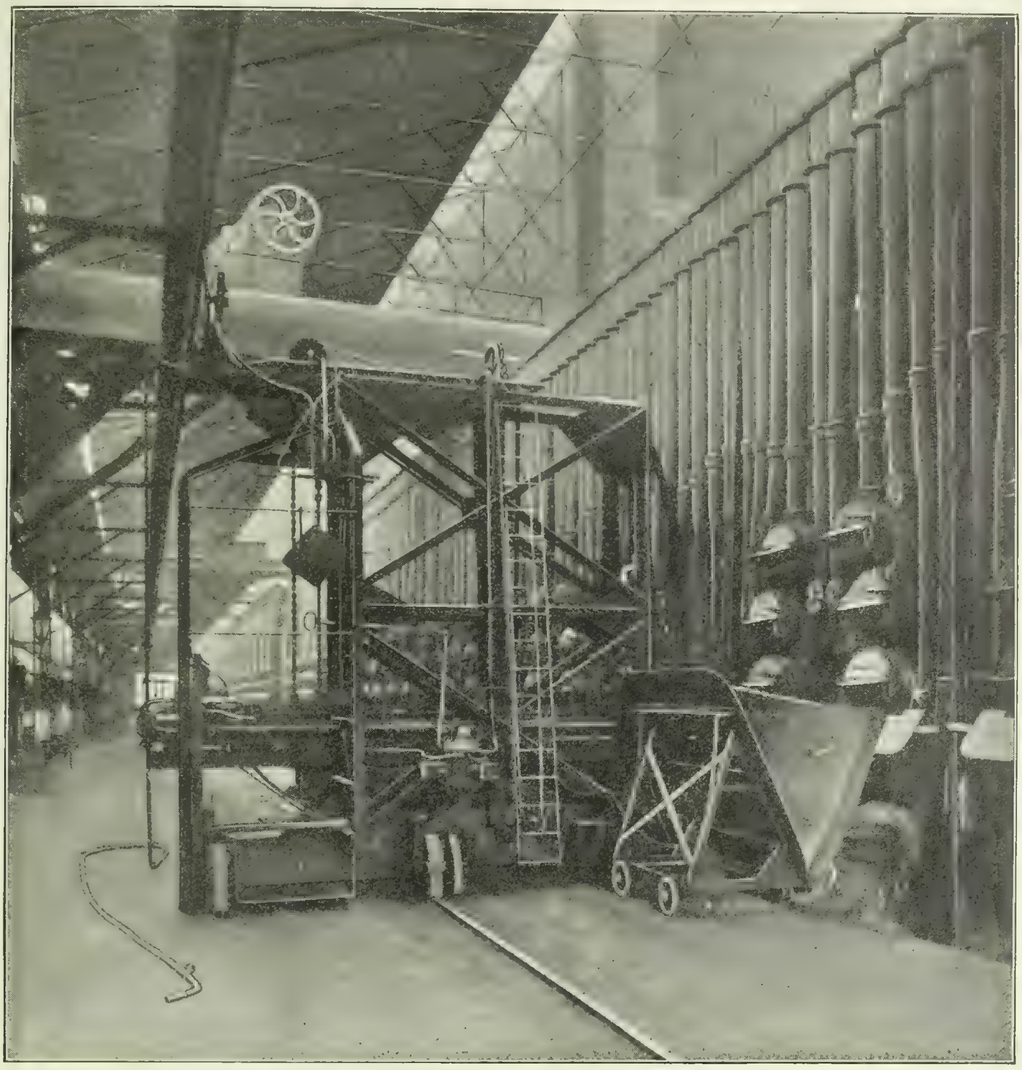
A View Riverwards from the East Greenwich Works of the South Metropolitan Gas Company.

the visitors through the exhauster-house to the hydraulic pumping-engines and to the stores for purifying material. Here it was remarked that the Company have returned partly to lime purification. They have no carburetted water-gas plant; so that coal gas only is distributed. Under the circumstances, it has been thought desirable to supplement in a measure oxide purification. Mr. Carpenter intimated this at the last half-yearly meeting of the proprietors, when he said: "Turning now to our working expenses, purification is some £4000 higher. We are working to a higher standard of purity, and have increased our expenditure both in experimental plant and in purifying materials. . . . Large quantities of gas are used for heating and power purposes, where a high degree of purity is of little or no moment. On the other hand, about one-half is used for the illumination of dwellings and workshops, &c.; and it is important that regard should be had to this in determining our standard." The underground station meters were looked at with much interest; and one German visitor remarked to the writer: "There is not much luxury about these works; but it is all very fine and practical." The extensive and well-equipped workshops caused the visitors to linger somewhat examining the machinery and the large variety of work that was proceeding. They were especially interested in a planing-machine which Mr. Austin (who has for so long been foreman carpenter) demonstrated dealt with four sides of a plank of wood at the same time. No. 3 retort-house was the one selected for showing the high character of carbonization work done here; and the changes that have been wrought by heavy-charge working were explained. The sulphuric acid plant on these works is something that no one should miss; and no one did miss it on this occasion. Naturally, from there the sulphate of ammonia plant was inspected.

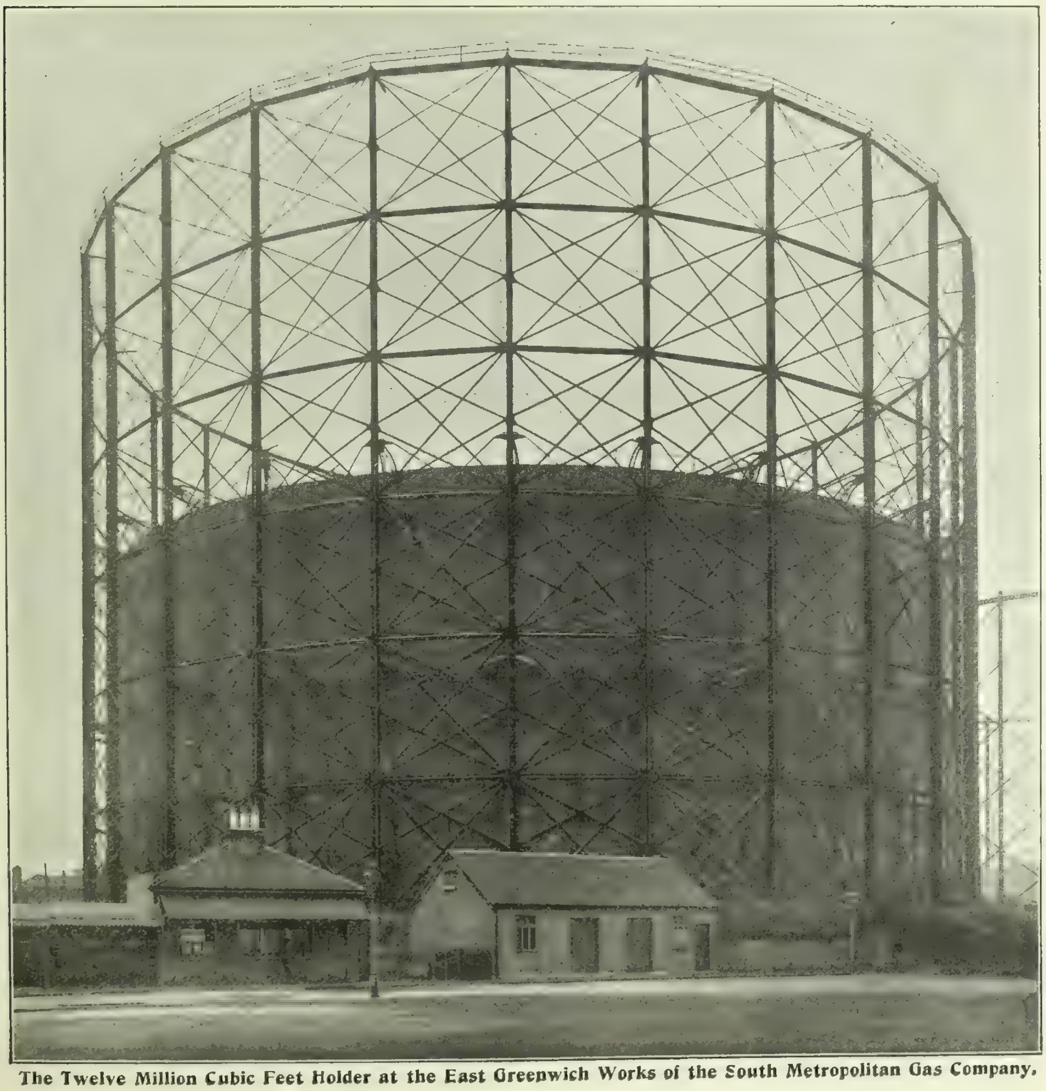
By this time the numerous company was hungry; and with little delay over necessary ablutions, the luncheon-room was entered. This room was a marvellous transformation of a yet unused sulphate store into a picture of magnificence in the way of a banqueting hall. It was obviously the work of a genius. Tapestry covered the wall. Shields were there bearing the coats of arms of the principal cities of the German Empire. The flags of the two nations were entwined here and there. The oil painting of Sir George Livesey that has hung in the Board-room at Old Kent Road since the strike was suspended behind the Chairman's position at the head of the table. Overhead a gauzy material blocked out the fact that a sulphate conveyor was interposed between it and the glass roof of the building. The subdued light added richness to the scene. Palms and rich floral decorations abounded. This could all be taken in at a glance. The lunch was worthy of the occasion. Mr. Carpenter delighted the Company's guests as Chairman; for nothing had been left undone to give them pleasure. Grace was said by the Chairman; and, rising from the neighbourhood of the palms at the opposite end of the hall, came from a quartette party a beautiful rendering of "For these and all Thy mercies, Lord." Seated, it was observed that among the guests were Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, the Chief Engineer (Mr. Thomas Goulden), the Secretary (Mr. H. Rayner), and Mr. F. W. Goodenough, the Controller of the Gas Sales Department.

After lunch,

The Chairman, in proposing the first toast, said: On occasions like the present, it is customary in Great Britain to drink to the health of the King. As this, however, is a gathering of representatives of an industry of two nations, I propose to modify the toast, and ask you



The "Co-Partnership" Retort House Machine.



The Twelve Million Cubic Feet Holder at the East Greenwich Works of the South Metropolitan Gas Company.

to drink to the health of the Sovereigns of both. Both nations are fortunate in having at their head practical monarchs. King George's most remarkable pronouncement was "Wake up, England," and it is well known that the Emperor Wilhelm's utterances have often caused Germany to keep awake. The two monarchs are related by blood, and both take the liveliest interest in the navies which watch the shores of their countries. May the sea always be large enough to hold both navies! and may their ships always meet in as friendly a manner as we meet to-day! Gentlemen, I raise my glass and ask you to drink to the health and long life of the two monarchs—Wilhelm II., German Emperor, and King of Prussia; and George V., King of Great Britain, and Ireland, and of the British Possessions beyond the Seas. "*Hoch! hoch! hoch!*"

The toast of the two Kings was enthusiastically drunk.

To the Memory of Sir George Livesey.

The Chairman: It is a remarkable coincidence that the day which has been chosen for you to honour us with your visit is the anniversary of the death of Sir George Livesey, who exactly two years ago passed into what Shakespeare called

> The undiscover'd country, from whose bourn
> No traveller returns.

Sir George was a great man; and as I know that my British friends would not let this occasion pass without honouring him, I ask you to join with us in rising from your seats, and drinking in silence to his memory.

The request was at once complied with; the large company standing silent for two or three minutes.

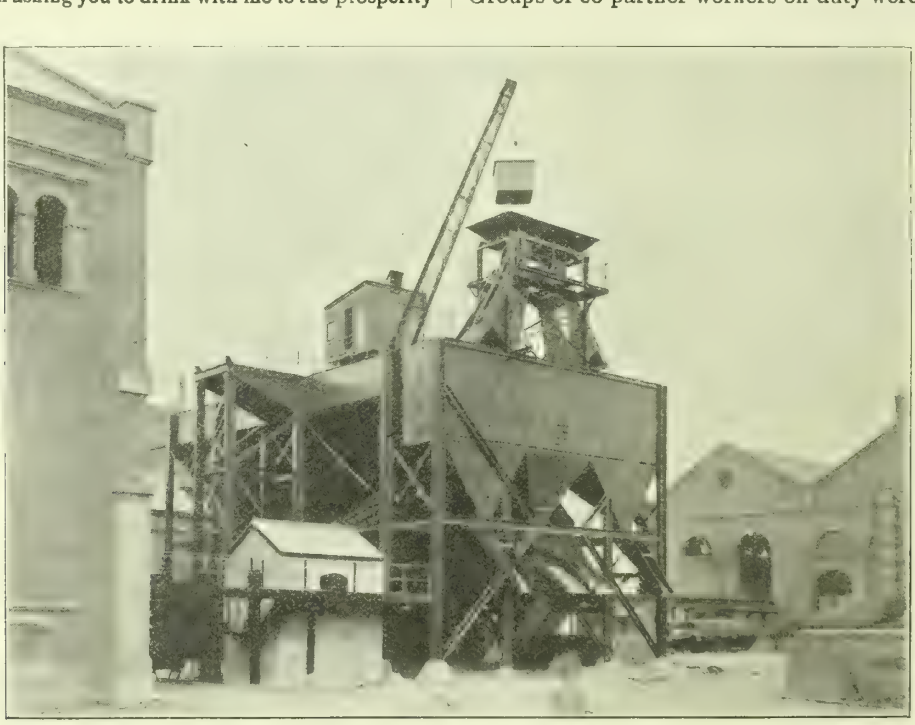
The Chairman said there was one other toast that he had now the honour to rise and propose. It was: "The Success and Prosperity of the German Association of Gas and Water Engineers;" and with that toast he desired to couple the name of Herr Direktor Prenger. Proceeding, he said: In proposing it, I must ask for your indulgence in my presuming to venture to address you in the German language. But I am filled with such great admiration for the qualities which have built up the Germany of the present day, that I am expressing myself in your tongue, although I have had to avail myself of friendly assistance in order to do so. I am forced also to discharge a debt of gratitude in expressing my thanks for the never-failing courtesy which has been extended to me whenever I have visited Germany and your gas-works. I have always, as an engineer, felt the greatest admiration for them; while as an administrator I have often envied your performances. I am not unmindful also how much we in Great Britain are indebted to the work of your inventors in the domain of gas manufacture—from Siemens right down to Bueb and Ries—and again to the wonderful manner in which you brought the invention of Dr. Auer into practical form, and made it accessible to the poorest users of gas. I have never met a British engineer who has not been of opinion that a visit to Germany was not of the highest service to him. So far as I myself am concerned, I only regret that I have not been able to go there more often and to stay longer. I am very sorry that Professor Dr. Bunte has not been able to be present with us to-day, as, after your President, there is no member of your Association whom I should have welcomed with greater pleasure. In asking you to drink with me to the prosperity and success of the Association of German Gas and Water Engineers, permit me to couple with the toast the name of Herr Prenger, the most worthy Manager of the Corporation Works for Light, Heat, Power, and Water Supply of the renowned City of Cologne, whose gas-works I have had the pleasure of inspecting. Let us also include in this toast, although it can only be done "*in absentia*," the health of our friend Professor Dr. Bunte.

Herr Prenger, in response, said they had come to the works of the South Metropolitan Gas Company that morning with much expectation. They had all felt a great wish to see the works of Sir George Livesey, who was not only the greatest of gas engineers, but he was a great social reformer. He had done much for the improvement of the conditions of those employed by this Company and others; but he had done much for the advantage of the poor through his encouragement of the penny-in-the-slot meter. Co-partnership was his own great work; and it had done much for many gas-workers in this country. He was sorry that the conditions of gas supply in Germany were such that the scheme could not be adopted in the same manner. But his memory remained with them; and next day he—in the name of the German Association—desired to lay a wreath upon his grave. They saw from the book that the Chairman had kindly presented to each visitor that the amount of the investment of the employees of the Company through co-partnership now amounted to somewhere about 10 million marks. That was a sum that spoke for itself; and it did not need many words to emphasize it. Though Sir George Livesey was not living in flesh, his work would live for all time. He had a worthy successor in their Chairman, Mr. Charles Carpenter. For the way he had received them in his fine works, for his kindly and courteous manner, and for the great hospitality they must thank him, and through him the Company. He (the speaker) desired therefore to propose the toast of "The Chairman and Directors of the South Metropolitan Gas Company."

Mr. Carpenter said: In the name of my colleagues on the Board of the South Metropolitan Gas Company, I express to you our heartiest thanks for the manner in which you have proposed and drunk our health. It has been a very great pleasure to us to see you here to-day; and your visit will remain memorable to ourselves, as well as in the annals of our undertaking. I hope you will allow me also to express the great gratification I feel that so many officers of the Gaslight and Coke Company have been able to attend this function to-day. Many years ago I had the run of the works of the Gaslight and Coke Company. Those were happy days; and I am always pleased to acknowledge that I learned a great deal from the opportunities I had years ago when at Vauxhall. This gathering, and the fact that we are meeting in the way we are now doing, are unique, or nearly so, in the annals of the South Metropolitan Gas Company. I am sure that nothing would have pleased our late Chairman more than to have seen you here to-day, and to have welcomed you to these works. I thank you most heartily for the manner in which you have drunk our healths.

AT THE CROYDON GAS-WORKS.

Leaving the luncheon room, the guests made their way to the main road through the works, where the motor cars were assembled. Here good-bye was said to Chairman and officers. Groups of co-partner workers off duty were standing about; and



Coke-Sorting Plant at the Croydon Gas Company's Works (Marcus Screen, &c.).

as the cars left, these aided Chairman and officers in giving a ringing cheer of farewell. Outside the works, the cars were headed for the Croydon Gas-Works; and the route taken was through some of those further south-eastern suburbs that have a matchless picturesqueness so near London. When the Croydon gas-supply district was reached, it was found that Mr. Helps—good organizer that he is—had thoughtfully had posted at the corners of the roads where the cars were to turn men with small flags to direct the drivers. We were soon on the road to Waddon, and then not long in reaching the main entrance gates to the works that have had, during the last few years, their original character and conditions completely effaced by the large extensions and conversions carried out by the Engineer (Mr. Helps). At the entrance gates there were assembled the genial Chairman of the Company (Mr. Charles Hussey), Mr. Samuel Spencer, Mr. Percy Hall, Mr. W. J. Russell (Directors) to welcome the visitors. The other Directors—Mr. Corbet Woodall, Mr. William Cash, and Mr. T. Rigby (Deputy-Chairman)—had engagements which prevented them being present. Mr. W. W. Topley (Secretary), and Mr. A. Caddick (Mr. Helps' chief engineering assistant), and many other members of the staff were there prepared to guide and render information. The visitors were divided into groups, and taken round the works.

A GENERAL VIEW OF THE CROYDON GAS COMPANY'S WORKS, WITH THE LARGE RECREATION GROUND IN THE FOREFRONT.

The banks of luxuriant flowers bordering the road from the main entrance delighted them; as did every part of the works, the size of which came better than that of the more extensive London works within the comprehension of the greater number. They wandered through the retort-houses, and witnessed the machinery at work; and in the last house to be converted, they saw how a pair of West's machines had been converted, at comparatively small expense, so as to be capable of dealing with almost full charges. The coke plant was examined with keen interest; but from among it all the new Marcus coke screen, conveyor, and loading plant was singled out for the greatest attention. The water-gas plant, Marsh's rotary meters, Colman's cyclone, the process for dealing with naphthalene, the condensing and washing plant in one house in the new section, and the magnificent purifying-plant all came in for notice and admiration. Lastly, the men's recreation ground was visited—the finest attached to a gas-works, we should imagine, in the South of England—and this appealed very strongly to the German visitors. Co-partnership and such provision as this are regarded by them as being of the best of influences against the socialistic tendencies of the times.

On this recreation ground photographs of the group of visitors and their hosts were taken; and then a walk through the works brought us to the large stove-shops and stores, one of which had been cleared and decorated, and made into an excellent tea-room. The German and British flags were conspicuous companions. One German visitor remarked that their British gas friends must have "spent much" on German flags; but it was a delicate token of amity, which was highly appreciated. After tea, there was a little speech-making.

Mr. Charles Hussey said it was his proud privilege, as Chairman of the Croydon Gas Company, on behalf of his brother Directors and himself, to bid their guests a very hearty welcome to the works. He could assure all present that it had given them the greatest pleasure; and he hoped the works they had passed through during the afternoon (although, of course, they did not expect they would compare in any sense with the works their visitors had seen during their short stay in this country) had been interesting to them. At any rate, on behalf of their Engineer (Mr. J. W. Helps) he wished to say that it had been a great pleasure indeed to him to show their German friends round the works. Croydon (like many towns he expected in Germany) had not always been the size it was now. It had small beginnings, and had gradually crept up until at present the population of the town was about 164,000; and to this figure it had grown within his own knowledge from 44,000. With this growth they had been able to keep pace in the manufacture of gas, and in the supply of the burgesses. He would like to couple with the toast of "Prosperity to the German Association," the name of Herr Prenger and Dr. Karl Bunte. It was also a great pleasure to have with them Mr. Alexander Wilson, the President of the Institution of Gas Engineers, many of the members of which paid them a visit in the summer. The Directors liked to receive their technical friends there, because they were proud of the works, and proud of their Engineer. (Applause.) Mr. Helps had been with them for nearly 27 years; and he (the Chairman) hoped it would be as long again before he left them.

Herr Prenger, in reply, said their heartiest thanks were due to the Chairman for the kind words he had used. He could assure their hosts that it had been a great pleasure to them to visit the very fine, clean, and well-appointed works of the Croydon Gas Company. The day before they had visited the Beckton Gas-Works, which were only visible to them by express train. This [Tuesday] morning they had visited the East Greenwich Gas-Works of the South Metropolitan Company, which were only visible to them by the use of motor-cars. [Laughter.] They had that afternoon been able to see on foot the excellently planned buildings and plant in all their details of the Croydon Company. They had noticed at the entrance to the works how beautiful flowers could be grown in a gas-works; and they had seen in the machines, and in every other direction, how even a gas-works could be kept clean. Mr. Helps had been most modest in showing them his works; but all his friends from Germany could subscribe to the statement of the Chairman that the works were such that they were justified in being proud of them, and of the Engineer who had built them. They thanked the Chairman and Directors of the Company; and they drank to the health of Mr. Helps.

Mr. Helps, in acknowledgment, said that he was proud to have the opportunity of seeing so many of his German friends there that day. With regard to the works, he thought the visitors would agree with him that they were moulded to a certain extent on the lines of some of the works on the Continent. He had paid many visits to the Continent, and especially to Germany; and he had always returned with some ideas which he hoped he had managed to convey to the works which had been erected at the command of his Directors. He thanked Herr Prenger most heartily for his kindly remarks.

Shortly afterwards, we were all again aboard the cars, waving adieus to hosts, and then tearing over the roads through Mitcham to the main road to London, proceeding *viâ* Streatham and Brixton. Westminster Palace Hotel was reached before 6.30; and that evening and next day were free to the visitors to engage their time as best suited them and their inclinations. Some visited places of entertainment on Tuesday evening, but not a small proportion took the opportunity of inspecting the newest forms of gas lighting in London streets. During Wednesday, too, many were diligently inquiring in various quarters respecting commercial gas matters in London—several finding their way to the Horseferry Road offices of the Gaslight and Coke Company, to obtain information from the Controller of Gas Sales (Mr. F. W. Goodenough). As mentioned elsewhere, too, Herr Prenger, with Herr Kordt (accompanied by Mr. Alexander Wilson and Mr. S. Y. Shoubridge) visited the grave of Sir George Livesey, and placed a wreath upon it in the name of the German Association.

TO SCOTLAND.

Platform No. 14 at Euston Station of the London and North-Western Railway presented a busy scene from eleven o'clock on Wednesday night for the space of about forty minutes. A special train composed of sleeping cars had been engaged to transfer the visitors from London to Scotland during the night; first visiting Edinburgh and then Glasgow—the city which absorbs the professional activities of Mr. Wilson The party numbered ninety; and dealing with the luggage of, and the handing of tickets to, such a number, was not a small matter. But the compartments had previously been allotted, tickets for the whole journey enveloped and named, and luggage labels provided by Mr. Dunn; so that everything went off with mechanical precision. At 11.40 we steamed out of the station; and the travellers were soon in the arms of Morpheus. The train, however, was nearly an hour late in reaching Edinburgh, fogs having caused some delay during the night. On arrival, Mr. W. R. Herring was there to receive the visitors; as well as Mr. Canning Williams (lately removed from Reading to take up the position of Treasurer to the Edinburgh and Leith Gas Commissioners). Mr. J. Ferguson Bell (the Junior Vice-President of the Institution) was also present, and Mr. Charles Wood, Mr. John Bond, and probably (but at the time unnoted) others had come through to meet the travellers. Breakfast was served in one of the rooms of the Caledonian Hotel. Afterwards a special train was boarded, and soon the members found themselves on the platform of the private station

AT THE GRANTON GAS-WORKS.

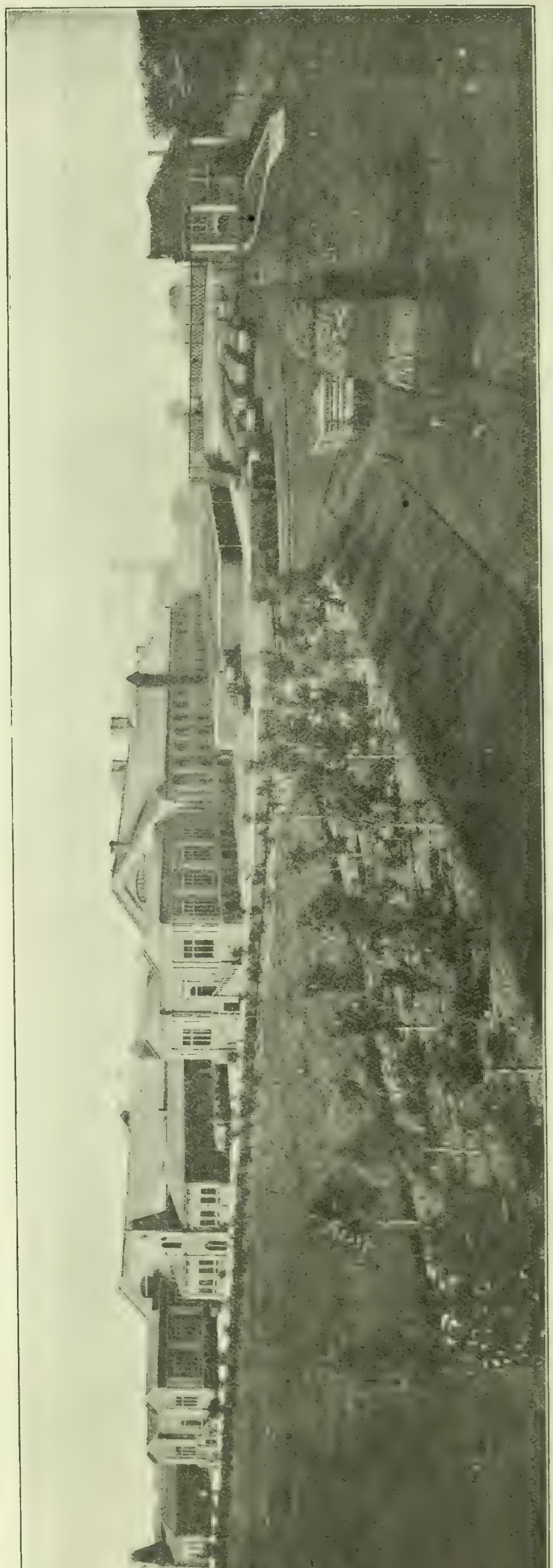
There was reception here by the representatives of the civic life and Gas Commissioners of Edinburgh and Leith whose names precede the report of the speeches at the luncheon. The visitors were quickly face to face with the greatest engineering feat in Mr. W. R. Herring's life-work. Knowledge of the works had already reached Germany through the "JOURNAL;" and there was an anxiety to see the real thing. Immediately the visitors were on the works, they grasped the systematic simplicity of the plans of the Engineer, from the arrangement of his railway lines throughout. The architectural features of the buildings (which give an impression of costliness, but which Mr. Herring has demonstrated really represents little more in outlay than plain brick building) were highly admired by these Continental practitioners; and no doubt before they left many of them learned that, in designing the works, the Engineer had to take into account the fact that the susceptibilities of the people of Edinburgh were not to be tormented when they turned their eyes in the direction of Granton. The Engineer succeeded in this matter. In going round the works, Mr. Herring was assisted by his successor-elect in the Engineership (Mr. Herring on his removal to London will continue to act in an advisory and supervisory capacity), Mr. A. Masterton, and the members of the staff generally—principally Mr. John Davie, Mr. H. Gracie, Mr. D. Bisset, and Mr. J. Jamieson. It was a beautiful day; the sun shining brilliantly. The huge creation, certifying great engineering skill, looked under these conditions at its very best. The route marked out for the inspection took the visitors from the coal-truck tipping arrangements through to the ammonia products works. The coal was seen broken, conveyed to the elevating plant, and removed to the hoppers at the top of the house in No. 2 section.

The inclined retort-settings were inspected; and at the end of the house was found the vertical retort-setting with which Mr. Herring is experimenting, but about which there is yet nothing special to say. Mr. Herring's ideas in this matter have already been described in the "JOURNAL;" and now he is merely continuing his experiments for information and improvement. The plant can be worked intermittently or continuously just as desired. It has an outside producer, and deals with 20 tons of Scotch coal a day—the producer, by the way, being of ample capacity for several more settings. It was noticed that the coke came out small; and Mr. Herring explained that his coke extractor was provided with claws specially for breaking the coke, as his principal market demands that it shall be small; and extraction and breaking are therefore done in one operation. Passing along, the company visited the exhauster and machinery rooms, the power house, the coke plant, the condensing and washing plant, the pumping-station, the purifying-house, the high-pressure plant, the workshops—in fact, every place was open to inspection; the last to be examined being the ammonia products works.

Returning to the main buildings, it was found that the technical office had been converted into a luncheon room; the decorations again showing, by flags and other emblems, Germany and England united. While we were waiting for the appointed time to arrive for the luncheon, Piper-Major Anderson (who is employed on the works), in Highland garb, entertained the visitors by an exhibition of his talented handling of the bagpipes. At the luncheon, Lord Provost Brown (Edinburgh) presided; and near him sat the two Presidents (Herr Prenger and Mr. Alexander Wilson), Herr Kordt, Dr. Bunte, and Mr. Herring. Present, among others, were: Provost Smith, of Leith, Sir Richard Mackie, Bailies Cullen, Geddes, Laing, Lindsay, Stewart, and Tod; Treasurer Calder, of Leith; Convener of Trades Duncan; Judges Bryson, Carmichael, Inches, and Pennell; Councillors Lewis, Harvey, Lyon, M'Michael, Rawson, Stark, and Wilson.

After luncheon,

The LORD PROVOST, without comment, gave the two toasts of "The King," and "The German Emperor;" and they were both duly honoured.



A GENERAL VIEW OF THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

COKE TRANSMISSION AT THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

Provost SMITH (Leith) then gave the toast of "The German Association of Gas and Water Engineers." In the name of the Edinburgh and Leith Gas Commissioners, he offered the visitors a hearty welcome, and went on to say that they included eighty representatives of important public services, who were visiting not only Scotland but England, on an educational tour of inspection under the able presidency of Herr Prenger, who was the Manager of the Gas, Water, and Electrical Departments at Cologne. It would be invidious to name particular individuals from among so large a gathering of men eminent in their profession; but he might be permitted to express extreme regret that Professor Bunte, of world-wide scientific fame, and who had done so much to organize the visit, had been unable to take part in the journey. He was well aware that the feeling of friendship and brotherhood between the British and German Engineers was of no recent growth, but, on the contrary, of long standing; and that on more than one occasion British engineers had enjoyed the good fellowship and hospitality of their German brethren. The Gas Commissioners of Edinburgh and Leith had not forgotten the courtesy and attention shown to themselves some thirteen years ago, when a small Committee, accompanied by their Engineer, made an extended tour of the German works, and were on that occasion received with the utmost courtesy, and given every opportunity for inspecting and assimilating the leading features of the different works at which they called. They were, therefore, glad to welcome such an important and representative body of the industry of the great Empire of Germany; and they to some extent realized that their own works, which they had had an opportunity of inspecting that morning, were the outcome of both German and British thought. The gas undertaking carried a capital burden representing actual expenditure to the extent of £1,621,871, much of which was unfortunately obsolete capital, represented by the purchase of the original works. The liquidation of the dead capital, however, was proceeding apace; and no less a sum than £45,906 per annum was being contributed towards the extinction of the capital debt. The water-works, though not a commercial undertaking in the same sense as the gas undertaking, were a still larger factor—involving a capital outlay of £2,818,870, against which there was an annual contribution of £38,178 towards the extinction of the capital debt. They would be interested to know that the Granton Gas-Works were completed at nearly £30,000 below the estimated cost of £645,000; their Engineer, Mr. W. R. Herring, being the architect and engineer in their construction. It was gratifying also to observe that the working results were better by some 5 per cent. than was estimated, and that in the works more could be taken from a ton of coal than anywhere else in Scotland. The result of this was that, whereas prior to the erection of the works, the price of gas in the district was never less than 3s. per 1000 cubic feet, it now stood at 2s. 8d. for lighting, and 2s. 3d. for trade purposes, and would no doubt have been considerably reduced but for the heavy burden of old debt, to which reference had already been made. The visitors would also have observed the comparatively favourable conditions under which the workmen discharged their duties. They were provided with baths and canteens, and were enabled to carry on their work under what might be regarded as cleanly and wholesome conditions. The extensive use of machinery had brought the functions of the brain rather than of the muscle into fuller operation; and the Commissioners had the gratification of knowing that their employees were giving every satisfaction, and appreciated very highly what had been done for them. He need scarcely add that it had been a great pleasure to the Commissioners to have the opportunity of meeting so distinguished a company of German representatives, and hoped they had learned something by their visit to this country that might be of service to them when they returned to their homes. They trusted also that these and similar visits would tend to remove any misunderstandings that might exist, and to still further strengthen the feeling of kinship and of affection which they hoped would always subsist between their great country and our own.

The toast was enthusiastically received.

Herr PRENGER replied in the German language; his remarks, which were to the following effect, being afterwards interpreted by Dr. Lessing. After they had seen for two days, he said, the great works of the Metropolis, they came North to inspect, in the Scottish Capital, the works which the two towns of Edinburgh and Leith had at Granton. They came with the feeling that the Scottish people were, both in character and disposition, similar to Germans. Their patriotism, their love of home and of country, were both the same as they found it at home. They had, however, come as men of work, who wanted to find out the technical achievements which might have been made in this country. They had come to see one of the greatest engineering feats in the world—the Forth Bridge. They had seen at a glance what a beautiful gas-works they had there—the whole disposition, so clean, so simple, and so particularly suited to the work that had to be done. By simple means a lot had been achieved there; and beauty had not been forgotten in building the works, although it had been beauty from a utilitarian standpoint—simple and with a view to its objects. The works were a sign of the eminent capacity of their Engineer—Mr. Herring. The capital of Scotland and the town of Leith could be proud of what they had got there. They could be proud of their Engineer, and he was sure they all felt that it was a pity that Mr. Herring was going away from them. But he would be with them yet, and would co-operate with them, and would keep his paternal eyes on his creation. They saw there an example which they could safely take home with them to Germany, to copy, in the two towns of Edinburgh and Leith combining to build such beautiful works, and by this means bring about the highest possible economy and usefulness for the Corporations. It must often happen that there were people who, with narrow-mindedness, could only say: "This is my border, and my consideration is not extended beyond this." Many small works sprang up in consequence of this, and economy was not attempted. There they had two towns which had co-operated for the good of their citizens, and for the good of their country. They would take this example of true economy with them, and would try to emulate it. He thanked the Commissioners for the very kind hospitality which had been extended to them. He could only repeat that they had seen there much to take home with them. They had been received in the most hospitable spirit; and he asked his German colleagues to give expression to their thanks for all that had been done for them; for all the arrangements

which had been made, including the weather. [The concluding remark was received with loud cheering and laughter.]

Herr KORDT, in proposing "The Lord Provost and the Gas Commissioners of Edinburgh and Leith," said they had just come from the largest city in the world, where they had seen the biggest gas-works imaginable; but now they had come to a town which was famous for its art and science, and they would notice that in these gas-works regard had been had to art in perfection. The Gas Commissioners had done all they possibly could have done. They gave the funds to build these new works; and their wisest action, no doubt, had been in entrusting to their Engineer—Mr. Herring—the carrying out of the works. Not only were the works very beautifully arranged, but the beauty of them was of a practical nature. Human labour had been, wherever possible, replaced by mechanical means, so that it was not possible to see in them such scenes as were shown in the pictures on the walls of the room. [This referred to some old pictures of retort-house working, with men, almost naked, scoop driving.] The works had been built in the period of inclined retort construction; but they had seen that morning that Mr. Herring had already taken steps to go in for the construction of vertical retorts; and they were certain that, with his energy and knowledge of the work, he would be able to achieve the best in this direction. They hoped that his services would long be connected with the undertaking. He was, on the other hand, to be congratulated on serving under Commissioners who gave him the hearty support which alone made it possible to bring works of this kind to the height of perfection. He asked his colleagues, both English and German, to join with him in congratulations to the Commissioners.

Lord Provost BROWN, in response, said he endorsed all that had been said by the Provost of Leith. As Chairman of the Gas Commissioners and of the Water Trust, he gave them all a very hearty welcome to the place, and everyone desired that the visitors should go away realizing that they were in earnest when they said to them that the oftener there were meetings such as the present the better for the nations at large. The oftener that professional gentlemen, and working men—aye, and Statesmen likewise—met one another, as they were met that day, the less danger was there of the misunderstandings which they were constantly reading about, and having dinned into their ears, in the Press, from day to day. He was quite sure that a few decades ago, when cholera abounded at Hamburg and elsewhere, the engineers who came from Germany learned lessons, just as the Commissioners learned lessons in Germany, when they went there to take the advantage which was so kindly afforded them of seeing their works. It was quite true what the Provost of Leith had said about the price of gas; but he did not tell them (what they knew themselves) that while they were getting cheaper gas, they were not getting gas of the same quality, and that the consumers were not going to allow them to make too much of having cheap gas, because cheap gas meant expenses in other directions. He could assure them that they regretted very much that they were going to lose the services of their Engineer. He supposed that, although they had offered Mr. Herring a great deal more, they could not have kept him; he was in such demand all over the country as a skilled witness. Again, he said that they cordially welcomed their guests there that day, and trusted their sojourn in Scotland might be of such a nature that they would carry home to their own land pleasant and happy recollections.

The proceedings were brought to a close by the singing of a verse of "Auld Lang Syne."

Outside, motor chars-à-bancs were waiting; and these the visitors mounted, and, with cheers of farewell to their hosts and Mr. Herring, they left Granton to visit the Forth Bridge. A close inspection of such an engineering achievement as this could not be missed by any body of engineers visiting Edinburgh for the first time. But there was not much time to spare for lingering in its neighbourhood; and from there departure had to be made in time to catch the special for Glasgow at 5.10. *En route*, the visitors had much to talk about regarding their visit to Edinburgh. Then as we approached Glasgow, the great shafts of the factories in the outskirts attracted attention, belching forth continuous clouds of dense smoke. The visitors had heard of the crusade the Glasgow authorities had commenced against the pollution of the atmosphere by smoke; and they recognized what a big task they had taken in hand in the attempted suppression of this waste and nuisance.

IN GLASGOW AND THE BANQUET.

The Central Station Hotel at Glasgow was our destination; and by about 6.15 we were there. Rooms had already been allocated; and Dr. Bunte, Dr. Lessing, and Mr. Dunn were immediately engaged handing out the tickets to the members. As an instance of the completeness of the arrangements made for the comfort of the travellers, it may be mentioned that the bags that had been left on board the train at Edinburgh in the morning were found, each in its owner's bedroom, at Glasgow. Little time remained for dressing, to keep the appointment with the Lord Provost of Glasgow and the Convener and members of the Corporation Gas Committee, at a banquet at the City Chambers. Arriving there, the visitors were charmed with the beautiful and artistic architectural features of this far-famed home of civic administration, and when they reached the magnificent banqueting hall, they were inexpressibly delighted with its magnificence. But after all it only exemplifies the richness of the hospitality of the Glasgow City Council to the "strangers within their gates," who may be paying formal visit after the manner of our German friends. Some 246 sat down to the banquet; and a neighbour from across the North Sea whispered that it was "a great time." There was agreement.

Lord Provost M'INNES SHAW presided, and was supported on the right by Herr Prenger, Mr. Alex. Wilson, Deacon Convener M'Lennan, Dr. Paul Rottenburg, of Glasgow, Dr. K. Bünte, Dr. Beilby, Dr. Crawford, Herr Hasse, Herr Kobbert, and Dr. Lessing; and on the left by Bailie Dunlop, Herr Kordt, Mr. M. W. Montgomery, Herr Heidenreich, Sir John Ure Primrose, Bart., Herr Müller, Bailie Borland, the Rev. Alex. Brown, of Pollokshields, Herr Möllers, ex-Bailie Calderwood, Sir Wm. Bilsland, Bart., Herr Pfudel, Dr. Schütte, Herr Pohmer, Sir Nathaniel Dunlop. The croupiers were Bailies Russell, Paxton, Kirkland, and Guest, and Councillors W. B. Smith and W. Nelson.

The LORD PROVOST gave, in succession, the toasts of "The King;" "The Queen, Queen Alexandra, The Prince of Wales, and the Other Members of the Royal Family;" and "His Imperial Majesty the Emperor of Germany." These were all duly honoured.

The LORD PROVOST then said that, unfortunately for him, he had to leave this interesting function, to fulfil another important engagement, which he had contracted before he knew that they were to be honoured by the presence of their distinguished guests that evening. He could not, however, take his departure without voicing the feelings of satisfaction and pleasure with which his colleagues and he received their German friends that night. He spoke, he knew, for the whole community, when he bade them a hearty welcome to the City of Glasgow, in which, he was sure, they would find many things to interest them, and many points of similarity with the progressive and enlightened towns of their own country. The feelings of friendship and amity between the Germans and the British were of the warmest nature. Commercially and scientifically, they stood side by side; and there were no limits to the possibilities for good throughout the world, from the friendly co-operation of Germany and Great Britain. They would be untrue to their traditions, both personal and political, if anything but the most harmonious sentiments animated either of their peoples. They welcomed, therefore, with the greatest pleasure, the members of the German Association of Gas and Water Engineers in Glasgow, and congratulated them on their scientific achievements. Scotland gave to the world the inventor of gas—as it had kindly given the inventors of many other things—in the person of William Murdoch; but Germany had done much to perfect and develop subsequent processes and methods in the science of illumination. He could not leave the table without expressing his personal gratification at meeting them; and he wished them the very best of times in Glasgow.

Bailie DUNLOP, the Senior Magistrate, took the chair on the departure of the Lord Provost, and called for the next toast.

Councillor M. W. MONTGOMERY, the Convener of the Gas Committee of the Corporation, proposed "The Members of the German Association of Gas and Water Engineers." He said he had the greatest possible pleasure in submitting the toast. He felt, however, in very considerable difficulty, in view of the remarks which had been made by the Lord Provost. He had prepared an elaborate speech, by way of welcome to their German guests; but the Lord Provost had extended to them a welcome which, he thought, for warmth and cordiality, left nothing to be desired. His difficulty was to get on to his feet again; but the occasion was such that he thought, no one need feel very great difficulty in expressing his feelings. He was extremely delighted to see so many of their German friends there that evening. He was only sorry that their arrangements would not permit of their making a longer stay in Glasgow. Just fancy, they had arrived that night, and he understood that they had arranged to leave about two o'clock the next day. This did not give them the opportunity which they would like, of showing their friends all they would wish them to see, and of expressing to the full their appreciation of the visit. He greatly approved of visits of this character. He believed that they did a great amount of good. In these times, telephones and telegraphs, and rapid transit, undoubtedly did much to knit communities and countries more closely together; but he affirmed that, over and above all these things, and he believed more effectual than them all, was interchange and intercommunication between representative bodies such as that which had honoured them by their presence that night. They were divided by the seas, and they belonged to different nationalities; but when they came together, and when they exchanged opinions one with another, they found that, after all, they were striving after the same things, and attempting to solve the same problems. And, as they conversed and exchanged thoughts one with another, they really found that, after all, the distance between Germany and themselves was not so very great. He need scarcely touch upon the remarkable effect which interchanges of this kind had upon international relations. Their guests that night represented the great gas industry of Germany. It was common knowledge that in scientific attainments, and in technical knowledge, the German people had, and still occupied, an honoured place among the nations of the world. While this was true in general of the German people, it was, he could assure them, particularly true in relation to the gas industry. The Lord Provost had told them that they, in Scotland, claimed to have, as a countryman, the inventor of gas. They were naturally proud of the fact that William Murdoch, somewhere about 1792, lighted up his own house with gas, and thus introduced into the world an industry which was destined to have a great future, and which had developed into a tremendous industry all the world over. But, while saying so, he would like his hearers to quite understand that very important improvements in the methods of gas production, and in methods of lighting, they owed to an enormous extent to German enterprise, to German skill, and to German research. In confirmation of this statement, they knew that many of their engineers had visited Germany from time to time, and when there, he must say, they had received the very kindest and most hospitable treatment. They, in Glasgow, were therefore glad to have this opportunity of reciprocating, even to a small degree, the many kindnesses which they had often experienced at the hands of their German friends. Some time ago, a deputation was arranged by the Corporation of Glasgow to visit Berlin in connection with the Gas Department; and the gentlemen who went received not only the education and information which they wanted, but they also received the greatest kindness and consideration and hospitality at the hands of their German friends. They could not mention their German friends in connection with the gas industry without thinking of the name of Welsbach, and of the marvellous invention, and the great diffusion of light which had accompanied it, which had done more than anything else to give a new lease

of life to the gas industry. He was sure of this, that all their improvements, and all their skill, would have been as nothing but for this great invention—the incandescent mantle. They would observe that their friends were an Association of Gas and Water Engineers. He was not quite sure whether they wanted him to turn off gas and plunge into water. Time would not allow him to do so, however; but he felt one genuine regret, which was that their visitors had not time to visit their water-works at Loch Katrine, where, he was sure, they would see a combination of natural beauty and engineering skill which was rarely to be found. He would like their visitors to understand that they were most delighted to see them there; and they trusted that during their stay in Glasgow they would see something which would increase their appreciation of the work done in the city, and, inferentially perhaps, increase their appreciation of themselves as well. He had great pleasure in coupling with the toast the name of Herr Direktor Prenger; and he hoped they would give the toast a rousing reception, and show how greatly they appreciated the visit of their German friends.

The toast was received with great cordiality.

Herr Prenger (who was received with loud cheers), in responding, said the kind words that had fallen from Councillor Montgomery had put him in a state of delight. After having seen the beautiful capital of Scotland and the engineering achievement of the Forth Bridge, they had arrived at the large industrial city of Glasgow. Here commerce, industry, and shipbuilding were the important features of the ancient city. Here it was that an enterprising people were, in their endeavours, one with Germany; and it was quite clear that their energy had left its mark on the technical institutions of the city. As engineers, they noted that the gas, water, and tramway systems were under the Corporation; and, as technologists, it was with pleasure that they heard of their Technological Institution. But above all, they were overwhelmed by the kind reception they had received at the hands of the municipal authority. The Lord Provost had spoken of the cordial relations between the two nations, and said there never could or should be a discordant note in these relations. As Germans, they subscribed to this sentiment with every fibre. Only people high in culture really achieved benefits to mankind, which, after all, were the objects of human endeavour. They were all very delighted by the kind words of welcome which had been spoken; and it added to their pleasure to come to the country that was the birthplace of the inventor of gas lighting. They were sure of this—that Glasgow always upheld the principles that were laid down by Murdoch, and that the gas supply of the city was of the highest character. In proof of this, stood their friend the Engineer and Manager of the gas-works; and further proof was seen in his selection as President of the Institution of Gas Engineers. Both the Lord Provost and Mr. Councillor Montgomery had spoken of the achievements of gas engineers. During the four days he and his fellow-members of the German Association had spent in this country, they had seen enough to satisfy them that Great Britain was in every respect capable of maintaining its position among the nations in their industry. He was sorry they had only come for so short a stay; but the winter's work was before them, and mankind prayed for light. They would be extremely glad to stop here longer; but their stay could now only be counted by hours. Their most sincere thanks, however, were due to all of them, not only for the interesting things they had seen in their capacity as technologists, but at the cordial and kind hospitality they had received in Great Britain.

Herr Kordt, in proposing "The Corporation of Glasgow," said that morning he had the opportunity of giving his impressions of Edinburgh, with its art and sciences. His first impression of Glasgow was that it was a centre of science, commerce, and industry; and the factories were a proof of the energy with which the work was carried on. They had heard from Mr. Wilson during the week as to the determination of the Corporation to combat most strenuously the terrible nuisance produced by the smoke; and in this endeavour the Corporation had hearty support. One could not help admiring the pluck and determination with which the Corporation were attacking this problem. But Mr. Wilson would do his part in carrying out the wishes of the civic authority in this matter.

The Chairman said he regretted that the Lord Provost was unable to remain to reply to this toast; but he and all his colleagues were pleased to welcome so many friends from that great country, Germany. In the speeches which had been made, they had referred to Scotland in the most flattering terms; and they showed that Scotland was a country to be reckoned with. Scotsmen in like manner had a great and sincere respect for the mighty Empire of Germany. If there was one country in the world at the present time that had been a model to them, that country was Germany. The competition of this wonderful country had inspired Scotsmen, who saw they must do all they could to maintain their supremacy. [Laughter.] A few years ago the idea of a Technical College in Glasgow was not heard of; but they learned that Germany was getting before them in this respect, and they said that Scotland must keep well to the front. Therefore there was a brotherhood between the members of the two nations. The very idea that the two countries should ever quarrel with each other was barbaric. Both nations had a great work to do in the world; and he believed they were doing it. Their meeting that day, though only perhaps in a small way, helped to combine the two nations. The citizens of Glasgow were delighted to extend a welcome to their friends from Germany. Many British gas engineers had visited Germany; and they had always been received hospitably. It was with great pleasure they had now the opportunity of extending the hand of friendship and hospitality to their German friends.

Bailie Paxton proposed the toast of "The Institution of Gas Engineers." He remarked that the Gas Committee realized the great importance of the Institution in the British Isles, and had year after year sent a deputation to the annual conference. He had himself had the honour and pleasure of representing the Gas Committee at the annual conference on two or three occasions; and he could assure his colleagues that no deputation was sent from the Corporation of Glasgow which was more important or learned more of the scientific aspects of gas production even from the layman's point of view. He did not pretend to have any scientific knowledge of the making of gas; but even by the mere layman a great deal could be learned. He had noticed that the deliberations of the Institution were of the most technical character; and it had occurred to him that if the Institution would add a much broader representation of commercial men interested in gas it would be a great improvement, and of benefit to the gas undertakings of the country. He would suggest to the worthy President—their own able and estimable Gas Engineer and Manager—that something should be done to educate many of the gas administrators on the distribution side of gas supply. He submitted that there was a great deal to be considered and done at the present time in addition to the real manufacture of gas. In Glasgow, they were at present engaged in a crusade against an impure atmosphere; and it rested in great measure with the Institution of Gas Engineers to provide (he wished some genius would arise to give) a smokeless fuel. A great opportunity had now arisen; and he hoped that something would quickly come to take the place of the burning of coal. Next year they were going to have in Glasgow a Scottish Industrial Exhibition. The Institution of Gas Engineers were also coming to Glasgow for their annual conference, under the presidency of their friend Mr. Wilson; and as he (Bailie Paxton) explained to the members of the Institution when he was in London last June, a very hearty welcome awaited them in the city. He hoped when they came they would be able to say something to help in the matter of this awful scourge of a polluted atmosphere.

Amid much laughter, the band struck up "Lead, Kindly Light, amid the Encircling Gloom." The banqueting hall was electrically lighted; and the speech just heard had, as seen, largely directed attention to the murky atmosphere of the city.

The Institution and its Work.

Mr. Wilson, the President of the Institution (who was received with ringing and continuous cheering), said that if Herr Prenger was overwhelmed with the reception he received, he was afraid he (the speaker) ought, after such an ovation, to bow his modest head. The author of the interesting air they had just heard suggested many thoughts; but he did not think he would dwell upon them now. The idea, however, of playing "Lead, Kindly Light," to a gas engineer was almost too flattering. They were quite aware that in lighting the gas undertaking always did the leading. His friend Bailie Paxton had spoken of the importance of the Institution of Gas Engineers; and he was sure the members of the Institution would take his words as coming from his heart—he having on many occasions attended the annual meetings, and had seen the work that was undertaken at these meetings. He knew that the whole of the members were earnest in their work; and it would be seen from what he had said that he thought the Institution was almost too technical. But he (the President) would point out to Bailie Paxton and others that the Institution must be technical; and they must follow out the lines of their technique to the utmost, if they wished to do the best they could for the gas industry and all the citizens whom they served. But Bailie Paxton had touched on a point with which he was sure all gas engineers would agree. He had been struck with the onesidedness of the meetings; and he thought, as a layman, that they would do much better if they introduced more of the commercial element at the gatherings. Perhaps he might tell Bailie Paxton that this idea had been brought forward by one of the most eminent men in the Institution at the present time. He referred to his friend Mr. James Helps. It was felt the Institution had a great deal more to do than the mere manufacture of gas. Of course, their first wish was to make and sell gas as cheaply as possible. This was certainly the first object of gas engineers. The next was they had to consider the question of getting a good outlet for the gas; and they could best do this by taking up the commercial side of the business, and by training men on that side as well as in the fundamental science of gas engineering. He had also spoken in London on this very point; and he was glad to think that Bailie Paxton was impressed by the importance of it. He thought also the gas industry ought to undertake in a more forcible way than it had done the education of their different communities in the proper uses of gas; and he was quite certain that if the Corporations, the gas companies, and the Institution all worked together, they would not only make the gas industry a very prosperous one, but they would also do a great deal towards the object that Glasgow had taken up so heartily—that was, the abatement of smoke in cities. There was no doubt that much might be done with smokeless solid fuels; but so far as he was concerned, he was more impressed with supplying gas of reasonable candle power, or rather reasonable calorific power, at the lowest possible price, because he thought that in gas they had one of the most convenient fuels that it was possible for the citizens to have, either for domestic or commercial purposes. Gas did not require storage by consumers; all that was required was the mere turning of a tap to get the necessary heating power. He supposed he felt rather strongly on this smoke abatement question. They had—as many of those present knew—a Smoke Abatement Exhibition now open in the city, and he wanted to bring the subject before the public as strongly as possibly, and, before the members of the Institution, the necessity and importance of advising and educating the public as to the proper uses of gas. With reference to the visit of their German friends, he could only add—what had been said by the Lord Provost, by Councillor Montgomery, and Bailie Dunlop—as to the feeling of dissatisfaction that their visitors were to be with them so short a time. They could have wished them to stay, not for a few hours but several days. If they could have given them a whole week in Glasgow, the city could have shown them not only matters of interest and importance in connection with the gas industry, but in regard to many of the other manufacturing industries of Glasgow. He hoped that at some future time they would have the pleasure of welcoming them again; and perhaps on another occasion they would be able to spare a little more of their valuable time. The Institution of Gas Engineers, however, had been favoured by having their German friends with them so long as a week. As the President of the Institution, he should like to thank the Gas Companies in London and the Corporations of Edinburgh and Glasgow for the interest they had taken in their German friends, and for the kindly way in which they had received them. The Institution were quite sure that would be the case; and that the projected visit had only to be brought before their various governing bodies to ensure a very hearty reception. He had likewise to thank Bailie Paxton for the kind way he had proposed the toast; and their visitors for the handsome manner in which they had received it.

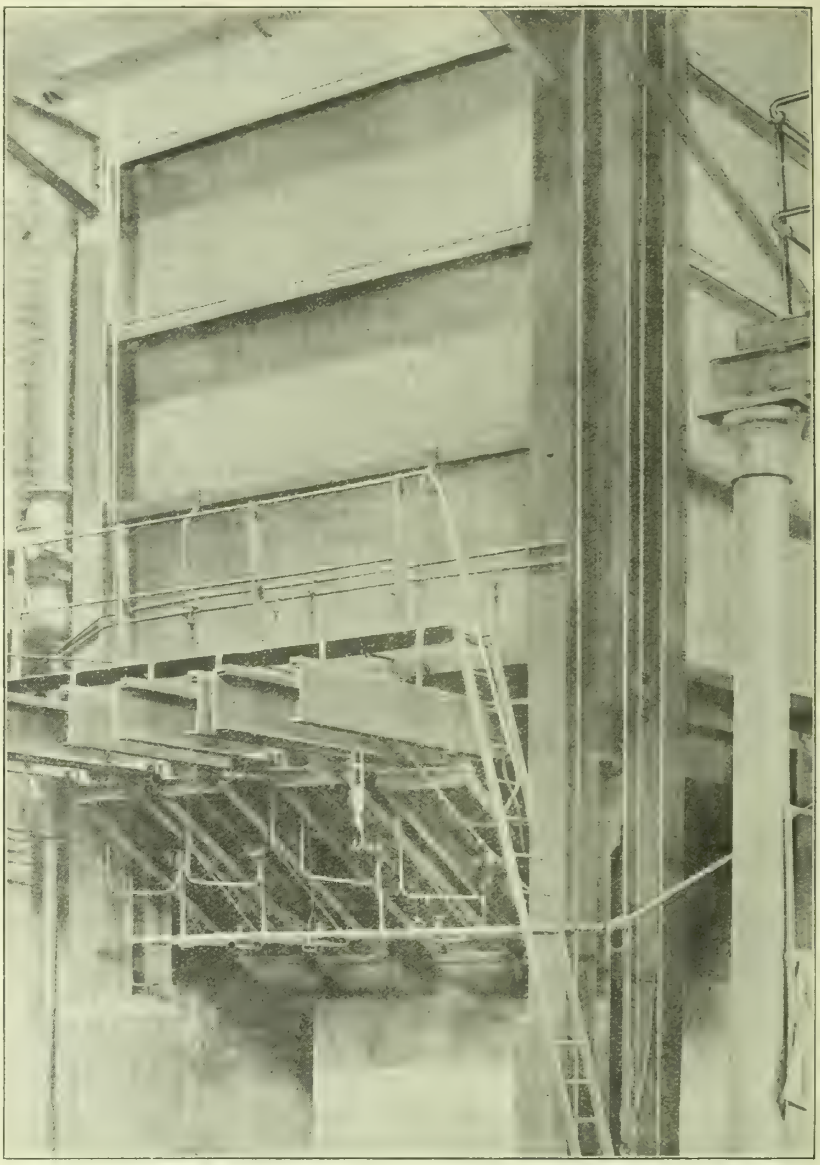
During the banquet and after proceedings, a splendid programme of music was rendered; and the introduction at intervals of some half-dozen pipers, who marched round the magnificent banquetting hall, greatly delighted the German guests. But the end of an evening (which had flitted away all too quickly) had now arrived. Before parting, however, the Scotsmen sang, and the Englishmen tried to sing,

Will ye no come back again?
Will ye no come back again?
Better loo'ed ye could'na be,
Will ye no come back again?

Then with a chaining of hands "Auld Lang Syne" was sung with much enthusiasm. "God Save the King" followed. Adieus were said, and the guests of the city were back at the Central Hotel by about 11.30.

THE GLASGOW EXPERIMENTAL VERTICAL RETORT-SETTING.

Next morning some half-dozen or so of the visitors were up betimes to keep a little private engagement with Mr. Wilson to inspect his experimental vertical retort-setting at the Temple works. It was too far away, and there would have been delay in carrying through the morning's programme (full as it already was for the time at disposal), had there been a general invitation. And, as a matter of fact, Mr. Wilson's work in this direction has been entirely confined to developing a setting and a system of working suitable to Glasgow conditions and to the splint coal usually employed there for gas making. His experience so far with the trial verticals, has been very encouraging; and by the time he comes to write his Presidential Address next year, he will have considerably more to say about the setting and his longer experiences than can be told now. We will not trespass on the ground reserved for a future occasion, other than to give to-day a little general information from its borders. The setting that Mr. Wilson has developed is something between the continuous and the intermittent system, as complete evacuation and charging is known. There are, in all, four 20 feet tapered retorts in the setting; and the top of each retort is 4 ft. by 10 in. in section—the bottom being 4 ft. 8 in. by 18 in. The four retorts deal with 14 tons of Scotch splint coal per day, or 3 tons 10 cwt. per retort. At the bottom of the retort, there is a shoot covered by a water-sealed cap, operated by a small hydraulic piston. When the cap is opened, about one-fourth of the contents of the retort is allowed to run out—representing about 7 cwt. of coke; and then from 11 cwt. to 12 cwt. of coal is charged in at the top. This is an operation that is regularly performed about every four hours. As the lid is opened, and the coke falls out, the small quantity of water that has served as a seal comes with it; and by the appearance of the coke, no further quenching is likely to be required. This possibly is also partly due to the fact that the retort is heated on the principle of having the greatest temperature at the top and diminishing towards the bottom. Scotch coal, such as that employed at Glasgow, is not of a character that will permit of constant movement, as occurs in a continuous system; hence the idea of only subjecting the charge to four movements, and four hours' repose between each, from entrance to exit. Examination was made of the coke produced with this coal in horizontal working; and it was very small. The coke from the verticals is larger and somewhat harder, and Mr. Wilson mentioned that he could get a better price for it.



The Discharging Arrangements of the Trial Bed of Verticals at Glasgow, as Designed by Mr. Alexander Wilson.

Mounting to the top of the setting, the charging arrangements were inspected. A coal-hopper running on rails feeds the retorts every four hours, or one an hour, as already explained. The charging is through a vertical feed roller, slightly conical in form, and having an 8-inch opening, which for the purpose of charging is brought round in the casing so as to face the hopper mouthpiece. The producer is also fed through the top of the charging-stage. Among other points it was learned that the retorts only require scurfing about once every five or six weeks; but should there in the meantime be any little sticking of the charge from any cause, there is at the top of each retort a small hydraulic piston to assist the charge. This is not often required; but there it is ready for use. When a retort is scurfed, it is off at most for twelve hours; and when re-charging commences, the first part of the charge consists of coke, so as to form a bed for the coal. The simplicity and cleanliness of the whole arrangement are features that struck the visitors. About it, there can be no waste or loss. The setting has been in use about seven months; and there have been no interruption of regular working. This speaks well for the design.

With regard to results from the Scotch coal used, some four years ago, about 9200 cubic feet of gas were produced in horizontal working per ton of coal carbonized; now something like 10,000 cubic feet are obtained. At the time of the visit to the verticals, the return showed a make of 10,700 feet per ton. The illuminating power of the gas is between 16 to 18 candle power with the No. 2 burner. Mr. Wilson could not remember the calorific power off-hand; but he knew that it was somewhat higher than for gas from the horizontal retorts. The advantages are, using Scotch coal of the type employed here, a higher make, with no depreciation of candle power, a rather better calorific value, an improved coke, cleanly conditions, and, certainly, one man at the top of a bench of such settings and one at the bottom ought to be equal to (say) the production of 3 million cubic feet of gas a day.

AT TRADESTON, THE EXHIBITION, AND PROVAN.

The privileged few who had been to the Temple Station, were back at the Central Hotel with a few minutes to spare before, at 9.30, the morning's programme was entered upon. Motor cars took the large party first to the Tradeston works, the Manager of which is Mr. Alexander Smith. To him as well as to Mr. Wilson's other technical assistants—chiefly Mr. Walter Grafton (Assistant Engineer and Manager), Mr. John Webster (Manager at Provan), and Mr. Andrew M'Leod (Manager at Dawsholm)—the visitors owe much of the interest derived from the visits during the morning. The works are briefly described elsewhere; but the visitors were particularly interested in the works at both Tradeston and Provan that bear so much evidence of the stern engineering skill of the late Mr. William Foulis. At Tradeston they examined the Arrol-Foulis retort machinery with considerable interest; and were highly pleased with the trolley trains with their diminutive engines removing coke with rapidity from the retort-houses.

From Tradeston a visit was paid to the Smoke Abatement Exhibition, which was about due to close its doors. The gas section dominated (as was seen from our previous notice of the show) the whole of the other exhibits. But the visitors evinced no partizanship in making inspection; viewing the electric house with the same thoroughness as the gas exhibits, though there were indications of an inclination to combat some of the statements made as to costs for heating and other purposes. The latest British manufactures for the utilization of gas were examined with avidity—particularly those for heating water by gas. Yet another object of especial interest was the "Nonpareil" ventilating inverted gas

At the Provan Gas-Works of the Glasgow Corporation.

sun-burner for lighting large interiors, which is lighted and extinguished from a distant control switch.

Then to Provan we went; and there in a few cases renewed, but in the greater number of cases made for the first time, acquaintance with the last great engineering work that Mr. Foulis left behind him—again a monument to a magnificent ability and capability for making the best of local circumstances in the planning and designing of a large works. The plainness of the buildings, but in their very plainness bold and striking, were noted by the visitors. They were quick to detect, too, how the varying levels of the site had been made use of in letting the incoming coal pass downwards from coal-store to coke disposal. The huge range of outside producers were the subject of much inquiry. The first section of Provan has a capacity of 12 million cubic feet. "Will the second section," asked a German visitor, "be also equipped with horizontal retorts?" Even Mr. Wilson cannot yet answer the question. His longer experience with the vertical trial setting (referred to above) may answer it. All parts of the big plant were inspected; but another special feature of interest was the arrangements for feeding and emptying the purifiers—the former from the overhead enclosed gangway, and the latter through bottom outlets in the boxes. The men's accommodation for meals, for washing, for reading, and for other recreation was examined.

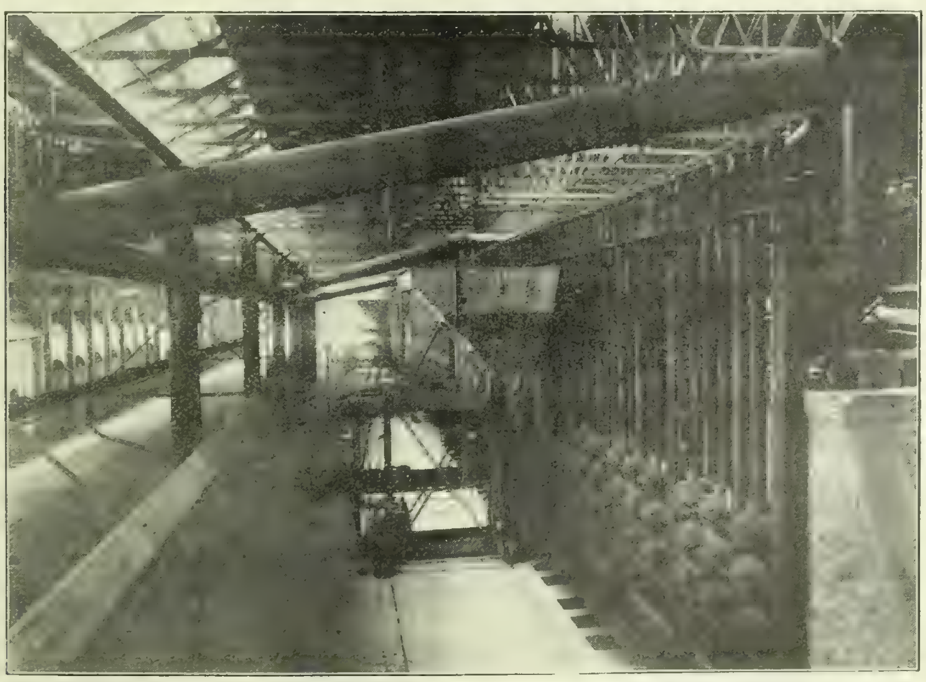
After passing through the huge works, the company were invited to partake of refreshments; and then a photographic record was made of the occasion. Immediately after Provan was added to the stock of memories associated with this visit, which will ever and again be revived when the beautifully illustrated souvenir is glanced at, in which excellent pictures of the works appear and photographs of some representatives of the Glasgow hosts.

TO LONDON AGAIN.

A smart run from Provan brought the party once more to the Central Hotel; and there were forty minutes or so to spare for minor preparations before the special train left for London. There was no personal worry throughout this long trip; and again it was found that the luggage was all ready for disposal in the train. Before the departure of the train, Mr. Councillor Montgomery came along, as did also Mrs. Wilson and the Misses Wilson, to bid the visitors "Good-bye" and a safe journey to their homes. This was the first time the German visitors had had an opportunity of meeting the President's wife and daughters; and the kindly thought that brought them to the station gave immense satisfaction to Herr Prenger and all those of his colleagues who had an opportunity of introduction and a shake of the hands. The nine hours spent on that "special" passed pleasantly. We lunched, we "tea'd," we dined—very appropriately (the major part of the travellers coming from Germany) on, as one wag ventured to point out, the intermittent system; we conversed, and we read. The train arrived at Euston about 11.15; and a quarter of an hour later, the motor-cars that had been sent to meet the travellers were all well on their way to the Westminster Palace Hotel.

A VALEDICTORY LUNCH.

Soon after noon on Saturday, many of the German visitors might have been seen going round the Japan-British Exhibition



Inside the Retort-House at the Provan Gas-Works of the Glasgow Corporation. An Arrol-Foulis Machine in the Foreground.

at Shepherd's Bush; and by 1.30, they were all assembled in the Garden Club at the invitation of the Institution of Gas Engineers, to a luncheon, at which "farewell" was to be said. The President (Mr. Alexander Wilson) presided, and ranged either side of him were Herr Prenger, Herr Kordt, Mr. Corbet Woodall, Dr. Bunte, Mr. J. W. Helps, Dr. O. Knublauch, Mr. S. Y. Shoubridge, Dr. Bueb, Mr. W. Doig Gibb, Mr. J. van Rossum du Chattel, Herr Pohmer, Mr. W. T. Reid, Herr Zolliköfer, Mr. T. Goulden, Herr H. Koppers, Mr. H. F. Andressen, and Herr Bernauer. There was one vacant chair at the top table through the unavoidable detention of Mr. Charles Carpenter elsewhere. But the following telegram was received from him:

> An unavoidable circumstance prevents me joining farewell luncheon to our German friends. I hope they have enjoyed their tour, and that they will have a safe and pleasant return journey home.

At the conclusion of luncheon,

The President said: Gentlemen, we have met you to-day not so much as gas engineers, but the keynotes of our proceedings are brotherhood and friendship. That being the case, I wish to couple the loyal toasts together, and to drink unitedly to our King and to the Emperor of Germany. We wish both of these monarchs long life and happiness; and we trust that both rulers of the two nations will ever stand shoulder to shoulder in the earnest endeavour to do what is right to protect the weak, and to do everything possible in the cause of justice and right.

The toast was enthusiastically honoured; both National Anthems being sung.

Mr. Corbet Woodall then said: Mr. President and Gentleman, I am quite sure my friend, Mr. Carpenter, has some sufficient reason for not being present to share in the honour of proposing the toast which has just been entrusted to me. It is a pleasanter thing to welcome the coming guest than to wish God-speed to the parting one. We have, hosts and guests, seen much of each other during the week that has passed, and we members of the Institution of Gas Engineers hope our guests will carry away with them pleasant recollections of the time they have spent in Great Britain. One thing they may be fully assured of—they will leave with us only the happiest thoughts of them. I venture to hope that the notes some may have made during their visit, are not wholly of things to avoid; that some things in the works you have honoured us by visiting will be deemed worthy of remembrance, and possibly even of adopting—that, from a professional point of view, the journey has not been barren. These are, as we all know, strenuous times not only for our industry, but for most industries; and one thing we learn from our gathering here is that, in order that the industry may prosper to the full extent, we should not grudge to communicate one to another everything likely to be helpful to the whole. One part cannot prosper without its conducing—I think I may say that no part ought to prosper without that prosperity being shared by all. In other words, we cannot be advantaged by anything short of the best on the part of any of our members. In saying "Good-bye" to you, we as your hosts can only wish you smooth seas and prospering gales, and a very happy and safe journey home. On to-day's programme appear these words:

Happy have we met,
  Happy have we been,
Happy may we part,
  And happy meet again.

In other words, we say not "Good-bye" but "*Auf Wiedersehen.*"

Mr. W. Doig Gibb: Mr. President, Herr Prenger, and gentlemen: At the eleventh hour, I have been asked to join Mr. Corbet Woodall in proposing this toast in the place of Mr. Carpenter. The last time I saw Mr. Carpenter he was looking forward very much to being here to-day; and I am certain there must be some serious reason for his not being present. When I visited Berlin three or four years ago as President of the British Institution of Gas Engineers, on the occasion that you gentlemen gave us such a magnificent banquet, I expressed the wish then that, in the years to come, we might be "Still closer knit in friendship's bonds each passing year." Surely to-day, to some extent, sees the consummation of that wish. We are closer and firmer friends than we were when we met you in the outskirts of Berlin; and, if I may once more quote the well-known words, I hope, in the years to come, we may be "still closer knit in friendship's bonds each passing year." I need not add anything to what Mr. Corbet Woodall has just now so ably said, excepting this: To the Scotsman (I am a Scotsman), the word "brother" conveys perhaps a deeper meaning than even it does to the average Englishman, because in Scotland a brother is a man one has to stand by whether he is in the right or in the wrong—one has to see him through as long as life exists. When we address you, therefore, my German friends, as brothers, we mean we have taken you to our hearts. We welcome you here. We hope you have had a good time; and if you have, we are amply rewarded. And you will show your appreciation, if appreciation is due, by coming back to see us. Good-bye for the time being, a pleasant journey, and a safe return to your own country.

Herr Prenger replied in German, which was translated by Dr. Lessing. He said: Brethren and friends, we are at the end of the fine days we have spent in this country—both in England and Scotland. We have experienced the sincerest hospitality imaginable; and we have seen some of the largest works in our industry. The President has said that we have not met here to-day as gas engineers. We have met as friends, and not only so but as old friends. I am sure, Mr. President and colleagues, you will subscribe to this: We have been one in heart; and more it would be impossible to say in few words. We have learned that the only proper course to follow in our profession is to stand by each other, and to work together for the common interest of our industry and of our nations. Any one of us who may have arrived in London a week ago harbouring any other opinion than this must surely be converted by now, and must be convinced that England and Germany together must be able to rule the globe. Gladly would I take this opportunity of looking back, and giving you a retrospect of all that we have seen during our week's travels; but it would be impossible to do so, as I should not be able to finish my speech to-day. If we consider all the vast preparations, and the enormous labour spent on the arrangements, we find that no efforts have been spared to give us a most enjoyable time in this country. There has been every proof of how sincere the feelings on your side are. Regarding the hospitality we have met with, I should like to point out that this is not due to a few good friends, but it is due to the combined gas industry of Great Britain. Gas companies and gas-works owning corporations have stood together to enable the Reception Committee to welcome their German colleagues in proper manner. It was not the invitation of a few; but, so to speak, it was a national one. The cordiality that has pervaded everything that has been done to make us happy here is due to a large extent to the Reception Committee, and foremost to their Secretary, Mr. Dunn. I ask you, my German friends, to try to imitate his grand example. He must be in possession especially of a most correct watch [laughter], because we were always kept to our programme to a minute. But the whole Reception Committee have worked in an exemplary manner, and have produced for us a most enjoyable stay. We are here as the guests of the Institution of Gas Engineers and of its President, Mr. Alexander Wilson, whose splendid works we had an opportunity of visiting yesterday. The names of Wilson, Woodall, Carpenter, Helps, Herring, Doig Gibb, and others, have a good sound in our profession; and as long as men of their type are leaders in our industry, we shall rest assured that that industry will prosper. We beg to thank you for all we have been shown, and for all the kind attention that has been showered upon us. Be assured, we take back with us the most pleasant recollections, and the memory of it all will remain with us for many years. Mr. Woodall has been good enough to quote poetry. I will do the same.

Nun sind die Freuden vorüber,
Wir kehren zur Heimat zurück,
Doch nehmen wir mit hinüber
Ein unschätzbares Glück.

Uns einen die gleichen Ziele,
Uns eint ein gleiches Band,
Wir tragen der Freundschaft Gefühle
Hinüber von Strand zu Strand.

Heil Euch! Ihr englischen Brüder,
Wir reichen zum Abschied die Hand,
Will's Gott, wir sehen uns wieder
Da drüben im deutschen Land.

Poetic Translation by R. L.

The joys of our meeting are ending,
  And homeward we have soon to turn;
As back our way we are wending,
  We rejoice in the happy sojourn.

United in common endeavour,
  Much closer than ever before,
Of friendship a bond, not to sever,
  We stretch it from shore to shore.

To you, English brethren, greeting!
  In parting take our hand;
May the Lord soon permit our meeting
  You yonder in German land.

Literal Translation by W. J. A. B.

[This may serve to inspire a minor poet.]

Now that the festivities are over,
We are returning home;
But we are taking away with us
A joy that is beyond price.

Both of us have the same aims,
And a common tie unites us.
We are carrying feelings of friendship
Across from this to that shore.

Here's to you! English brothers,
We give you our hand at parting.
An't please God, we shall meet again
Over there on German ground.

I ask you, my German friends, to put all your feelings into the words which we usually cry, "*Hoch! hoch! hoch!*"

With great heartiness, the German guests complied.

The President: Herr Prenger and Gentlemen, this is an occasion on which one would have liked to have framed a really suitable reply; and I do feel this is not an occasion on which I can do full justice to it. However, if I have not the gifts, I hope you will take it from me that I yield to no one in my sincerity and cordiality. [Applause.] Herr Prenger has said that the Institution of Gas Engineers invited our German friends here. That is quite true; and we have been happy to do it. But we have been greatly assisted by various Gas Companies and Corporations in making it the success that it has been. Our German friends, too, have given us of their time; and they have spared no personal expense to make this visit as successful as possible. In that way, they have also aided us in our wish to meet them. In going round the various works with our German friends, no one could help being impressed by the earnestness with which they go into their business. They have all shown themselves deeply interested in gas technique of every kind; and the smallest details have not escaped observation. If they have been enabled to learn, even in small matters, from us, we are pleased. We have learned much from them. I have visited Germany on two occasions, and the visits were of the utmost help to me in my business, as I have no doubt similar visits have been to many others. But, gentlemen, although our German friends are so keen in business, no one will deny me for a moment when I say they are likewise "jolly good fellows all." They are men of our own hearts; and we can fraternize with them, not only in our business, but also in our pleasures. Visits of this kind are not only of great good to us in our profession, but they help in every way to smooth away difficulties or tension between the two nations. It would be better if we had more visits of

this kind. There ought to be great opportunities for us in the future now that so many of us have met our German friends. We have been able to make friendships which, I hope, will last long. Herr Prenger has spoken of the work of Mr. Dunn. Great credit is due for all he has accomplished during this visit. He has shown great capacity for work in making the arrangements; and we are indebted to him for the excellent way in which the arrangements have been carried through. My friend, Mr. Helps, also had a great deal to do with the preparations. As I explained at the banquet on Monday, I have stepped in, as it were, and robbed Mr. Helps of the fruit of his labour. Personally, it has been very pleasant to me; and Mr. Helps in his magnanimity does not grudge me the pleasure. [Mr. HELPS: No, no.] At the same time Mr. Helps ought to have a great deal ot the credit for the initiation of this work; and in the ordinary course of things, he would have been in the chair. We heard an old Scotch song at Glasgow, "Will ye no' come back again." We hope that this visit will be repeated; we hope, too, we shall have the pleasure of meeting our friends again in Germany. ["*Hoch.*"] The time has come to say "Good-bye." We hope you will all reach home safely, and will have pleasant recollections of your visit to Great Britain. [Applause.]

"Auld Lang Syne" was once more sung; and with individual handshakings and adieus, the end of a happy week's events was reached.

Saturday evening and Sunday morning witnessed the quitting of our shores by the majority of the visitors; but a few are remaining for two or three days' further holiday. A considerable number, however, left by the 9 o'clock train from Charing Cross on Sunday morning. At the special request of Mr. Corbet Woodall, Mr. F. W. Goodenough went to the station just before that hour; and, on behalf of him and the Gaslight and Coke Company, sped the parting guests, among whom were Herr Prenger and Dr. Bunte. The Governor had intended to be there himself, but felt rather fatigued after the week's exertions. Dr. Colman also turned up for a final "*Auf Wiedersehen.*" Everyone seemed to be very full of pleasant memories of the visit.

GASLIGHT AND COKE COMPANY'S STATIONS.

ORIGIN AND PROGRESS OF THE COMPANY.

The Gaslight and Coke Company, the first Gas Company to be established, was founded in 1810, incorporated by Royal Charter in 1812, and for many years was known as the Chartered Gas Company. In its early days, the Company's operations were, of course, on a very small scale; and the selling price of the gas distributed was 15s. per 1000 cubic feet. The site of the works in which manufacture was first carried on is now occupied by the Company's chief offices in Horseferry Road, Westminster. From time to time other gas companies were formed, until in 1860 some thirteen were selling gas in the Metropolis, many of them within the same area, and therefore in competition with each other. In the year named, the Companies agreed, in order to economize capital and to avoid too frequent opening of the public streets, each to confine its supply to a separate district; and this agreement received the sanction of Parliament. In 1868, Parliament further sanctioned a policy of amalgamation, with a view to the reduction of the Companies' expenditure. By the year 1883, the Gaslight and Coke Company had absorbed seven of the thirteen Companies, and became possessed of the statutory right to supply all gas required in nearly the whole of London on the north of the Thames, as well as a considerable area on the south. Last year, a further amalgamation (with the West Ham Gas Company, whose district lay in Essex, beyond the Metropolitan area) was authorized by Parliament; and the Company's district now comprises an area of upwards of 75 square miles. The amount of their capital is over £27,500,000.

Including the West Ham Company's district, the bulk of coal carbonized during the year 1909 was more than $1\frac{3}{4}$ million tons; and the amount of oil used in manufacturing carburetted water gas, upwards of 16 million gallons. The quantity of gas actually sold during the same year was 24,434,672,000 cubic feet; and the coke and breeze produced and sold during the year amounted to upwards of a million tons. The Company's largest output of gas on record for one day of 24 hours is 140 million cubic feet. Besides conducting the manufacture of gas, the Company have a tar and ammonia products works at Beckton, where the whole of the residuals are worked up.

The manufacturing stations of the Company, eight in number, aggregate a total productive capacity of 146 million cubic feet of gas per day, of which 32 millions would be made by carburetted water-gas plant. Of this total productive capacity, Beckton—the largest station—represents 71 million cubic feet. The gas is brought to London, at a comparatively high pressure, through two trunk mains, each of 48 inches diameter, which are in communication with the various other manufacturing stations of the Company, and with the district mains, by means of governors in various valve-houses upon the Company's district. The distribution system includes 2458 miles of mains, varying in diameter up to 48 inches. The whole system is so arranged that any part can be supplied practically from any of the Company's stations. The Company employ about 11,000 officers and workmen, the majority of whom are under agreement, and are members of a co-partnership scheme under which they become shareholders in the Company, and participate in the profits earned. In addition to this scheme, the Company have their own pension scheme for officers, make allowances to old and incapacitated workmen, and liberally support sick clubs for all branches of the workmen. The consumers now number about 675,000, of whom 395,000 use penny-in-the-slot meters. The number of gas stoves and fires in use is is approximately 550,000; and, in addition there are large numbers of gas-engines, hot-water circulators, and heaters in use.

The Company are under strict obligations with regard to the illuminating power, purity, and calorific value of their gas. The standard of illuminating power is 14 candles; of calorific value, 125 B.Th.U. per cubic foot of gas, measured at 60° Fahr.; and no trace of sulphuretted hydrogen is permitted. Testing by the public authorities is carried on throughout the whole of the day and night, except in the City of London, where there is a cessation of testing on Sundays. In the event of the Company failing to supply gas of the statutory quality, they are liable to substantial penalties, which are rigorously enforced. The price of gas is at present 2s. 8d. per 1000 cubic feet for private lighting, and 2s. 2d. for public lighting.

BECKTON.

This station, which, as readers of the "JOURNAL" are aware, is the largest in the Company's possession, is situated on the north bank of the Thames, about a mile below Woolwich. It is consequently specially well placed for receiving the supply of raw material and for the shipment of residual products. The quantity of coal landed is about 2 million tons per annum; and it is conveyed over the works by waggons of 5 tons capacity drawn by locomotives over a network of railway. The descriptions of these great works which have appeared in our columns from time to time on the occasions of visits of engineers, have rendered most of our readers familiar with their equipment; but the following particulars will probably be read with interest.

MANUFACTURING PLANT AND ACCESSORIES.

There are altogether fourteen retort-houses, varying in size, each containing from 30 to 45 settings—some of nine, but in the majority of cases of ten, retorts; their present carbonizing capacity being $58\frac{1}{2}$ million cubic feet per day. The houses are for the most part arranged in two parallel lines extending inland from the river. The retorts are all set on the horizontal system; and they are charged and discharged by machinery of the Arrol-Foulis and West type. But a Fiddes-Aldridge machine is being installed. The first two systems are operated by pneumatic and hydraulic power; electricity will be used for the last. Each retort-house forms the nucleus of a works in itself, having its separate purifying plant, exhauster, condenser, and station meter. The connections are so arranged, however, as to be interchangeable, enabling the staff to effect repairs to any portion of one set of plant without throwing the remainder out of action. The material used in the purifiers is mostly oxide of iron; but a small quantity of lime is still employed for the removal of carbonic acid. The coal-gas plant is supplemented by carburetted water-gas plant, which was the first installed in this country. Its capacity is equal to the production of 13 million cubic feet per day. It is on the Lowe system, and consists of twelve sets.

STORING AND CONVEYING PLANT, &c.

The holders which store the Beckton gas are only to a limited extent situated within the works—19 million out of a total of 61 million cubic feet. The largest holder, of 8 millions capacity, has four lifts; its total height, when fully inflated, being 180 feet, exclusive of the height of the crown. The diameter of the tank is 250 feet. The gas is conveyed from Beckton in the direction of London in two 48-inch cast-iron mains, through which, owing to the distance from the Metropolis, it is necessary to pump the whole of the gas. The pumping plant consists of Donkin's exhausters, which work up to a maximum pressure of 48 inches of water. The necessity for this is shown by the fact that in the transit of gas to Bromley, $3\frac{1}{2}$ miles from Beckton, 15 inches of pressure is lost when the main is being used to only a little more than two-thirds of its capacity. Gasholders into which gas from Beckton is pumped are situated as far west as Fulham—a distance of twelve miles in a direct line.

The total area covered by the works is 271 acres. Their river frontage extends half-a-mile; while their complete depth to the extreme land side is rather more than a mile. Besides the river front, a branch of the Great Eastern Railway is available for carrying material in and out of the works from the land side.

KENSAL GREEN.

These works are of a total manufacturing capacity of 15 million cubic feet per day; and they occupy an area of 28 acres. Their special features are the installation of vertical retorts on the Woodall-Duckham principle of continuous carbonization, the inclined-retort house, with its labour-saving devices, and the carburetted water-gas plant. These are described below; and other particulars in regard to the works will be found in the "JOURNAL" for Jan. 19, 1909 (p. 167).

INSTALLATION OF VERTICAL RETORTS.

This installation occupies part of the site of an old bench of horizontal retorts in No. 1 retort-house; and it was erected and set to work last year. The plant consists of ten settings, four retorts to a set, each retort being 23 ft. 6 in. long (exclusive of the iron mouthpieces), in eight lengths, seven of them being 3 feet long, and the eighth or mouthpiece end 2 ft. 6 in. long. The internal dimension of the retort at the bottom is 29 in. by 21 in., tapering to 21 in. by 9 in. at the top. The plant is constructed in

two parallel sections of five sets each, with the producers on the outer side of the sets, leaving a passage way of 9 feet between the sections. The capacity of the installation is 1¼ million cubic feet per day; and each retort will carbonize some 2½ tons of coal per 24 hours. The area occupied by the plant is 59 ft. by 58 ft., or make for make, less than half the ground space of the displaced settings.

The power required for working the installation is supplied by two electric generators of 63-H.P. and 20-H.P. respectively; the larger generator being used only when the coal is being broken and elevated to the overhead hoppers. On being received into the house, the coal is passed through a breaker, and elevated on to two push-plate conveyors running over the two sections, delivering coal into the storage-hoppers fixed immediately over the charging-drums of the retorts. The coal is fed automatically and continuously into the retorts through feed-roll drums kept continuously revolving at any determined speed by rocking shaft and ratchet apparatus. The retorts are worked at a high temperature at the top end; gradually lessening towards the lower portion, until at the discharging end a dull heat is reached. Here the coke passes into the discharging-drums, and quenched and emitted at every revolution of the drums on to the coke-floor placed beneath the settings. These discharging-drums can, like the feed-roll drums, be worked at any required speed. Fitted between the sections is an electric lift, for raising coke from the ground floor to the producers.

Inclined-Retort House.

This house contains 36 settings of inclined retorts set at an angle of 31°. The retorts are ◻ shape, 24 in. by 14 in., eight to a bed. They are worked with 8½ cwt. charges three times in 24 hours; giving the house a total manufacturing capacity of 4 million cubic feet per day. The special features are the coal and coke handling plant. The coal is deposited in the main coal-breaker from barges in the dock by grabs, elevated to the main push-plate conveyor running over the settings, and conveyed into overhead storage-hoppers and charging-shoots fixed the whole length of the house. Coal-stores of 5000 tons capacity run along each side of the settings. They are fitted up with push-plate conveyors for loading the stores, and continuous conveyors for emptying the coal out of the bunkers and carrying it to elevators fitted on each side of the house for depositing it on to the main conveyor over the sets.

The hot coke from the retorts is directed on to De Brouwer conveyors fitted at the stage level, which remove it to the centre of the house, where it is quenched and conveyed outside to a series of hoppers capable of holding some 250 tons. Here the trade is supplied direct from the hoppers to carts, trucks, and other conveyances.

The power required for this retort-house is supplied as to coal breaking and conveying plant by Galloway compound steam-engines of 120-H.P. in duplicate, and for coke handling by duplicate gas-engines of 40-B.H.P.

Carburetted Water-Gas Plant.

This plant contains six sets, each capable of making upwards of a million cubic feet of gas per day. The coke for the generators is loaded direct from the retort-house storage-hoppers into trucks, and drawn to the plant by small locomotives. The trucks are raised above the charging-floor by a hydraulic lift, and the coke is tipped on to a De Brouwer conveyor travelling from end to end of the house, filling the charging-hoppers, which are fixed directly over the generators—an adjustable charging-shoot joining the two. In connection with this plant there are four Babcock and Wilcox boilers, Westinghouse engines of 40-H.P. being employed in driving the Sturtevant blowers producing the air blast. The oil storage is of 2 million gallons maximum capcity; and separate plant for screening and grading the pan refuse is fixed close to the house.

FULHAM.

This station covers an area of about 26 acres; and it is connected by a tidal creek with the River Thames at Chelsea, by which means the supply of coal is brought by barges from Beckton. These are unloaded by grabs, and the coal is broken and conveyed by machinery to the various parts of the works. The total capacity of the station is about 11 million cubic feet per day; being 8½ millions of coal gas and 2½ millions of carburetted water gas.

Retort-Houses and Machinery.

There are four retort-houses in use, three of which (Nos. 1 and 2 and 4) are equipped with inclined retorts—eighteen beds of eights, 24 in. by 16 in., and 20 feet long—set at an angle of 31°, and have a daily productive capacity of 2 million cubic feet each. The third house has lately been reconstructed, and furnished with twenty beds of ten horizontal through retorts, 23 in, by 16 in., and 20 feet long, in five tiers. These retorts are operated by the Fiddes-Aldridge machine, worked by electricity generated by gas power. It places in the retorts an average of 10 cwt. of coal; and with this the house is capable of producing about 3½ million cubic feet of gas per day. Complete coke handling and storage plant is provided for each of the three retort-houses now in use; that in the third house being worked by electricity. The three-shift system is in vogue, with eight-hour charges, in the three houses; the production of gas per ton of coal averaging 11,900 cubic feet. There is another retort-house containing eighteen beds of six through retorts, 21 in. by 13½ in., and 20 feet long, worked by hand; but it is only used in the event of a heavy demand arising for gas in the winter months.

Condensing and Purifying Plant.

On leaving the exhauster-house, the gas is divided into two streams, each having a set of condensers, naphthalene extractor, and tower scrubbers for taking out the ammonia and cyanogen. A "Standard" centrifugal washer, capable of dealing with 4 million cubic feet of gas per day, has just been erected. After passing the scrubbers, the gas is divided into three streams for the purpose of purification; the material employed being oxide of iron, with Weldon Mud in the catch vessels. Each section of the purifying plant comprises four oxide and two "mud" boxes, of an average area of 930 square feet.

Carburetted Water-Gas Plant.

The installation of this plant has lately been re-modelled, and the building containing it enlarged. There is now room for three sets, each having a capacity of 1¼ million cubic feet per day; but only two sets have been erected. The latest type of twin generator sets of Messrs. Humphreys and Glasgow has replaced the old plant, with greatly improved results; the fuel used being reduced and the daily productive capacity increased. The air blast is obtained by Sturtevant blowers, the largest of which is driven by a 50 B.H.P. De Laval steam-turbine. The gas is purified by oxide of iron only.

SOUTH METROPOLITAN GAS COMPANY'S WORKS.

ORDNANCE TAR-WORKS.

On reaching this station, it was considered to be for the convenience of the visitors to start at the tar-works, where the whole of the tar produced by the Company—about 50 million litres (1000 litres = 220 gallons) per annum—is brought for distillation. The process is only carried as far as the primary products; it not being deemed desirable at present to produce the finer chemicals or colours. The works stand on a site formerly occupied by a manufactory of ordnance, and thus obtains its name. The chief apparatus of interest in the plant is the stills, which are of the continuous type as distinct from the ordinary intermittent pot stills. There are three of these, having a total distilling capacity of 250,000 litres of tar daily: No. 1, 73,000 litres; No. 4, 109,000 litres; and No. 5, 68,000 litres. The tar is delivered through a 23 cm. (10-inch) cast-iron pipe from the neighbouring East Greenwich works; and from the other five stations it is received in tank barges. It is stored in an underground well of about 6 million litres capacity, and in various storage tanks, where it is allowed to settle to separate the ammoniacal liquor. Each continuous still consists essentially of a coil having a total length of about 804 metres (1 metre = 3·28 feet) in the case of the largest still, and a set of condensers maintained at such temperatures as to successively cool the various products of distillation. The products, except the pitch, are completely vaporized during their passage through the coil, which lies horizontally over the furnaces; liquid fuel being employed. The process employed is the converse of a true fractional distillation; and it might be correctly called "fractional condensation." Crude tar is used as the cooling medium in the condensers; and it is thereby heated to such an extent as to dehydrate it, and deprive it of most of its light oils, before it passes through the coil of the still itself. There are thus obtained the following crude products: Pitch, anthracene oil, creosote oil, light oil, and naphtha.

The pitch is run through steam-jacketed pipes to cooling tanks, and subsequently to the pitch "bays." These bays have a total storage capacity of about 10,000 tonnes (metric). The pitch is loaded into steamers and barges by means of a Temperley transporter, capable of handling 400 tonnes per day. The crude anthracene is cooled out, and the oil separated by centrifugals, giving a good quality of anthracene. The creosote is agitated with caustic soda solution for the extraction of phenols, which are rectified by fractional distillation; and it may then be subjected to treatment for the removal of naphthalene if desired. It is, however, generally stored in tanks until ready for shipment. The light oil and crude naphtha are fractionally redistilled to separate the naphthas from the higher-boiling constituents; and the products of this distillation are agitated or "washed" with dilute sulphuric acid so as to remove pyridine, and afterwards with concentrated acid to destroy impurities—the washed spirit being finally rectified to produce benzol, tuluol, and solvent naphtha. The crude naphthas and their products are all very inflammable, and are consequently stored in underground tanks.

GAS-WORKS.

The Gasholders.

On entering the gas-works, the most prominent objects are the gasholders, of which there are two. No. 1, erected in 1885, has four lifts varying from 73·5 metres to 76·2 metres in diameter and 13·7 metres deep. It contains 226,520 cubic metres of gas. No. 2, built in 1891, has six lifts, two of which rise above the framing. The holder has a capacity of 339,780 cubic metres. The combination of the bracing in this holder is such that it acts not only in tension but in compression, in accordance with the varying strains produced by the wind pressures. The late Sir

George Livesey considered that the limit in the economic use of material had probably been reached in this last type of holder, which, inclusive of tank, cost complete 3·61 marks per cubic metre of capacity. It is not now customary to depend upon the static pressure given by the holders for the delivery of gas through the distributing mains. The inner lift of the holder only balances a pressure equal to 73·66 mm. of water. Centrifugal fans are therefore provided, not only to raise the pressure of gas at the inlet of the distributing governors, but to increase the rate of flow through the two trunk mains, 1·21 metres in diameter, by which the gas made at East Greenwich is sent to the storage station attached to the older works of the Company.

Coal Unloading Plant.

The party next proceeded to inspect the coal-unloading jetty. Coal is brought from the North of England to the works by steamers carrying from about 1000 to 4500 tonnes. The vessel is berthed alongside the jetty at high water, resting on the shore of the river-bed when the tide is down. Four hydraulic cranes, with self-acting grabs, perform the work of lifting the coal from the ship's hold, and discharging it into storage hoppers. The height from the hold to the top of the hoppers is 22·87 metres; and the weight of coal lifted by each grab is about 1·25 tonnes. The radius of each crane is variable from the maximum of 11·66 metres from the centre to a minimum of 4·57 metres. The cranes are operated by hydraulic power of 49·21 kilos. per square centimetre; and each weighs about 50 tonnes. The coal is conveyed from the hoppers by trains of 14 waggons, each holding 5 tonnes, and drawn by steam locomotives. The hoppers hold 173 tonnes, and this capacity allows continuous working of the cranes, irrespective of any irregularities in the rate at which the coal is drawn away. The jetty was originally ┐ shaped; but it has been extended in the form of a T—the older portion being generally used for the loading of large vessels with coke. It is intended to add four additional cranes to the newer end, so as to enable two ships to be unloaded simultaneously.

Retort-Houses and Machinery.

The retort-houses next claimed attention. It is intended that these shall be in blocks of four, the first set of which is erected and at work. A commencement has been made with the secod block, the first house of which is built and partly occupied. The structures are designed to be parallel with the river, and at right angles to the elevated railway which runs from the jetty. This affords ready and economical means for supplying each section with coal, and for the transport of the coke and breeze produced in the process of manufacture. The retort-houses are 148 metres long and 21·6 metres wide. The capacity of each coal-store is about 6600 tonnes. The retort-houses contain 45 settings, in three benches of fifteen, each with ten retorts in a setting. The section in general use is ⌓ shaped; but the last renewals have been made with retorts of elliptical section, which afford increased facilities in working.

The stoking machinery in all the retort-houses consists of the Arrol-Foulis chargers and the Hunter-Barnett dischargers worked by hydraulic pressure. The retorts are 6·1 metres long, exclusive of the cast-iron mouthpiece, and their cross section is about 0·53 metre by 0·39 metre. Each charge consists of 560 kilos. of coal; the duration of carbonizing being twelve hours. The time of charging a retort is 40 seconds, and of discharging 20 seconds. The gas produced averages in quantity 33·45 cubic metres per 100 kilos, has a calorific value of 5225 calories per cubic metre, and an illuminating power of 16·65 Hefner candles by the No. 2 "Metropolitan" argand, which is the official testing-burner. This represents 16·65 Hefner candles with gas burning at the rate of 141·6 litres per hour. The coke and breeze sold are about 50 per cent. by weight of the coal carbonized. Most of the settings have a single furnace on each side; but in the latter type, each double furnace heats three complete settings with economy of fuel and labour.

It should be mentioned that the present stoking machinery has only been installed a few months, displacing power rakes and scoop chargers actuated by a high-speed wire rope. With the use of power rakes and scoops, a good deal of wear and tear takes place; and the whole of the retorts are not at present in the best condition for the use of "pushers." But this defect will gradually be eliminated as time goes on and the retorts have to be rebuilt. The cost for labour in the retort-houses works out to 150 pfennigs per tonne. German-made retorts are used at these as in other works of the Company; and it is affirmed that they last longer, and keep their shape better, than the home-made production. The clinkering of the furnaces is done from a tunnel under the centre of the bench, which allows the various operations to be conducted irrespective of the stoking of the retorts, in the course of which large quantities of red-hot coke are drawn into the retort-house vaults, and there quenched prior to being loaded-up into waggons. These waggons are then drawn out by steam locomotives, and the trains of coke are either loaded into barges or conveyed to the store heap.

Condensing, Exhausting, and Purifying Plant.

The flow of gas from the foul-gas main is controlled by equilibrium governors of very simple type; and the regularity of the exhaust is registered by continuously working gauges. Condensation is effected by a combination of air and water cooled condensers; the first portion consisting (for each retort-house) of a coil of pipe 91 cm. diameter and 460 metres long. The water cooling is carried out in alternate chambers of gas and water about 1·82 metres high by 27 cm. wide, through which gas and water flow in opposite directions.

The exhauster-house contains six sets of engines, each working two exhausters, and provides a margin of some 50 per cent. in excess of winter requirements. The engines are of the well-known "Farey" type, compound, horizontal, and steam-jacketed. The peculiarity of their design is that the front and back crossheads are coupled up by means of stiff side rods, and relieve the cylinders from much of the dead-weight of the pistons. The engine dimensions are: High-pressure cylinder, 23 cm. diameter; low-pressure cylinder, 37 cm. diameter; stroke, 41 cm. Similar engines are used for driving, by means of belting, the tar, liquor, and water pumps.

The washing plant consists of Livesey washers worked three in a set, through which the gas passes in series. The vessels are placed at different levels, so that the ammoniacal liquor which comes from the scrubbers flows through them without pumping. Scrubbers are provided in sets of two or three; clean water being used to extract the final traces of ammonia. The scrubbers are filled with wooden boards, 28 cm. deep and 6 mm. thick, and with 18 mm. spaces between them. This arrangement was devised by the late Sir George Livesey many years ago; and it provides a large surface for the extraction of the gaseous impurities.

The dry purifying plant was originally laid out for the reduction of sulphur compounds by the lime process, and is in sets of six. The first four vessels work in rotation, and in these lime was used; and the last two, charged with oxide, were required for the complete removal of the sulphuretted hydrogen. The purifiers are 21·3 metres long, 9·1 metres wide, and 1·5 metres deep. The covers are lifted high enough to provide protection against weather to the men when charging and discharging them; and, to save expense, only sufficient covering to the plant is provided for the storage of the materials used, whether oxide of iron or lime. A Livesey washer for the extraction of naphthalene is connected to the outlet of each set of purifiers.

CHEMICAL-WORKS.

The chemical-works, occupying an area of about 1·2 hectares, are situated at the southern extremity of the gas-works, and have a river frontage of about 274 metres. They consist of sulphuric acid and sulphate of ammonia plant.

Sulphuric Acid Plant.

This plant is on the well-known chamber system, in four units, capable of producing 61 tonnes of 1·62 specific gravity acid per day. Each unit consists of a spent-oxide kiln, a Glover tower, 3·4 m. by 2·4 m., and 9·1 metres high, four chambers, each 33·5 metres long, 6·1 metres wide, and 5 metres high, and a Gay-Lussac tower, 3·4 m. by 2·4 m., and 12·2 metres high. Seven tonnes of spent oxide, containing 45 to 50 per cent. of sulphur, are used in each kiln per day; and the necessary heat of the kiln is maintained by the combustion of the sulphur. Nitrous oxide, the oxidizing agent, is produced from nitrate of soda; 12·7 kilos. being used per tonne of acid. The four Gay-Lussac towers are connected to a large absorbing catch tower 4·9 m. by 4·6 m., and 9·1 metres high, where any nitrous oxides passing from the Gay-Lussac tower are absorbed. The draught on the apparatus is regulated by a fan. An acid-concentrating plant is attached to the acid-works, for concentrating chamber acid up to 1·84 specific gravity for commercial purposes. The plant is on the Kessler system; and from 4 to 8 tonnes of acid, according to the strength required, can be concentrated per day.

Sulphate of Ammonia Plant.

In this plant two units are completed, capable of making 43 tonnes of sulphate per day from liquor containing 1·7 per cent. of ammonia. Each unit deals with 318,000 litres of liquor per day, and has two stills, each 1·8 metres in diameter. The ammonia from both stills passes into the saturator, 2·2 metres in diameter, where it meets the sulphuric acid. The acid and the ammonia combine to form sulphate of ammonia, which crystallizes and falls into the well of the saturator, from which it is ejected by a steam-jet into the centrifugal machine. It is then dried (the mother liquor running back to the saturator), and the crystals fall from the centrifugal by the bottom discharge-valve, and are elevated and conveyed into the stores. The saturator working in No. 1 plant is eight years old, and has made 42,670 tonnes of sulphate of ammonia. The sulphuretted hydrogen evolved in the process is cooled and conveyed to the acid plant for conversion into sulphuric acid.

The engine is of 70-H.P., with cylinders 30·5 c.m. and 55·9 c.m. diameter and 66 c.m. stroke. It drives the liquor-pumps, river-water pumps for cooling the saturator gases, boiler-feed pumps, centrifugals, and the elevating and conveying machinery for both units. The boilers are six in number, each 2·4 metres in diameter and 8·2 metres long, consuming coke breeze only. The steam is delivered at a pressure of 5·3 atmospheres and is reduced to 1·3 atmospheres before entering the liquor stills. The stores are capable of holding upwards of 4000 tonnes of sulphate, and from them it is elevated into the overhead hoppers of the bagging-room, where it is filled into bags and weighed. The bags are then placed on a "Slat" conveyor and carried to the loading wharf, automatically counted, and put into barges.

CROYDON GAS COMPANY'S WORKS.

At the commencement of the operations of the Croydon Gas Company, in 1847, the works were situated in the centre of the town; but in 1867 new ones were completed on the present site at Waddon. They comprise two complete sections of coal-gas plant, each capable of dealing with about 4 million cubic feet of gas per day, and carburetted water-gas plant having a daily productive capacity of upwards of $3\frac{1}{4}$ million cubic feet. The old section is being gradually remodelled and brought up to date; the other is quite new, and was opened in 1907. The works, which, as readers are aware, are under the supervision of Mr. James W. Helps, M.Inst.C.E., the Engineer and General Manager of the Company, have on several occasions been described and illustrated in the "JOURNAL"—the last being as recently as in June, on the visit of the members of the Institution of Gas Engineers. It is only necessary, therefore, to give a few general particulars.

Dealing first with the old section of the works, one of the retort-houses has been remodelled and enlarged, and now contains fifteen settings of 22 in. by 16 in. ◠ retorts, put in by the West Gas Improvement Company, Limited, who supplied the stoking machinery and the coal-elevating and coke-handling plant—the former being driven by compressed air and the latter by electricity. Charging is done at both sides by means of the above-named firm's latest form of scoop, which allows of the retorts being fairly well filled with about $10\frac{1}{2}$ or 11 cwt. of coal. The coke is pushed out by a discharger from one side of the house, falls on to a conveyor driven by an electric motor of 9-H.P., is extinguished by sprays of water under a pressure of 60 lbs. per square inch, and eventually drops into shoots having automatic valves through which the coke-skips are filled. The skips deposit the coke in hoppers capable of containing 500 tons. If it is to be broken, this is done by two of Cort's breakers, in addition to which there are two "Marcus" screening conveyors, each capable of dealing with 30 tons of coke per hour. This conveyor was fully described and illustrated in the "JOURNAL" for May 31 last (p. 553).

The retort-house in No. 2 section is 400 feet long, and contains 29 through settings of eight retorts, worked by West's compressed air machinery. The house contains four sets of coal-elevating machinery; and governors are used throughout. The coke produced is either drawn direct into the producers, or is carried by De Brouwer conveyors to the screens, which divide it into two sizes. The plant in the house is driven by "National" gas-engines. The principal novelty in this section of the works is the system of treating the gas for the prevention of naphthalene deposits. It has already been described in the "JOURNAL," but may be again briefly alluded to. The gas first passes through Dr. Colman's "Cyclones," which take out the heavy tars; it then goes through a Livesey washer containing carburetted water-gas tar, heated by a steam coil, which extracts some of the naphthalene, and gives up to the gas a considerable quantity of the lighter oils. Subsequently it passes through specially-designed water-tube condensers, constructed by Messrs. Clapham Bros., in which it is cooled; the products of condensation flowing by gravity to the seal-pots, which are all placed outside the house. The gas finally goes through Livesey washers and "Standard" scrubbers. By this special treatment of the gas the products of condensation are kept liquid, and all obstructions by naphthalene are avoided. The purifiers are of the luteless type. There are six of them, each 40 feet square; and they are charged with oxide of iron.

The Company treat their ammoniacal liquor; and the works comprise plant equal to the production of 40 tons of sulphate of ammonia per week. It is furnished with centrifugal drying apparatus and conveyors.

The Company's district extends over 80 square miles, and includes 252 miles of mains.

EDINBURGH AND GLASGOW GAS-WORKS.

Granton Works of the Edinburgh and Leith Gas Commissioners.

On reaching these works by special train from the Princes Street Station of the Caledonian Railway Company, visitors alighted at the Commissioners' private station in part of the administrative block of buildings comprising the timekeeping and pay offices on the platform level with general stores above, and then ascended the stairs communicating with the footbridge spanning the eight lines of railway where the traffic from the two railway systems and the Granton Harbour converge, and is distributed to its various lines of sidings.

Coal Unloading and Delivery Plant.

After crossing the bridge, the party descended to the yard level, moving in a southerly direction, passing the south end elevations of the buildings forming sections Nos. 1 and 2 of the works. As only the latter was in full operation, the inspection was confined to this division, commencing at the point where the loaded coal waggons are discharged by the upending of them. This is brought about by the rising of a hydraulic ram sunk between the rails, the fork of which catches under and raises the back axle of the waggon, the end door of which being released, the entire contents are precipitated into the shallow hopper beneath the rails. When bottom door waggons are employed, of which there are few in Scotland, upending is not necessary. The bottom of the hopper is made to travel at varying rates of speed, by which means the contents are projected forward to one of two breakers, where the coal is dealt with by heavy breakers with rotating toothed rolls in three tiers. The upper tier is of large dimensions, to take the largest pieces of coal or cannel, the smaller material falling between them; the medium tier is for reducing the coal to moderate size, the small still passing through; and, finally, there is a double tier of rolls with projecting teeth for bringing the coal down to the right size for carbonizing. The breakers, as already explained, are in duplicate, and are each capable of breaking 125 tons of coal per hour. From the base of the breaker, continuous bucket elevators remove the coal, and raise it to an elevation of 93 feet on the transverse central line of the retort-house. At the point of discharge, horizontal push-plate conveyors transmit the coal to one or more of four longitudinal conveyors of like character, over the four lines of bunkers supported upon the superstructure of the retort-bench, the contents of which are equal to 16 hours' work. Beneath these bunkers are fixed the measuring chambers for determining the charge, the top and bottom slides of which are actuated by a small hydraulic piston and cylinder. Portable adjustable shoots, running on rails in front of the mouthpieces, are employed to direct the contents of the chambers into the particular retort to be charged.

Retort-Settings and Accessories.

The retorts are $22\frac{1}{2}$ in. by $15\frac{1}{4}$ in. in section and 20 feet long, in settings of nine per bed, having a gas take-off pipe at the lower mouthpiece only. The removal of the spent charge is effected principally by gravity through portable shoots (which act as shields to protect the operatives) running on rails immediately over the coke-conveyor. The coal-stopper used to prevent the charge descending upon the iron mouthpieces is withdrawn from the retort, and rests upon the travelling shoot ready for being returned to the retort. The retort contents are then allowed to flow through the shoots into the conveyor beneath. The red-hot coke is carried by means of a drag-chain conveyor to the north end of the retort-house before any water is applied; the quenching arrangement being semi-automatic. At this point the conveyor is enclosed, and an iron shaft 75 ft. 6 in. long rises from the top and discharges under the retort-house roof, by which means the men are freed from the annoyance and inconvenience of the steam, and the building is protected from the destroying action of the acid vapours resulting from the quenching of coke. From the end of the retort-house the conveyor trough rises in an inclined plane at an angle of 30°, and at a suitable point is made to discharge over jigger screens and into railway waggons ready for transport; the dust or breeze falling through the screens being accumulated in the hopper beneath, from which point it is transported on a narrow-gauge railway to the steam-boilers. Arrangements can be made in the coke-handling plant for storing a quantity in bunkers, as well as for automatically stacking it at a depth of 25 feet in the open yard.

Installation of Vertical Retorts.

Returning from the coke yard, the party passed along the producer furnace clinkering-floor, which is on the yard level, in order to take up again the course of the flow of gas. This enabled a thorough inspection to be made of the small vertical retort installation which has been at work for about four months. This plant has been erected in order to gain experience of its adaptability for the special purposes of the locality and the coal available. The setting has been designed in such a way that it could be used on the intermittent, or Dessau, system, and also on the continuous system, of charging and discharging. Since the commencement, it has been used on the latter system.

The retorts are 25 feet long, rectangular in section, measuring 20 in. by 48 in. at the bottom and 11 in. by 39 in. at the top. The setting is constructed so that the distribution of the fuel gas can be either continuous throughout the vertical length of the retort or from the upper end only. The retorts, six in number are made of special grooved bricks, of which a small section was exhibited. The bench is built on exactly the same area as is occupied by one of the settings of inclined retorts, and is fired by gas produced in a separate generator; the intention being to extend the bench when necessary, so as to occupy the original foundations put in for the inclined retorts. The charging and discharging are done by rotating gas-tight valves having pockets sunk in the drum; and according to the speed at which they are rotated the carbonizing capacity is varied. The retorts are arranged in two groups of three in line, with a breeches spout communicating with the coal-hopper above and with the coke hoppers beneath, discharging into one central conveyor. As there is no commercial demand for coke in the locality, it was thought necessary that what was produced by the vertical retorts should be of a size suitable for the local market. The discharging arrangements were therefore in the nature of a breaker as well as a discharging device. Further particulars as to the installation were published in the "JOURNAL" for the 12th of April last (pp. 109-111).

Since the setting has been in operation, while the usual troubles incidental to putting new plant to work have not been wanting, they have been entirely of a mechanical character, brought about by the shafts and gear getting out of alignment, owing to their attachment to the buckstays supporting the bench moving slightly

with the expansion and contraction of the brickwork—difficulties which would not arise in an ordinary way in a large installation, as the temporary means of supporting its parts would not be followed. No difficulty has been experienced with the heating or charging and discharging devices; but considerable trouble has resulted from the installation of the special exhauster and means to isolate the gas from the works proper until after its measurement is accomplished.

Notwithstanding the fact that a large water-tube condenser is employed through which the gas is required to pass, it was found that the meter was frequently flooded with a thin fluid tar. The meter employed for measuring the gas was one of the air meters removed from another part of the works, and was in good condition when installed; but within a few weeks the drum was found to be perforated to an enormous extent, and has had to be renewed. It is not convenient, therefore, to give any long-period particulars of actual results. It appears, however, that the make per ton is greater by 15 per cent. without water added to the base for quenching purposes. The illuminating power of the gas is not higher than 14 candles, whereas 17 candles is obtained from the inclined retorts; and the calorific power is not inferior to the general installation. The carbonizing capacity of the retorts is at present 20 tons per day; but Mr. Herring does not consider that they have yet reached their full capacity. The installation has been run merely as part of the producing plant common to the section of the works in which it has been placed. Further particulars relating to it will be found in the "JOURNAL" for the 5th of April last (p. 33).

Condensers, Exhausters, &c.

After completing the inspection of the vertical installation, the visitors proceeded along the stage floor of the retort-house and along the corridor over the tops of the water-tube condensers, which are beneath the floor of the gangway leading from the retort-house, to the workmen's messrooms and lavatories. Immediately following these are the exhausters, supported on a girder floor above the room within which is contained the main driving plant for the coal breakers, coal and coke elevators and conveyors, the hydraulic plant, and other subsidiary machinery; the whole of the retort-house plant and the coke-handling plant being driven from this source by means of a line-shaft extending in a trough under the retort-house floor. The main driving-engines have an electrically adjusted stop-valve and electrically connected pushes situated at various parts of the plant, including the conveyors from the roof of the retort-house to the coke-handling plant in the yard, so that in the event of a mishap of any kind occurring, the nearest operative depresses the button, which immediately effects the closing of the stop-valve of the driving-engine, and brings to a standstill the source of power, which if running for only a few moments would result in very much greater damage being done. This appliance has been found of great use. From the exhausters, the gas passes through the Pelouze and Audouin oil-extractors into the ammoniacal liquor washer, which is charged periodically with liquor from the well, previously cooled by passing through a water-cooled tower. From this point the gas goes into an ammoniacal liquor scrubber for the final elimination of this product, after which it is made to pass through a cyanide washer, and then flows on to the purifiers proper.

Workshops and Purifying Plant.

From this point the party proceeded to the north end of the works, passing under sections Nos. 1 and 2 of the coke-handling plant and through the mechanics' shops on their way to the purifying plant. The shops have been equipped in such a manner that the staff can deal with the repairs of the whole plant, of whatever character, on the works. Associated with the mechanics' shops are joiners' shops and the workmen's canteen.

On reaching the purifying-house, the visitors found the purifiers placed on a concrete foundation on the ground line, with a pipe-connection trough running centrally between two rows of boxes. The inner and outer connections of the purifiers are attached to the outside row of plates in each case; and the gas is distributed beneath the bottom layer of material in the purifier by means of iron perforated troughs. The purifiers are of the water-lute type; the covers being lifted in the usual way. The method of discharging is by means of transverse frames on which are attached four dredger elevators which discharge on to a belt running transversely with the line of boxes. The belt is reversible, so that in the days when lime was used it discharged its contents into railway waggons on a low-level siding on either side of the purifying plant, but now it is discharged into the boot of a centrally traversing elevator, which lifts the material, and discharges it on the upper floor, where it is revivified and prepared for being put again into the boxes. The method of charging is by means of a canvas shoot with rope tackle attached to the lower mouth; the material being fed into the mouth of the spout, sunk in the floor.

Station-Meter House and Offices.

The station-meter house adjoins the gasholder. As the telephone system is established throughout the works, the employees in one department can speak with those in another. The meter readings are hourly reported to the carbonizing foremen in the exhauster-house, where records are duly entered, together with the weight of coal used per hour and the production of gas per ton worked out, as well as other fundamental data which go to control the operations in the works. The technical office provides accommodation for the engineering and chemical staff, as well as for statistical clerks engaged in the work of the manufacturing department.

Cost of the Works.

In the course of their inspection, the visitors were doubtless struck with the pleasing design of the works. But though this is so, it may be pointed out that they have not necessarily cost more than is ordinarily considered reasonable for constructions of this character. This matter is specially dealt with by Mr. Herring in his book on "The Granton Gas-Works: Their Design, Construction, and Equipment."* The total capital of the works as they stand, with a producing capacity of 15 million cubic feet per day (with the second section buildings completed, but only one-half equipped with plant), including products works, roads, railways, and main drainage system for the entire area, has amounted to £43,000 per million cubic feet of carbonizing capacity, or £430 per ton of coal carbonized. The average cost for the three years 1907 to 1909 for repairs, renewals, and maintenance of works, plant, and appliances, has amounted to 2·63 per cent. on the capital outlay—labour costing 1·52 per cent. and materials 1·11 per cent.

THE NEW WORKS AT PROVAN (GLASGOW).

These works, which are the latest and most modern ones of the Glasgow Corporation, were formally opened in September, 1904. They stand on a site approximately 123 acres in extent, and are conveniently situated for both railway and canal communication. The levels are somewhat irregular; but advantage has been taken of the difference to facilitate the transfer of materials—the coal, lime, &c., being received at the high level, and the coke, &c., sent away at the low level. The works were designed for four sections, each forming independent works capable of manufacturing 12 million cubic feet of gas per day, or a total of 48 million cubic feet. At present only the first section has been constructed; but offices and workshops have been erected for the complete works. Ample railway siding accommodation has been provided; and both the standard gauge (4 ft. 8½ in.) and a narrow gauge (2 ft. 6 in.) of rails are laid throughout the works. After passing the entrance gateway, the visitors saw on the right-hand side the offices, workmen's bath-rooms, with dining-hall above, workshops, and the small locomotive shed; on the left being the governor, meter, exhauster, and boiler houses.

Retort-Houses and Coal-Stores.

There are two retort-houses, each 390 feet long and 78 feet wide, and each containing 720 fire-clay retorts, built in regenerative settings of twelves. The retorts are 23-inch by 16-inch, ◯ shaped, and 9 feet long over all. The fuel gas by which the retorts are heated is generated in large gas-producers placed outside the retort-houses; the gas being conveyed to the settings through steel mains lined with fire-brick. Dampers are provided to regulate the supply of gas to each setting of retorts. The charging and drawing machines are of the Arrol-Foulis type, worked at a hydraulic pressure of 500 lbs. per square inch.

As the coke is drawn from the retorts, it falls through openings in the retort-house floor into steel waggons, which are drawn out by small locomotives and conveyed to the plant for storing, screening, and loading. A proportion of the coke direct from the retorts, without being quenched, is taken in hopper waggons to the gas-producers. The hot coke in the waggons is first taken to the quenching-house and then emptied into the sunk hoppers, which supply the gravity bucket conveyors. These conveyors elevate the coke on to high-level gantries, which are erected over the coke yard, and the coke is either dropped into stock or conveyed to the extreme end of the gantry, where the screening machinery is placed. This machinery separates the coke into various sizes, and loads it into carts or railway waggons. The coke is taken from stock by means of steam-cranes, equipped with grabs, which travel on the top of the gantries and discharge the coke into the conveyors as required.

The coal-stores have a capacity of 50,000 tons. The railway waggons containing the coal are run on to platforms 17 feet above the floor level; and, if required, they are emptied by hand into the store. For daily use, the waggons are run on to tipping platforms at the end of the stores, over the storage hoppers, which supply the coal-breakers, and are there emptied by the platform and waggon being tipped by hydraulic power to such an angle that the coal falls into the hoppers. Hydraulic capstans are provided for moving the waggons. The supply of coal from the hoppers to the breakers is governed by hydraulic-driven regulating drums, which ensure a constant supply equal to the capacity of the elevating and conveying plant. The broken coal is delivered into high storage hoppers by means of elevators and a system of gravity bucket conveyors. The supply of coal for the charging-machines is taken from these high storage hoppers.

Condensing, Exhausting, and Purifying Plant.

The condensers are of both the atmospheric and water-tube type. The former are constructed of 18-inch steel tubes, and the latter are four in number, made by Messrs. Kirkham, Hulett, and Chandler, Limited. Each is able to deal with 3 million cubic feet of gas per 24 hours. There are eight of Waller's patent exhausters, in four sets of two, each set being driven by a vertical steam-engine. Each exhauster is capable of passing 120,000 cubic

* Published at the offices of the "JOURNAL."

feet of gas per hour. Four C. & W. Walker ammonia scrubbers have been erected, each machine being capable of dealing with 3 million cubic feet of gas in 24 hours; also two Holmes's rotary brush scrubbers for cyanide. The purifier-house is 503 feet long by 85 feet wide, and contains 24 purifiers in six sets of four. They are each 38 feet long, 27 feet wide, and 5 ft. 5½ in. deep. Lime is used exclusively, and is fed into the purifiers from an overhead gangway through canvas shoots. The spent lime is discharged through plugs in the bottom of the purifiers into waggons on the narrow-gauge railway beneath.

STATION METERS, GASHOLDERS, AND GOVERNORS.

Three station meters have been erected, each capable of passing 200,000 cubic feet of gas per hour. There are two three-lift gasholders of the same dimensions; the capacity of each being 8½ million cubic feet. The outer lift is 280 feet diameter and 50 feet deep, the middle lift 276 ft. 10½ in. diameter and 50 feet deep, and the inner lift 273 ft. 9 in. diameter and 51 feet deep. The tanks are of brick, 284 feet diameter and 51 feet deep. Within the governor-house are installed two Parsons turbo-exhausters. These are used to send the gas down through a high-pressure main to the gasholders at the Dalmarnock station. Each of the exhausters is capable of dealing with 780,000 cubic feet of gas per hour, working with a difference of pressure between the inlet and outlet of 24 inches of water.

THE TRADESTON WORKS.

These works, which are situated on the south side of Glasgow, cover an area of about 15½ acres, and are divided by the main line of the Caledonian Railway. Their present productive power is 10 million cubic feet per day; the storage capacity of the four gasholders is 7,350,000 cubic feet; the maximum make of gas in 24 hours is 9,393,000 cubic feet; and the total number of retorts is 1232. The works (formerly belonging to the Glasgow Gaslight Company) were built in 1838. In 1869, their productive capacity was 1½ million cubic feet per day, and in 1888 the production had increased to 4½ million cubic feet. In that year, a reconstruction of the works was carried out, extending them to their present capacity.

RETORT-HOUSE AND COAL-STORE.

These form a block measuring 301 feet long and 322 feet wide. There are four retort-benches set parallel with each other. Two benches have sixteen through ovens of eights, and the other two have fifteen of twelves. The retorts are all the same size—viz., 21 in. by 15 in. ◠ shaped, and 9 feet long, set back to back, and heated on the regenerative system by semi-internal gas-producers. A complete installation of Arrol-Foulis charging and drawing machinery, worked by hydraulic pressure of 450 lbs. per square inch, is fitted to all the benches. The coal-store has a capacity of upwards of 14,000 tons, and has three lines of elevated railway with crossovers, three hydraulic capstans, and nine twin-ram tipping-machines. Bucket elevators, worked by the same steam-engines as drive the coal breakers, raise the broken coal to the storage hoppers, from which the charging-machines draw their supplies as required. As the coke is drawn from the retorts it is diverted into the producers, or sent down iron shoots, placed immediately in front of the retorts, into iron side-tipping waggons drawn by small locomotives running on a 2-feet gauge of rails. The coke is afterwards quenched in the yard, and lifted by means of grabs worked by travelling steam-cranes on the gantries.

CONDENSING, EXHAUSTING, AND PURIFYING PLANT.

The condensers are of the atmospheric type, formed of cast-iron pipes arranged vertically. There are twelve sections of 9-inch and eight sections of 12-inch pipes. There are four sets of two exhausters, each set being driven by a vertical steam-engine placed between them. Each exhauster is capable of passing 100,000 cubic feet of gas per hour. There are four ammonia scrubbers, each capable of dealing with 2½ million cubic feet of gas per 24 hours. The purifier shed is 350 feet long and 100 feet wide, in two spans, and contains four sets of purifiers, each set consisting of four cast-iron boxes, 35 feet square. There is a line of railway along each side for the lime waggons. Lime is the purifying agent; and it is burnt in the lime-kilns within the works. The spent lime is removed in waggons and carts to the country.

STATION METERS, GASHOLDERS, AND GOVERNORS.

The station-meter house is 107 feet long and 34 feet wide, and contains four station meters each capable of registering 120,000 cubic feet of gas per hour. Within it are the air-vessels, registers, and gauges in connection with the governors, which are placed underground, and connected to the trunk mains at the most convenient positions. There are seven mains leaving the works, varying in size from 18 to 30 inches diameter. There are four gasholders of a combined capacity of 7,350,000 cubic feet.

The annual general meeting of the Gas Companies' Protection Association will be held on Monday, the 24th inst., at the Westminster Palace Hotel.

Alderman Thomas Robert Gainsford, of Woodthorpe Hall, Sheffield, for many years Chairman of the Water Committee of the Sheffield Corporation and of the Derwent Valley Water Board, who died on the 3rd of July, aged 65, left estate of the gross value of £18,407, with net personalty amounting to £10,835.

OBITUARY.

The death occurred on Monday last week, at the age of 83, of Mr. GEORGE FIELDING, who had for sixty years practised as a Solicitor in Dover, and had for upwards of half-a-century been the Secretary of the Gas Company. Deceased was for many years District Registrar of the High Court and Registrar of the Dover County Court and of the Harbour Board, was Mayor in 1877, and was a Magistrate for the borough. He was a lineal descendant of Henry Fielding, the novelist. He will long be remembered in Dover for his generous benefactions. The late Mr. Fielding was a widower; and he is survived by a family of nine children.

Up till seven years ago, the name of Mr. ALFRED BONHAM-CARTER frequently appeared in our reports of parliamentary inquiries, from the fact that he was the Referee of Private Bills in the House of Commons. He retired in 1903; and he died on the 2nd inst., in his 86th year. Deceased, who was educated at University College, London, was appointed a Committee clerk in the House of Commons in 1854, and four years later was called to the Bar at the Inner Temple. From 1859 to 1866, he was Private Secretary to the then First Commissioner of Works, and afterwards became Referee of Private Bills. His long experience of close upon fifty years in the service of the House of Commons made him a great authority on parliamentary practice. He joined Sir Reginald Palgrave in editing the tenth edition of "May's Parliamentary Practice." He was made a C.B. in 1900.

PERSONAL.

Mr. E. C. FIELDING, second son of the late Mr. George Fielding, of Dover, whose recent death is announced above, has succeeded his father as Secretary of the Dover Gas Company.

As will be seen from the report which appears on another page, it was stated at the meeting of the Midland Junior Gas Engineering Association on Saturday that Mr. R. WARDELL is leaving the Birmingham Corporation Gas Department, having been appointed Assistant to the Engineer of the Cambridge Gas Company.

It may be remembered that the death of Alderman T. R. Gainsford caused a vacancy on the Derwent Valley Water Board, of which he was Chairman. The Sheffield Corporation have now selected Alderman C. F. BENNETT as their representative; and the Board have unanimously chosen Alderman Sir EDWARD H. FRASER (Nottingham) as Chairman, and Alderman W. W. VINCENT (Leicester) as Deputy-Chairman.

Mr. ALEC. E. WHITCHER, Assistant to Mr. W. H. Ely, Resident Engineer and Manager of the Woking Gas Company, Limited, has just been appointed as Manager to the Mersea and District Gas Company, Limited, and will superintend the erection of the works and the laying of some five miles of new mains. He is not yet 24 years of age, and was trained at Gosport. The Company are acquiring powers for the supply of water; and Mr. Whitcher will also be their Water Engineer.

The City Council of Newcastle-upon-Tyne last Wednesday resolved to re-nominate Sir WILLIAM HASWELL STEPHENSON, the Chairman of the Newcastle-upon-Tyne and Gateshead Gas Company, for the office of Lord Mayor for the ensuing year. At a special meeting held on the same day, it was unanimously resolved to confer upon Sir William the Honorary Freedom of the city, in recognition of the numerous liberal benefactions and other eminent and meritorious services rendered by him during his public career of more than forty years as a member of the City Council. Sir William has given to the city three public libraries (Elswick, Heaton, and Walker), and a statue of Queen Victoria. He has been Mayor four times. His latest act of generosity is a gift of a new Sunday School in connection with the Wesleyan Church at Elswick, at a cost of £575.

Mr. A. I. EASTWOOD, who is under Mr. J. H. Crowther, the Engineer and Manager of the Wallasey Corporation Gas and Water Departments, has been successful, out of about seventy applicants, in securing the position of Assistant-Manager to the Matlock and District Gas Company (rendered vacant by the appointment of Mr. J. W. Brown to the position of Manager of the Chapel-en-le-Frith, Chinley, and District Gas Company). Mr. Eastwood served his articles under Mr. Crowther at the Wallasey works, and has been through the various shops, laboratory, and drawing office, during which time, owing to extensive additions to the works, he has been able to take an active part and interest in such extensions. He is the holder of first-class certificates of the City and Guilds of London Institute in both the ordinary and honours grades of "Gas Engineering" and "Gas Supply," in addition to a number of certificates in other technical subjects—studied at the Liverpool Technical School. Mr. Eastwood is a member of the Manchester District Junior Gas Association.

We learn that Mr. G. W. G. TATAM, who is engaged with the Chattanooga Gas Company (Tenn.) as Superintendent of Distribution, is returning to England on vacation. He has recently completed large main extensions to new territory of the Company. Before leaving England, Mr. Tatam was engaged on the Chemical Staff of the Gaslight and Coke Company at their Nine Elms

Works, and subsequently under Mr. Henry Hack, as Works Chemist and Superintendent of the Coal-Testing Plant, at the Birmingham Corporation Gas-Works. He was lecturer in "Gas Manufacture" to the Birmingham Technical Education Committee; and is, of course, a Past-President of the Midland Junior Gas Engineering Association. After short service in the Testing Department of the Postal Telegraphs in London, Mr. Tatam was, in 1907, appointed Gas Engineering Expert to the Pawtucket Gas Company (R.I.), where he undertook the extension and reconstruction of works and district mains, including the foundations for a million cubic feet gasholder in steel tank, and the laying of low-pressure and high-pressure mains.

THE ST. GILLES (BRUSSELS) GAS-WORKS.

It will probably be remembered that, in connection with the visit of members of the Institution of Gas Engineers and of the Société Technique du Gaz en France to Brussels last June, we gave some particulars of the Municipal Gas-Works, the Forest station of the Imperial Continental Gas Association, and the works of the St. Josse-ten-Noode Gas Company at Jette St. Pierre.* We are now in a position, from the "Transactions" of the Belgian Association of Gas Managers for the year 1909-10, recently received from the Secretary (M. Emile van Heede), and already acknowledged, to supplement the previous details by others relating to the gas-works which supply the commune of St. Gilles.

The works are situated on the communal land at Anderlecht, between the Senne and the Charleroi Canal. In front of them the canal has been widened, so that a dock has been formed, where the unloading of the water-borne coal can be carried on. The plant consists of a grab crane connected with the coal-store on the works by an automatic railway. The works are also connected, by means of a bridge thrown across the Senne, with a broad cart road, and by a siding with the Forest Station of the Brussels-Calais line. The network of lines on the works has been arranged to convey the raw material to the point of utilization and to remove the products.

Up to the year 1908, only coal gas was made; but plant for the production of carburetted water gas has since been installed. These gases are manufactured in separate works. Those for making coal gas consist of a retort-house and coal-store (with an annex containing the smithy, the repairing-shop, and the men's mess and bath rooms, &c.), the engine and boiler house, purifier and station-meter houses, and the building containing the sulphate of ammonia plant. The coal-store has a capacity of 4000 tons. The coal arriving by rail is conveyed into the store by an overhead railway; that coming by water is unloaded by the grab crane, transferred into hoppers, and from them deposited in special trucks running upon an incline in the direction of the store. The discharge of the coal at any given point is arranged by suitable mechanism. On each journey the truck is weighed and the weight duly registered. The retort-house contains four benches of five Klönne generator settings of nine horizontal retorts 10 feet long, charged by scoops supported by a rackwork which enables them to be raised to any height desired. By this arrangement the work of the stokers is considerably lightened, and the time required for charging the retorts is reduced to a minimum. Discharging is done by hand, in the usual way. The hot coke falls through openings in the charging-stage into trucks running on the floor below, which is on a level with the yard, where it is quenched, and either stacked or conveyed to the breaker. At the time of the preparation of these particulars, the third bench of horizontal retorts was being replaced by a setting of five horizontal carbonizing chambers having a total productive capacity of rather more than 700,000 cubic feet per day.

On leaving the hydraulic mains, the gas passes into a condenser of large volume; the principle adopted being to cool the gas in a single appliance in which the gaseous current ascends slowly. It consists of a steel cylinder 10 feet in diameter and about 65 feet high. The gas enters the vessel at a temperature of 140° Fahr., and leaves it at about 70°. In winter, when the outside temperature is too low, a second inlet, situated at about the middle of the apparatus, allows of the upper half only being used. After passing through the condenser, the gas is conveyed by an above-ground pipe to the exhausters, of which there are two (Beale's three-blade type), each worked by an independent steam-engine. It then goes through a Pelouze and Audouin apparatus, which takes out the remaining tar, is afterwards cooled by water-tube condensers, and finally passes through two "Standard" washers. The tar and ammoniacal liquor resulting from these operations first flow into one vessel, in which they are separated, and are subsequently conveyed into special tanks. The purifier-house contains six purifiers, constituting two groups of three in series. The material is divided into three layers, and the gas can be made to pass through one, two, or all of them, as may be desired. In this way the greatest amount of work is obtained from the material before revivification becomes necessary. A small quantity of air is mixed with the gas before it goes into the purifiers; so that, in a measure, the material is revivified *in situ*. The station-meter house contains, in addition to the meter, the various pressure regulators and a steam-engine working the washers and the water, tar, and liquor pumps. The liquor is converted into sulphate of ammonia on the premises.

The carburetted water gas is manufactured, as already mentioned, in entirely separate works. The machine-room contains two Laval blowers of 15-H.P. capacity, running at the rate of 24,000 revolutions per minute. Each works a fan furnishing the air necessary for supplying the apparatus during the period of the "blow." Two Beale exhausters, each driven by an independent steam-engine, are provided. The producing plant consists of two sets of Humphreys and Glasgow's apparatus, each having a capacity of 600,000 cubic feet per day. There are four purifiers, arranged in one block, furnished with Milbourne valves (two in each box), Spencer's hurdle grids, and dry lutes. By the side of the purifiers is the revivifying shed. In the meter-house, which adjoins the purifier-house, is a Pelouze and Audouin tar-extractor constructed specially for carburetted water gas. After purification, the gas is passed through a "Duplex" meter. The installation of water-gas plant is completed by a gasholder of 35,000 cubic feet capacity in a steel tank, an oil reservoir, also of steel, holding about 50,000 gallons, and a tar and liquor separator.

On issuing from their respective meters, the coal gas and carburetted water gas are mixed, and stored in two gasholders, each of about 536,000 cubic feet capacity. Between the two holders is a boiler for producing steam for heating the hydraulic seals in winter.

The laboratory contains all the usual apparatus. In the photometer-room there is a Dumas and Regnault photometer; also one of the Bunsen type with the Hefner standard. The determinations of the illuminating power of the gas are made with a "Metropolitan" No. 2 burner; but this is only done by way of check, as the working is regulated for the production of a mixed gas having a practically constant calorific power, as tested by the Junkers calorimeter.

* See "JOURNAL," Vol. CX., p. 941 and Vol. CXI., pp. 23, 112, 113.

The Dessau Vertical Retort Installation at Amsterdam.

We last week made brief reference to an order just placed with the Dessau Vertical Retort Company for a large installation of retorts to form the entire carbonizing plant of the new Southern Works of the Amsterdam Municipality. We understand that the order is a record one for verticals, comprising as it does 540 retorts with a producing capacity of about 6 million cubic feet of gas per diem. The Contractors are the Stettiner-Chamotte Fabrik, with whom the firm of Messrs. S. Cutler and Sons, of Millwall and Westminster, will be associated in regard to the steel constructional work and various other parts of this important installation. The decision to adopt the Dessau system was come to upon the recommendation of the Chief Director of the Gas Administration, Herr van Rossum du Chattel, who made a very exhaustive investigation of all carbonizing systems that are at present available.

Retort-House for Genoa with Fiddes-Aldridge Machinery.

The Union des Gaz have recently let a contract for the construction of a new retort-house to contain ten beds each of ten horizontal retorts at the Gavette station in Genoa. The Company have placed the order with Messrs. Aldridge and Ranken, for two of their five-tier stoking machines; and Messrs. Cutler and Sons, of Millwall and Westminster, are associated with the Paris firm of Messrs. Picard in regard to the supply of the coal and coke handling plants and other steel constructional work. Messrs. Cutler and Sons are sole agents in Italy for the Fiddes-Aldridge machinery and plant, which has already been installed at the Turin (Consumatori) and Como Gas-Works, and is giving satisfactory results. The firm also have the agency for the plant in Holland, where it is being installed at the Deventer Gas-Works together with coke handling and distributing plant. The Rotterdam Gas-Works have installed the second machine of this type.

Scraping Water-Mains.—The scraping of water-mains at Dundalk, Ireland, is accomplished both by hand and by pressure-driven tools. The hand method is used on pipes of from 3 to 5 inches diameter; a 5-feet length being cut out of the line and scrapers fixed to the ends of stout cane rods inserted in each direction. During the operations, water is allowed to run freely from the pipe. Two types of tool are used on the hand work—a round, chisel-pointed bar with a bow spring on one side, made to fit the circumference of the pipe, or a spring steel coil fitted on a ¾-inch round bar centre. Mr. M. Sellars, the Town Surveyor, who presented a paper upon this subject recently before the Incorporated Association of Municipal and County Engineers at Dublin, does not recommend the drawing of scrapers by chains and windlasses. Hand scraping on 3-inch mains is said to have cost from 2½d. to 3d. per lineal yard. The pressure-driven scraper used is fitted with adjustable blades and with a swivel joint between the sets of knives, to facilitate travel round corners. The head necessary to drive a 5-inch scraper is 60 feet. It is desirable, however, to have an available static pressure of 80 to 150 feet for pipes ranging from 12 to 5 inches diameter. The proper rate at which to drive the scraper is given as 4 feet per hour.

RETORTS AND GAS-METERS.

The report in the "JOURNAL" for June 28 last (p. 945) of the proceedings at the meeting of the German Association of Gas and Water Engineers at Königsberg contained a summary of the contents of a paper read by Herr Kobbert, the Manager of the Königsberg gas undertaking, on "Retorts and Gas-Meters." The paper was not at the time available for translation *in extenso;* but the full text of it has been published in a recent number of the "Journal für Gasbeleuchtung," from which the following more detailed abstract translation has been prepared.

The discussion of economical questions relating to gas-works has in the past year or two come much into the forefront. The last twenty years have constituted a period of development extremely interesting from the technical side and industrially of great consequence. It was humorously said at the last meeting of the German Association that gas manufacture had in this time entirely changed its face. The first fifteen of these twenty years were marked chiefly by the development of mechanical appliances in gas-works. Subsequently carbonizing plant took the foremost place, and doubtless the third and ensuing period will be distinguished as that of the chemistry of the bye-products of gas manufacture. The introduction of incandescent lighting and the consequent increase in the output of gas were contemporaneous with the introduction of inclined retorts, and the latter necessarily involved the use of mechanical means of conveying coal in the retort-house at least. The mechanical transport of materials in bulk was at the same time being much exploited in Germany, and gas-works presented an inviting field for its application. As a result, the immense number of workmen employed on gas-works was considerably reduced, when the works were extended or renewed. The gain thereby secured was, however, in part balanced by the increasing charges involved in the rising social requirements. It is unnecessary for the author to refer in detail to the gains attributed to the mechanical transport of coal and the introduction of machinery into the retort-house.

Naturally, the first point considered has been how much is the saving of wages secured by such installations? The consumption of power and the expenditure on wages can be fairly easily computed beforehand, and both are so much lower with modern conveying plant than with manual labour that the value of the plant may easily be overrated. For instance, at the old gas-works at Königsberg the bringing of coal into store by the primitive plant there available cost about 1s. 1d. per ton, and into the retort-house a total of about 1s. 4d. per ton. At the present time, at the new works the cost of current and wages, including all subsidiary charges for bringing coal into store, is about 4d. per ton (taking the cost of current at 3½d. per Board of Trade unit), notwithstanding that rates of wages have generally increased and incidental expenditure has been incurred to meet modern social demands. Naturally, this comparison does not illustrate the real value of the mechanical transport of coal. The interest on the capital expenditure for conveying plant to deal with a supply of about 60,000 tons of coal per annum amounts to about 6d. per ton; and to this must be added the necessary allowance for depreciation. The proper allowance under this head has been more fully dealt with in a paper by Herr Kordt, of Düsseldorf.* But in regard to this question, it may be observed that it is quite unjustifiable to take depreciation charges on modern mechanical plant on a gas-works on the common basis of a life of 35 to 50 or more years. Even if maintenance charges could be precisely calculated and allowed for over such a period, regard must be paid to the rapid change in technical equipment, which the lessons of the last three decades indicate will be out-of-date and superseded by new apparatus within a comparatively short time. The conclusion is thus forced on one that the allowance for depreciation can scarcely be made too high.

In the instance quoted—viz., conveying plant to deal with some 60,000 tons of coal per annum—if the allowance for depreciation is taken at the rate of 2 per cent. on the pile foundations, on the machinery at 10 per cent., and on the constructional ironwork at 5 per cent., the depreciation charges would average 6d. per ton of coal. Thus the total charges for the mechanical conveying of the coal would apparently be quite as high as for the former hand work. If the conditions had otherwise remained unaltered, the transition to mechanical working would not be justified. But mechanical plant reduces the time required for discharging a steamer, and does away therefore with the necessity for discharging the latter in the first instance into lighters. Thus about 1s. 2½d. per ton, the cost of lighterage, is saved. The rapid discharge of the steamers brings with it other advantages the exact value of which cannot be put into figures, but which are very real. The price of coal in the old conditions rose at the time when it was dearest (in 1900) to about 23s. per ton; whereas in the similar time in 1908 it only reached 18s. per ton. It has to be considered in this connection that a charge of 1s. 4d. for wages involves a higher commercial risk than an expenditure of 1s. 4d., of which 4d. is for wages and current, and 1s. for interest and depreciation charges. The 1s. in the latter case is fixed, and only the 4d. is liable to vary; whereas in the former case the whole charge of 1s. 4d. is subject to the tendency of wages to rise rapidly, and of attendant social burdens to increase. It will be seen that considerable technical advantages in working may be completely balanced by the indirect expenses which too large capital outlay or too small utilization of plant may entail.

In regard to the first stage of gas manufacture—viz., the transport of coal—the relationship between technical methods and economy can tolerably easily be observed. But when we pass on to carbonization, or the relation between technical methods and economy in respect of the retorts or carbonizing plant, a much more complicated problem is at once presented. The work done by mechanical plant can be measured, and thereby clearly ascertained; but the work of carbonization cannot always be ascertained clearly at the time. The work of carbonization is measured by the heat practically required in given conditions for the carbonization of a ton of coal. In the second place, however, the result attainable in yield of gas by the carbonization of a ton of any coal has not been properly established. The chemist may report the quantity of volatile constituents in the coal; but he cannot predict therefrom what proportion will be recovered in the form of gas and what proportion as liquid bye-products. A reliable criterion of technical utility—viz., the determination of the degree of efficiency—which is available in regard to mechanical and electrical plant, is thus lacking in regard to carbonization. Consequently, any judgment of settings and their duty is still based on purely empirical impressions. We must, therefore, take care in drawing conclusions from our practical and commercial results that we are not basing them on fallacies.

This defect makes it very difficult to compare different types of settings. It does not follow that because a certain proportion of fuel gives a satisfactory output from a setting that another setting is consuming too large a quantity of fuel. The figures for the two settings would be comparable only if it had been ascertained what was the ratio of the fuel consumed at any time to the heat actually required for the carbonization of the coal. It is well known that this ratio varies very considerably with the same description of coal according to the weight of a cubic yard of the coal as charged into the retorts, and according to other conditions which are not affected by the setting. The carbonization of coal nominally of the same kind often shows very different results in respect of the duty of the setting in different cases. Until the work required for the carbonization is known, we can only form a correct judgment on the work of settings by eliminating the smaller working differences—that is to say, the working results must be taken for a tolerably long period of observation in order to ascertain whether two types of settings working in presumably the same conditions have yielded the same quantity of heat from a given quantity of coal. At Königsberg, the heat expended in fuel and the heat obtained in the gas from the carbonizing chambers is now being checked over a period of four weeks. Formerly at least eight days were taken as the minimum time for checking the performances of the retort-settings.

It must be remembered that the settings store up a great deal of heat, and by suitable preparation they can give an extremely high duty for 24 to 50 hours with a very small consumption of fuel. The author, unfortunately, at the time is unable to give the working results for the chamber settings at Königsberg because the four weeks' trial only terminates on the day on which this paper is read. The conditions of the contract for the erection of the chamber settings, however, included a guarantee that coal containing about 1·55 per cent. of moisture and 9 per cent. of ash, and yielding 26·9 per cent. of volatile constituents should afford 6,894,720 B.Th.U. gross heating value in the total volume of gas produced from a ton of coal. The coal in question when in the steamers must not contain more than 15 per cent. of breeze which will pass through a screen of 0·16 inch mesh. This result must be attained, according to the guarantee, with a consumption of not more than 16·5 lbs. of dry coke, as obtained from the same coal in the chamber settings, per 100 lbs. of coal carbonized. Not more than six men are to be employed per 24 hours for the conveying of the coal, the removal of the coke, and firing the producers, &c. [A footnote states that in one trial 7,438,96[illegible] B.Th.U. were obtained in the gas made in the chambers from a ton of a particular coal which at the Carlsruhe Experimental Works yielded 7,502,750 B.Th.U. in the gas. The yield in the chambers was therefore more than 99 per cent. of the Experimental Works' result.

The working of the chambers has, however, shown that they behave in regard to the production of coke, tar, and naphthalene in the manner in which carbonizing plant which is completely filled by the charge and presents no superheating surfaces to the crude gas behaves. The settings are very readily regulated and fulfil all working requirements. The temperature of the chambers is about 1000° C. A shift of six men works from 6 o'clock in the morning till 5 o'clock in the afternoon, with an interval of three hours. At night, two men are left to watch the working of the settings. In the early part of the first four weeks, five settings were in use, and latterly only four. These produced the whole of the coal gas required for distribution. One-half the chambers were charged at the commencement and half towards the end of the working shift. As a rule, the carbonizing time was 24 hours but when the output of gas had to be reduced, it was extended to 36 to 48 hours. The calorific value of the gas as recorded by a registering calorimeter ranges from 395 to 675 B.Th.U. per cubic feet, with two peaks. The calorific power of the gas distributed is, however, nearly uniform; and no difficulty has been experienced in maintaining it to the desired standard of calorific power. Th[e]

* See "JOURNAL," Vol. CXI., p. 267.

coke produced from coal of uniform size, and containing at the most 4 to 6 per cent. of breeze, slides out of the chamber when the block is lightly pushed. If the charge contains much breeze, more difficulty is experienced, and a push discharging machine becomes necessary for the whole length of the chamber.

The expenditure on power and wages can naturally be as readily established for settings as for conveying plant; but a different value should be assigned to the labour according as one, two, or three shifts are required per 24 hours. The working advantages of a single shift are obvious; and it should also be borne in mind that sleep in the daytime in workmen's dwellings crowded with children and the subsequent nightwork are comparatively less valuable. The third factor in the determination of the value of settings is the allowance for interest and depreciation. Interest may be simply computed on the capital expenditure; but the depreciation allowance is more difficult to determine. On foundations 2 per cent. may be fairly applied, and on structural ironwork about 5 per cent. of the original cost should suffice. For the structure of the settings proper, the average allowance must depend on the difference in the life of the component parts of the settings. For the inclined-retort settings at Königsberg, 15 per cent. of their original cost was written off for depreciation. A high depreciation allowance has the advantage that there is less obstacle to the works being continuously kept up to date in equipment. In choosing a type of settings, not only the running maintenance work must be regarded, but also the renewal work which recurs periodically. It is a question for the book-keeper whether these periodical renewals are to be added to the value of the construction—a permissible course if the amounts written off for depreciation are sufficiently high—or whether they are to be booked as repairs and a more moderate allowance made for depreciation. With the 15 per cent. depreciation allowance at Königsberg, the renewals of the retorts have been booked as repairs; and this procedure seems in any case the soundest. As the retorts have had an average life of over 1600 days under fire, this allowance has been on the safe side.

Two examples may be given of the total cost of the output of settings. Two constructing firms—A and B—offer the following guarantees:

	A.		B.
(1) Yield of gas, cubic feet per ton	11,125	..	12,200
(2) Fuel consumption, per cent. by weight	16	..	12
(3) Daily make per shift per man, cubic feet	264,750	..	353,000
(4) Capital outlay per 1000 cubic feet of gas made per diem	£18 1s.	..	£20 17s.
(5) Life of the settings, days	1,000	..	1,000
(6) Cost of repairs per 1000 cubic feet of gas made per diem	7s. 6d.	..	£2 2s.
(7) Tons of coal carbonized per annum for a make of 35 million cubic feet	3,226	..	3,000
(8) Cost of coal per annum at 15s. per ton	£2,420	..	£2,250
(9) Value of coke used as fuel at 23s. per ton	594	..	414
(10) Wages at 4s. per man per shift	26	..	20
(11) Interest at 4 per cent.	71	..	82
(12) Depreciation, averaging 8 per cent.	143	..	164
(13) Repairs	40	..	225
	£3,294	..	£3,155
Deducting receipts for coke at 23s. per ton	£2,597	..	£2,415
Total cost =	£697	..	£740

It will be seen that quotation B presents, in regard to the coal carbonized and the coke used as fuel, an economy of £349; whereas quotation A affords in regard to the interest and depreciation charges an economy of £217. Thus dependent on the capital expenditure according to quotation A being less by £349, this quotation is ultimately more favourable by £43 for every 35 million cubic feet of gas made per annum. This illustration demonstrates that great economy in coal and coke consumption may be more than neutralized by the paramount effect of the interest and depreciation charges on capital expenditure. In regard to the fuel consumption, it may be pointed out that it may be computed according to one of three methods—viz.: (1) According to the number of the charges for the fuel consumption, after the yield of coke from the coal has been determined by crucible tests in the laboratory or the experimental gas-works; (2), by reference to the coke available for sale from the working of the settings; and (3), by the weight of coke used for fuel, allowing for the moisture it is found to contain on being tested in the laboratory. Differences of (say) 5 per cent. of the weight of coal can forthwith ensue according as one or other of these three methods is adopted in calculating the results. Hence the allowance for fuel consumption adopted in the foregoing comparison of the two quotations is valueless unless it is made in both cases on the same basis. Having regard to these considerations, the difference ultimately shown by the calculation has only a relatively small value. The capital expenditure is the predominant item in determining the choice of the type of setting, and compared with it the results for a 24 or 72 hours' carbonizing trial have a purely academical significance. There is one other point. While carbonizing plant for a make of 35,000 cubic feet per diem costs £650 to £750, water-gas plant of the same productive capacity costs only £300. Hence it would appear highly improbable that water gas can be produced more cheaply in coal-gas retorts or chambers than in water-gas generators.

Almost of equal importance with the handling of coal and the carbonizing, so far as the commercial results of gas undertakings are concerned, are the conditions of the sale of gas. The measurement of gas here becomes of pre-eminent consequence. Generally, the make at the gas-works is ascertained by standardized wet meters. So far as the control of the distributing system and of the output of gas to different parts of the district is concerned, this choice is justified; but in regard to the working results of the works, the ton of coal is more and more becoming recognized as the basis on which the results should be judged, just as is the case in coke-oven works. At Königsberg, for some years past a dry rotary meter has been used for part of the make. It occupies little space, and is simple. If used within a range of 10 per cent. above or below its normal capacity, its record is amply sufficient for controlling the make of gas from day to day. So far as distribution is concerned, the gas consumed for public lighting and the unaccounted-for gas are important items which bear a more or less definite ratio to the gas sold. The bearing of pressure ignition of street-lamps on the proportion of unaccounted-for gas is a question worthy of consideration. Whether the unaccounted-for gas has increased since the introduction of pressure ignition does not depend on the pressure itself or on the distributing system, supposing both are properly controlled and supervised, but rather on the method adopted for calculating the gas consumed for public lighting. The consumption under this head was formerly ascertained by assuming a certain average time during which the street-lamps were alight; but since the introduction of pressure ignition, this time is exactly known. Consequently, the figure for the unaccounted-for gas has gained considerably in exactness and in importance as a means for controlling the soundness of the distributing system.

Temperature variations and the errors of the meters have, however, still to be considered; and the author regards them as of more importance now than formerly. It was undoubtedly right, especially in the north, that dry meters should be preferred to wet. In Königsberg, dry meters of various patterns have been used exclusively for the last thirty years; but the superiority of the wet meter in regard to precision of measurement remains unchallenged. Meter manufacturers have, however, done everything possible to overcome the faults of the dry meter; and it is only its precision after it has been in use for some time that is in question. At the Königsberg Gas-Works, every consumer's meter which has been disconnected for any reason is forthwith proved again before it is re-connected in a new place; and the records of the proving of these meters show that it is desirable that a dry meter which has not been disconnected for any other reason should be removed for re-proving once in ten years at least, and, for choice, after it has been in use five years. Of 285 meters which were proved after they had been in use for over ten years, only 58 per cent registered within the permissible limits of error. Other tests of dry meters which had been in continuous use for from five to fifteen years showed a somewhat better, but still rather disconcerting, result, as 51 per cent. only of them registered within $\pm$ 2 per cent., of the correct quantity. The limit of error in respect of a further 36 per cent. was between $\pm$ 2 per cent. and $\pm$ 4 per cent. Of the meters which had been in use for nine years or more, 20 per cent. were outside the error permissible [in Germany] of $\pm$ 4 per cent. Having regard to these figures, gas undertakings are specially interested in the results of an attempt which is being made at Charlottenburg to use wet meters filled with a suitable oil. The effect of the price charged for gas on the output is a question which has been much discussed in recent years. At Königsberg, the average selling price of the gas sold for purposes other than public lighting has in ten years fallen from 4s. 3d. to 3s. 10d. per 1000 cubic feet.

The study of these questions presents many interesting points. If we attempt to investigate them from the reports of the gas undertakings without further information, we find that it is difficult to form definite conclusions, because the bases on which the balance-sheets and prime cost calculations of the different works are drawn up are not comparable. The author has made an attempt to compute the net profit for eleven gas undertakings for the year 1908, and sets out the results in tabular form. The net profit per 1000 cubic feet of the gas made, exclusive of street lighting, varies from 11·5d. to 1s. 5·7d.; while the amount written off for depreciation ranges from 0·76d. to 10·4d., making the profit (after writing off for depreciation) to vary from 7·3d. to 14·1d. The sums written off for depreciation vary from 5·13 per cent. to 58·65 per cent. of the net profit; leaving a residue equal to 41·35 per cent. to 94·87 per cent. If the highest depreciation allowance—viz., 10·4d. per 1000 cubic feet—is deducted from the profit in all cases, the net profit remaining varies between 1·09d. and 7·3d. per 1000 cubic feet. These figures demonstrate again the great importance of the allowances for depreciation in reckoning the economical and industrial results of gas-works.

The author does not pretend that his remarks have been in any way exhaustive; but he is forced to bring them to a conclusion and summarizes the points made as follows:

1.—The charges for interest, fair depreciation, and repairs may quite readily swallow up any advantage afforded by economies in other directions. The final and most important issue in the choice of settings or plant is therefore the cost of installation; and this for the same productive capacity frequently has nothing to do with the technical qualities of the plant.

2.—A proper computation and comparison of the cost of installation with different plant or types of setting is only possible when an actual definite determination of the efficiency has been carried out.

3.—Notwithstanding the perfection and great convenience of

dry gas-meters, the measurement of gas by wet meters must be regarded as less open to objection provided a liquid of constant volume which has no action on metals is used in the meters.

4.—A comparison of the economical results of different gas-works can only be based on the net profit, taking into consideration the average selling price of gas and the consumption for public lighting; and it is best carried out by drawing up a balance-sheet on the lines which would be followed in commercial as well as in municipal book-keeping.

5.—An endeavour should be made by gas-works to agree to a uniform scheme for reckoning prime cost, which should be independent of any mode of reckoning adopted by a works on its own account, and should afford a common basis for the exchange of opinions upon the important question of the industrial results attained by the works.

THE WASHER-COOLER AS A GAS-CONDENSER.

By Warren S. Blauvelt, of Detroit.

[A Paper prepared for the Michigan Gas Association.]

Three years ago, Mr. William Seymour presented to this Association an interesting and instructive paper, entitled "A New Method of Condensing and Scrubbing," in which he described the Doherty washer-cooler installed at Grand Rapids, and gave records of its performance."* It is the purpose of this paper to note some further developments in the type of apparatus described by Mr. Seymour; giving a description of the washer-coolers installed as coal-gas condensers by the Solvay Process Company at the Detroit coke-oven plant, and results of their operation.

The condensing apparatus in use at this plant prior to 1909 consisted of 16 tubular condensers, each 8 feet in diameter, and containing 187 tubes, 4 inches diameter and 18 feet long. The total tube cooling surface with these condensers was 56,400 square feet. The ground area required for the condensers and their connections approximated 1800 square feet. The cooling waters available at this plant come from two sources. River water in unlimited quantity may be had for the cost of pumping. In extremely hot weather, however, its temperature occasionally rises to 80° Fahr., and during two months in summer is seldom below 72° Fahr. About 150 gallons per minute of well water at 60° Fahr. are also available for gas condensation. With these supplies of cooling water, the old condensers were doing their utmost at Midsummer, when cooling daily 9 million cubic feet of gas, direct from the hydraulic mains, to about 80° Fahr.

When the decision was arrived at to raise the capacity of the plant to 1350 tons of coal coked daily (reaching this figure in September, 1910), it was evident that the capacity of the gas-condensing plant would have to be increased about 50 per cent. To have secured this additional capacity with tubular condensers would have required ground area in excess of that available, and would have involved a heavy investment in condensers and piping. The results obtained with an experimental Doherty washer-cooler, similar to the one described in Mr. Seymour's paper, had been so satisfactory that it was decided to secure the required condenser capacity by replacing the tubular condensers with washer-coolers. In order to keep down the cost, it was determined to use the old condenser shells for the new apparatus.

At this plant the gas leaving the ovens during the first part of the coking period is kept separate from that coming off later; thus requiring independent condensing and scrubbing systems for the rich and the lean gases. Though, from purely theoretical considerations, condensing in four or more stages is preferable, it was decided to do all the cooling in each system in two stages; thus greatly simplifying the plant and correspondingly reducing its cost. Four washer-cooler condensers were therefore installed; a primary and a secondary being supplied for both rich and lean gas systems. As the two condensing systems are exactly alike, one description will suffice for both.

The general arrangement of the condensing apparatus is shown in fig. 1. The gas comes from the hydraulic mains, through the foul main A, to the primary washer-cooler, which it enters at the nozzle B. A bye-pass C is provided, which may be used by withdrawing a slip blank at D and inserting slip blanks at E and H. The gas enters the space F, passing up through the narrow passages between the boards which comprise the grids G (shown in detail in fig. 2), where it is cooled and scrubbed by direct contact with weak ammoniacal liquor, which flows down over the surface of the grids. The gas leaves the primary cooler at the top nozzle H, and is conducted through the main A^1 to the secondary cooler, through which it passes in the same way.

At the bottom of the cooler is a liquor reservoir, J^1. This serves as a storage-tank for the circulating liquor and as a decanter for separating the tar, which is drawn off through the pipe O, extending to the bottom of the reservoir. As the quantity of liquor is constantly increased by condensation of vapour, a constant-level overflow N is provided, through which liquor equal in volume to the condensate flows continuously to the liquor reservoir in the secondary cooler. K is a baffle over which the liquor dropping from the grids flows to the side of the reservoir opposite the tar and liquor outlet-pipes. The circulating liquor is drawn off through the suction-pipe P to the centrifugal pump R, which delivers it to

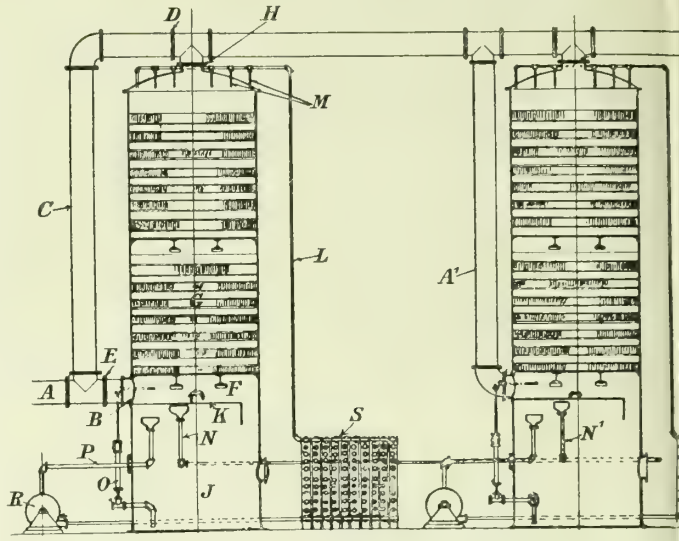


Fig. 1.

the cooling-coils S, whence it flows through the pipe L to the distributing-pipes M, which enter the top of the cooler, and discharge the cooled liquor over the grids through some suitable sprinkling nozzles. The circulation of liquor in the secondary washer-cooler is similar to that in the primary. As the heat transferred, however, is much less, a lower rate of flow and less cooling capacity are required. Through the constant-level overflow N^1 in the secondary cooler a quantity of liquor, equal to that condensed *plus* that fed to the apparatus from the primary cooler, flows to a weak liquor collecting-tank.

Two types of cooler (single pipe and double pipe) are used to cool the circulating liquor. The single-pipe coolers are stacks of 2-inch galvanized iron pipe, 11 pipes high. The hot liquor enters the bottom pipe, through which it flows, then through a return bend to the pipe above, &c., through the stack. Cooling water, properly distributed by a gutter, flows down over the outside surface of the pipes. The double-pipe coolers are made up of stacks of eight 2-inch pipes enclosed in 3-inch pipes; the 2-inch pipes in each stack being connected together in series by return bends. Special fittings are provided which connect in series the annular spaces between the different 2-inch and 3-inch pipes. The hot liquor enters the annular space at the bottom, flows through it, then to the one above, &c. Cooling water flows through the 2-inch pipe in the opposite direction. During the summer, cooling water is also used on the outside of the 3-inch pipes, in the same way as in the single-pipe coolers. The cooling-coils for the secondary circulation are placed directly over the primary cooling-coils; thus economizing space and making possible, without extra piping, the use on the primary coils of the cooling water from the secondary coils.

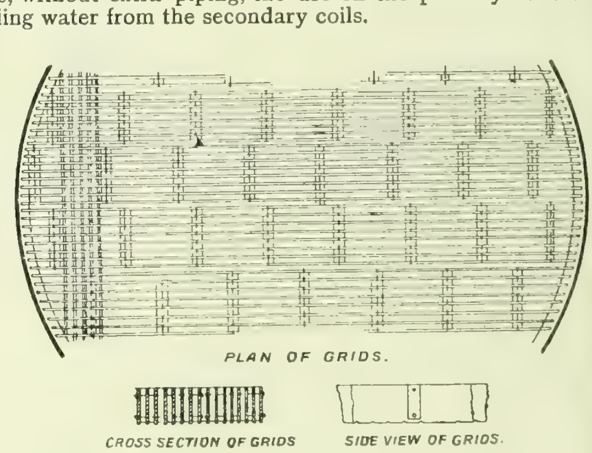


Fig. 2.

As temperature conditions during condensation are practically the same for both rich and lean gas, only two cooling and circulating systems are required for the four washer-coolers. A centrifugal pump is provided to maintain the circulation through each system. A third pump is installed in such a manner that it can handle either the primary or the secondary circulation.

The washer-coolers have been in continuous service since July, 1909. The only changes made since the original installation were the installation of a high-efficiency pump, to take the place of a low-efficiency one on the primary circulation, and the addition of seven stacks of double-pipe cooler. The addition to the cooling capacity was made in connection with an enlargement of plant, which increased the quantity of gas to be cooled daily by about 2 million cubic feet.

There has been no trouble on account of naphthalene stoppages in the apparatus. As naphthalene can collect in masses only on stationary surfaces, there can be no trouble from this source in an apparatus where all the surfaces are at all times covered with flowing liquor, which immediately carries away any particles of naph

* See "Journal," Vol. C., p. 99.

thalene which condense. There is a slight accumulation of it on the walls of the cooling-pipes through which the ammoniacal liquor circulates. This is very quickly removed by steaming out the coil. In order to maintain the cooling efficiency of the pipe coils, it has been found advisable to steam them out at intervals of about three months.

So far as observed, the rapid cooling has had no ill-effect upon the illuminating power of the gas; loss of candle power in condensation being due to the absorption of illuminants by tar. Such losses increase if the tar, after condensation, is allowed to remain in contact with the gas, and especially if the temperature of the tar is reduced before it is separated from the gas. In the washer-cooler, the tar flows down through the apparatus. As it descends with the liquor, its temperature is constantly raised, and its power to absorb illuminants greatly reduced. It is somewhat of a question also whether the tar, after condensation, ever comes in contact with the gas. It is probable that each particle is covered with water immediately after it has condensed.

Temperature observations, in degrees Fahrenheit, made July 21, 1910, are given below:—

	Rich Gas.		Lean Gas.	
	Primary.	Secondary.	Primary.	Secondary.
Gas entering washer-cooler	180	127	180·5	124·0
,, leaving ,, ,,	127	85	124·0	85·5
Liquor entering ,, ,,	119	85	119·0	85·0
,, leaving ,, ,,	169	101	162·0	100·0

The results of this substitution of washer-coolers for tubular condensers have been very satisfactory. The total condensing capacity has been increased 50 per cent., while the ground area occupied by the condensing plant, including the pumping-station, has been reduced 25 per cent. The cooling surface in the new installation per unit of condensation is less than one-fifteenth that provided in the old tubular condensers. The labour of cleaning the apparatus has been reduced, and naphthalene stoppages have ceased. The effective scrubbing during condensation removes practically all the condensate as soon as produced; thus delivering a very much cleaner gas to the ammonia scrubbers than was obtained from the tubular condensers.

MIDLAND JUNIOR GAS ASSOCIATION.

The Opening Meeting of the Sixth Session of the Association was held at the City of Birmingham Technical School last Saturday—the chair being taken at the commencement of the business by Mr. A. O. Jones, of West Bromwich, the Retiring President.

Official Changes.

Mr. Jones remarked that, owing to the appointment which their Senior Vice-President, Mr. H. E. Temple, had obtained at Christchurch, New Zealand, it had been necessary to make an alteration in the officers of the Association. Mr. R. J. Rogers (Birmingham) had been transferred to the Senior Vice-Presidency; and the Council had elected Mr. W. S. Smart (Birmingham) Junior Vice-President.

The New President.

Mr. Jones said his next duty was to introduce to the members the new President, Mr. R. S. Ramsden, who had always displayed great interest in the Association. He was sure they would find in him a President always well to the fore in regard to anything that would enlarge the usefulness of the Association. Mr. Ramsden held a good appointment at Burton; and his career was likely to be a bright one. He wished him a successful year of office as President of the Association, and success in his work as a gas engineer.

Mr. R. S. Ramsden (Burton-on-Trent), who was cordially received on taking the chair, said the first duty—and a pleasant one—which he was called upon to perform was that of moving a hearty vote of thanks to Mr. Jones, his immediate predecessor in the chair. Mr. Jones had worked hard for the Association; and, though he had been rather unfortunate in having two of the papers which were down on the programme to be read during his year of office unavoidably cancelled, he had, by throwing himself heart and soul into the work, given them a really successful session. Outside his duties as President of the Association, also, those who had come into contact with Mr. Jones would agree with him (the speaker) in saying that he was always most courteous and willing to give any help in his power—particularly on those little points of detail in which the experience of another undertaking was often so useful in drawing up a scheme for one's own working.

Dr. W. B. Davidson, in seconding the proposition, said that he would like to endorse all that the President had stated in regard to Mr. Jones.

The vote having been heartily accorded,

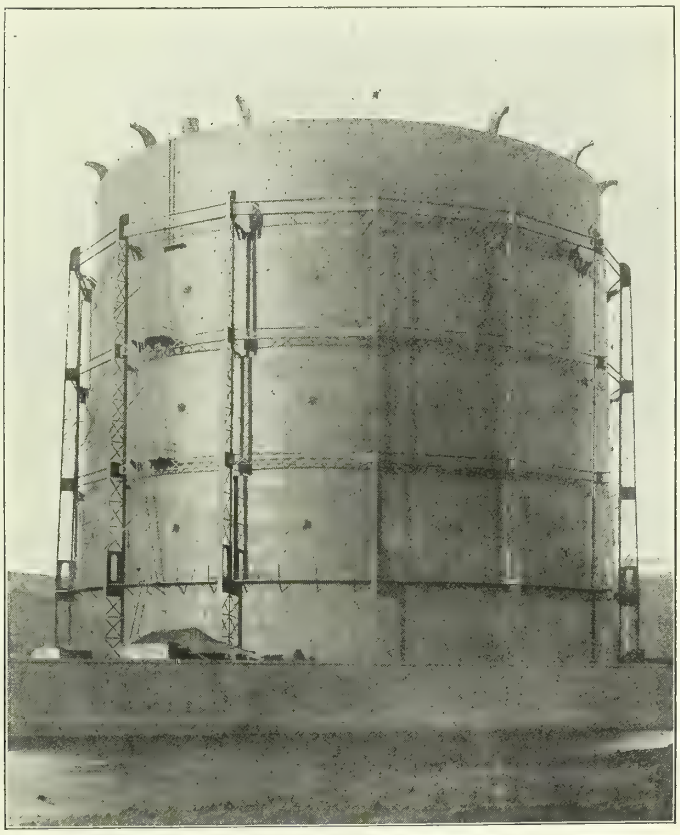
Mr. Jones acknowledged the compliment, and remarked that, though there were comparatively few papers last year, he was glad to be able to say that the programme for the present session had exceeded their expectations. The Council had had quite a number of papers offered which they had been obliged to hold over for a future session.

PRESIDENTIAL ADDRESS.

Mr. Ramsden then proceeded to deliver his Inaugural Address. After pointing out that the Association had been in existence for five years, and expressing the opinion that they might well congratulate themselves on keeping up the membership roll and the enthusiasm of the members, he referred to the reading and discussion of papers. The importance of the members becoming further acquainted with each other by means of informal gatherings was emphasized, as well as the fact that the writers would find that the preparation of a paper was a very pleasant form of education. In this connection, reference was made to the article on "Papers and their Preparation," by Mr. Norton H. Humphrys, which appeared in the "Journal" for Aug. 23 last (p. 521). Mr. Ramsden then continued as follows:

EXTENSIONS AT BURTON.

We have recently been extending and reconstructing part of our works at Burton-upon-Trent; and perhaps an account of some of the work may be of interest. Most of our retort-settings having become old-fashioned, the Gas Committee, in 1908, decided to replace them by something more efficient. At that time, we had one retort-house about ten years old, containing nine beds of eight through retorts, heated on the regenerative system, and four small retort-houses containing 150 retorts altogether, all direct-fired; and as there was no ground at the works suitable for retort-houses except that occupied by the old ones, arrangements had to be made for clearing away the four latter. In order to make it reasonably safe to do this, and with a view to more economical retort-house working generally, it was decided to increase our storage capacity, as our two holders held only a million cubic feet between them, while the maximum day's output was well over a million-and-a-half.



Dimensions: Tank 125 ft. diameter. Diameter of Lifts: 115 ft. 9 in.; 118 ft.; 120 ft. 3 in.; 122 ft. 6 in. Depth of Lifts: 25 ft. each.

Four-Lift Telescopic Gasholder and Steel Tank at Burton-on-Trent.

NEW HOLDER AND STEEL TANK.

By the time drawings and specifications for the new holder, tank, and foundation had been prepared by our Consulting Engineer (Mr. J. Ferguson Bell, M.Inst.C.E., of Derby), and tenders accepted, it was the middle of April, 1909; and we commenced operations by diverting a railway siding which went across the middle of the site of the new holder. In accordance with our usual custom, we had this work carried out by the Railway Company, finding part of the labour ourselves, to expedite matters.

FOUNDATION.

By the beginning of May, when we had cleared the site, the contractor for the foundation for the steel tank had obtained a convenient tip, and started excavating. Practically within a month, he had completed digging out a circle, roughly 133 feet in

diameter, varying in depth from 7 ft. 4 in. to 10 feet, and averaging about 9 ft. 6 in., representing about 6000 cubic yards of excavation, including the extra depth for the inlet and outlet pipes. The concrete foundation was formed of five parts of broken bricks and old retorts, one part sharp sand, and one part best heavy portland cement; a continuous concrete mixer in the form of a revolving cylinder 9 feet long being used. The materials were gauged dry in the usual way, and then shovelled in at the top of the cylinder, on the inner surface of which were a number of pieces of angle iron to help in mixing up the materials. A spray of water at the top was turned on at the same time, and when this was regulated properly, the mixing was quite satisfactory. But without close supervision, there was a liability for half a gauging to come out of the cylinder nearly dry, and the other half to follow of the consistency of thin grout. The mixer discharged the concrete alternately into two tip waggons running on tramways moved from day to day to enable the concrete to be tipped just where required. The foundation was put down in two layers, forming a circular block, 133 feet in diameter, with fourteen piers, 4 ft. 3 in. wide projecting 1 foot radially.

On the advice of the gasholder contractor, the top was formed with a rise of 6 inches in the centre; the thickness of concrete being 3 ft. 3 in. there and 2 ft. 9 in. at the circumference. This top was brought to a fairly smooth surface; and just before we were ready for putting together the steel tank bottom, an inch of dry sand free from stones was spread all over to within 2 ft. 6 in. of the edge of the tank. Very little timbering was required; and only a few days' hand pumping had to be done while excavating the trench for the inlet and outlet pipes. The time occupied in putting down the 1550 odd cubic yards of concrete was practically seven weeks.

TANK.

The steel tank is 125 feet in diameter by 26 feet deep. The bottom plates are $\frac{1}{4}$ inch thick, with the exception of the outer row of radial plates, which are $\frac{5}{16}$ inch thick, and a $\frac{3}{8}$ inch plate where the inlet and outlet pipes pass through the tank-bottom. The bottom curb is 5 in. by 5 in. by $\frac{1}{2}$ in. angle; the six rows of side plates are respectively $\frac{11}{16}$ in., $\frac{5}{8}$ in., $\frac{1}{2}$ in., $\frac{3}{8}$ in., $\frac{5}{16}$ in., and $\frac{1}{4}$ in. thick; and the top curve is of 5 in. by 4 in. by $\frac{1}{2}$ in. angle. The 28 rest-blocks are of 12 in. by 6 in. steel joist. The central pier for supporting the truss-column when the holder is grounded, consists of a lattice stanchion 3 ft. 5 in. square, formed of 3 in. by 3 in. by $\frac{3}{8}$ in. corner angles, and $2\frac{1}{2}$ in. by $\frac{3}{8}$ in. lattice bars bolted to the tank-bottom and surmounted by an oak rest-block bolted to the top. There are fourteen intermediate tank-guides, of 7 in. by 3 in. channel, weighing $17\frac{1}{2}$ lbs. per foot, at equal distances between the similar guides attached to the standards. These channels are secured to the tank by 4 in. by $\frac{1}{2}$ in. angle wing-plates. The steel inlet and outlet pipes are 24 inches diameter; the thickness of the vertical parts being $\frac{3}{8}$ inch and of the horizontal parts under the tank $\frac{1}{2}$ inch. They are stayed by means of three $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. steel angles secured to the tank-bottom. The overflow from the tank is of 3-inch wrought-iron tube. The platform round the top of the tank is 2 feet wide, formed of $\frac{1}{4}$ inch steel chequered plate strengthened by a 3 in. by 3 in. by $\frac{3}{8}$ in. angle at the outside, and supported by the top curb of the tank and 3 in. by 3 in. by $\frac{3}{8}$ in. angles, 7 ft. 3 in. apart, which are extended upwards to form the standards for two rows of 1-inch gas-tube hand-railing.

The tank-bottom was supported by a number of short props about 2 feet long while it was being riveted together; and when this had been done, the floor was just covered with water, and a man was sent underneath to make sure there was no leakage. The water was then run out again, the undersides of the plates were coated with hot tar, the weight of the tank-bottom was taken up by a number of screw-jacks placed at intervals round the circumference, the props were removed, and the tank lowered on to the sanded foundation. The border 2 ft. 6 in. wide under the tank which had been left unsanded, was filled up with a thick grout of cement and sand (1 to 2), well rammed in from the outside; and when this had set, hot tar was poured from funnels about 3 feet high through holes left for the purpose in the tank-bottom. The holes were then plugged up, and the tank bedded itself into the mixture of tar and sand spread all over the foundation. When the gasholder was completed and the tank had passed its final test, the bottom row of side-plates was coated with a mixture of eight volumes of tar, one volume of kerosene, and one volume of portland cement, put on hot; the cement being mixed with the kerosene before the tar was added, and the whole being kept well stirred while being applied. Carefully selected soil was then rammed against the sides of the tank, the sloping trench was filled up, the ground trimmed level with the top of the bottom row of plates, and a border about 8 feet wide was made of granite chippings. If it had been practicable, I should have preferred leaving all the side-plates exposed to view; but the site was too restricted to allow of this being done.

HOLDER.

The principal dimensions of the steel gasholder are as follows.

Inner lift. —115 ft. 10 in. diameter by 25 feet deep.
Second lift.—118 ,, 1 ,, ,, ,, 25 ,, ,,
Third lift. —120 ,, 4 ,, ,, ,, 25 ,, ,,
Fourth lift. —122 ,, 6 ,, ,, ,, 25 ,, ,,
Tank. —125 ,, 0 ,, ,, ,, 26 ,, ,,

As to the guide-framing, fourteen lattice standards were carried up from the bottom of the tank for the height of three lifts only above the top of the tank, with three rows of lattice girders and three tiers of diagonal bracing or wind-ties. The crown is supported by 28 main rafters of 4 in. by 5 in. by $\frac{1}{2}$ in. tees, each with three $1\frac{1}{2}$ inches diameter struts and $1\frac{1}{4}$ inches diameter tension-rod. There are 28 main tension-rods $1\frac{3}{4}$ inches diameter from the gusset-plates at the top of the vertical stays to the bottom of the central column. Each tension rod has a coupling-box for tightening up, and is prevented from sagging by being suspended from the tension-rod of the main rafter by a $\frac{7}{8}$ inch diameter rod. The central truss column is 24 inches diameter and 12 feet long, formed of $\frac{3}{8}$ inch welded steel plate, with a 4 in. by 4 in. by $\frac{1}{2}$ in. angle ring and two circular plates 4 ft. 6 in. diameter by $\frac{3}{4}$ in. thick at both top and bottom. The top plates are bolted to the 28 main rafters, and the bottom ones to the 28 main tension-rods. In each of the 28 bays between the main rafters there are seven angle steel purlins; the outer one 3 in. by $2\frac{1}{2}$ in. by $\frac{1}{4}$ in., the next two 3 in. by 2 in. by $\frac{1}{4}$ in., the next two $2\frac{1}{2}$ in. by 2 in. by $\frac{1}{4}$ in., and the two nearest the centre 2 in. by 2 in. by $\frac{1}{4}$ in. —each of them bent at the ends, and bolted to the main rafters. There are two top curbs; the outer one being of 5 in. by 5 in. by $\frac{5}{8}$ in. angle steel, and the inner or stiffening curb (which is 2 ft. $10\frac{1}{2}$ in. nearer the centre) of 5 in. by 5 in. by $\frac{1}{2}$ in. angle steel. The 28 vertical stays are formed of 12 in. by 5 in. joists, weighing 32 lbs. per foot, and extending 12 inches beyond the full depth of the inner lift. Their top ends are connected to the top curb and to the main rafters by two $\frac{3}{8}$ inch gusset-plates 3 feet long, riveted to the joists by angle-plates. They are bolted to the cup at the bottom, and the intervening length is free.

The crown of the holder has a rise of 5 ft. 8 in. The outer circle of crown-sheets is $\frac{1}{4}$ inch thick (except under the carriages, where it is $\frac{3}{8}$ inch thick), and is riveted to the two top curbs. The next circle is 10 B.W.G., and the remainder is 12 B.W.G., with the exception of the crown-plate, which is $\frac{1}{4}$ inch thick. The top and bottom rows of side sheets are $\frac{3}{16}$ inch thick; and the intermediate ones are 12 B.W.G. The cup is 20 inches deep, formed of 9 in. by 3 in. channel, weighing 19·37 lbs. per foot, riveted to the bottom row of side sheets above mentioned, and to a $\frac{3}{16}$ inch cup-plate stiffened at the top with a $2\frac{1}{2}$ in. by $\frac{3}{8}$ in. steel bead.

The fourteen top carriages are made of two $\frac{1}{2}$ inch cheek-plates kept 12 inches apart by two distance-pieces, and mounted on the $\frac{3}{8}$ inch crown plates with 5 in. by 4 in. by $\frac{1}{2}$ in. angles. The rollers are 24 inches diameter, and 4 inches across the face, which is turned. All the carriages are fitted with screwed adjusting rods on each side of the roller, to enable the latter to engage without strain in the channel-guides on the standards; and all the rollers have oil-holes. The 28 cup carriages are also formed of two $\frac{1}{2}$ inch flanged cheek-plates bolted to the underside of the channel steel and to the 12 in. by 5 in. R.S.J. vertical stays. The rollers are 9 inches diameter by 3 inches across the face. The handrailing consists of the usual two rows of 1 inch wrought-iron tubing, carried by standards of 3 in. by $\frac{3}{8}$ in. flats. There are three manholes on the crown; those over the inlet and outlet pipes being of the Livesey pattern. Near the centre of the crown is a 2 inch plug-cock, with a length of 2 inches of wrought-iron tube below it reaching nearly to the water-level when the holder is grounded, for the purpose of blowing the air out before filling with gas. The second, third, and fourth lifts have the top and bottom rows of sheets $\frac{3}{16}$ inch thick, and the intermediate ones 12 B.W.G. Near the bottom of each lift is a manhole. The cups and grips are of similar construction to the cup of the inner lift. The vertical stays are 7 in. by 3 in. channels, weighing $17\frac{1}{2}$ lbs. per foot, bolted to the cup and grip-plates. The top carriages on the grip-plates are all formed of two $\frac{1}{2}$ inch cheek-plates; and those on the second lift are strengthened by two side stays of $3\frac{1}{2}$ in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. angles bolted to the top of the inverted channel. The three sets of rollers are respectively 18 in. diameter by 4 in. across the face, 15 in. by 4 in., and 10 in. by $3\frac{1}{2}$ in.

The cup-carriages and rollers of the second and third lifts are similar to those of the inner lift. On the outer lift, the cup-carriages are of two $\frac{5}{8}$ inch cheek-plates bolted to the bottom curb, and the rollers are 10 in. diameter by $3\frac{1}{2}$ in. across the face. The bottom curb on the outer lift is formed of two 5 in. by 4 in. by $\frac{1}{2}$ in. angles. The fourteen lattice standards, about 100 feet high, are 4 ft. 3 in. wide from the base to the top of the tank, and then taper to 2 ft. 3 in. wide at the top. The front flange is formed of two 5 in. by 4 in. by $\frac{1}{2}$ in. angles back to back. The back flange is similar, and has the 7 in. by 3 in. channel-guide riveted to it. The diagonal and horizontal lattice bars are $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. flats up to the top of the tank. Above this they are 3 in. by $\frac{1}{2}$ in. From 2 ft. 6 in. below the tank platform to 6 ft. 8 in. above it, the lattice-work is replaced by a $\frac{1}{2}$ inch web-plate stiffened at the top with two 5 in. by 4 in. by $\frac{1}{2}$ in. angles, and provided with an opening 18 in. wide by 5 ft. 6 in. high, to allow of a passage round the platform. At the top of each standard is a cast-iron finial 2 ft. 6 in. high, the back corresponding at the base with the 7 in. by 3 in. channel guide, splayed out to a width of 12 in. at the top to receive the top rollers of the inner lift easily. The top flange of the standard under the finial is of two 4 in. by 4 in. by $\frac{1}{2}$ in. angles. The bottom flange is of two 5 in. by 4 in. by $\frac{1}{2}$ in. angles riveted to a base-plate 5 ft. by 2 ft. 6 in. by $\frac{1}{2}$ in. At the base of the standard there is a $\frac{1}{2}$ inch web-plate for a height of 2 ft. 6 in. in place of the lattice work, and a $\frac{1}{2}$ in. gusset-plate secured to the base-plate by a 5 in. by 4 in. by $\frac{1}{2}$ in. angle.

The three rows of girders connecting the standards together at approximately equal distances between the top of the tank and

the tops of the standards have the top and bottom flanges each formed of two 3 in. by 3 in. by ⅜ in. angles, with 2½ in. by ⅜ in. flat diagonal lattice-bars. The ends are of two 3½ in. by 3½ in. by ⅜ in. angles bolted to the standards; and the web-plates at the ends are ⅜ in. thick by 18 in. long. The top row of girders are 2 ft. 6 in. deep; and the middle and bottom rows, 2 feet deep. Between the several rows of girders and the top of the tank are three tiers of 1¼ in. diameter wind tie-rods, secured at the ends by angle-lugs to the lattice-girders or top of the tank, as the case may be, and in the centre of each bay passing through a strong steel ring with nuts on either side for adjusting the tension. There is a straight ladder secured to the inner lift, to gain access to the top when the lift is above the guide-framing, made just narrow enough from back to front to clear the grip-plate of the second lift when the holder is grounded. There are four ladders reaching from the ground to the top row of girders. They are placed in a sloping position, so as to be more easily climbed, and are 21 inches wide with 2½ in. by ⅜ in. flat-bar treads, 3 in. by ½ in. flat-bar sides, and a 1 inch wrought-iron tube for the handrail, carried by short cast-iron brackets. The three ladders above the tank each have a 3½ in. by 3½ in. by ½ in. angle-bar to stay them to one of the standards. At the middle and bottom row of lattice-girders, there are landing platforms 7 ft. by 5 ft. 6 in. between the ladders. The floors are of 2½ inch deals, carried on angle-brackets bolted to the girders; and the handrail consists of two rows of 1 inch wrought-iron tube carried by cast-iron standards.

There is an anti-freezing apparatus, consisting of four cast-iron injectors secured to the top of the tank and the grip-plates of the three bottom lifts respectively. The injectors warm the water, and cause it to circulate round the water-lutes; and each is fitted with a non-return valve. The main steam-supply pipe is 2 in., with a 1 in. branch to each injector; wrought-iron piping being carried about half way up one of the standards and connected to the injectors with flexible metallic tubing.

All the iron and steel work had a coat of boiled linseed oil applied before being delivered at the works; as soon as possible after erection, it was given a coat of red-lead paint; and on completion, it had two coats of a graphite paint. So far, the paint appears to stand satisfactorily. The usual tests for the steel plates and bars were specified; and the performance of them was witnessed in the test-rooms at the various rolling mills.

The erection of the inner lift of the holder was commenced from the tank-bottom; and when the sheeting of the top was well in hand, the cup of the second lift was placed in position on planks supported by the tank platform and the inner lift. These planks were in time replaced by screw-jacks; and the second lift was gradually lowered into the tank as the side sheeting was riveted up. The third and fourth lifts were erected and lowered similarly. As each cup was completed, it was filled with water and tested for soundness; and after the tank had been filled with water and the holder inflated with air, an inspection was made again from a raft inside the holder, to make sure that the cups were water-tight, and that the rollers were properly adjusted to the channel-guides. All the seams of the holder were tested with water for being gas-tight; and the holder was filled with air three times before any gas was admitted. Twenty-seven weeks elapsed from the day the contractor started unloading material to the day the holder was filled with air for the third time.

No quantities were given to the parties who tendered; but according to the information supplied by the contractor on the completion of the work, the weights were as follows:—

Tank, including steel inlet and outlet pipes and bottom lengths of standards	192	tons
Guide-framing (less bottom lengths of standards	79	,,
Four lifts	242¾	,,
	531¾	tons

The effective capacity of the holder is just over 1,100,000 cubic feet. The amounts actually paid to the two contractors were:

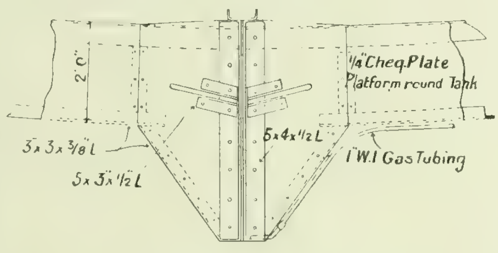
For the holder and steel tank	£8038	£9565
For the concrete foundation	1527	

The cost of altering our gasholder connections, putting in four new 24-inch valves, building a new valve-pit, laying about 180 yards of 24-inch cast-iron inlet and outlet mains, connecting the tank overflow to the sewer, levelling round the tank, printing specifications and plans, and proportion of Consulting Engineer's fees, brought up the total expenditure to £10,410, or £9 9s. 3d. per 1000 cubic feet of gasholder capacity. The accompanying are illustrations of a few details of the holder. The new holder was filled with gas in January of this year, by which time we had commenced pulling down some of our old retort-benches to make room for the new retort-house.

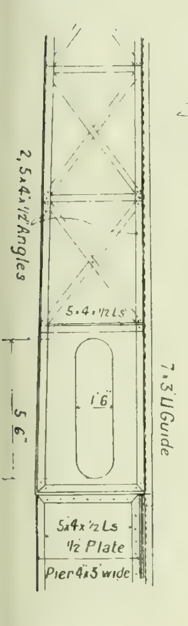
RETORT-HOUSE RECONSTRUCTION.

Practically the whole of the ironwork, including the retort-house roofs, was sold to scrap-iron merchants and cleared out of the way as soon as it was taken down. The good old fire-bricks were dressed and stacked, and afterwards sold to the contractors for the retort-bench and settings. The installation consists of ten beds of horizontal retorts in a new house, with De Brouwer stoking machinery and coke-conveyor; and as it is modelled on the lines of the new carbonizing plant at Derby, which Mr. Ferguson Bell described in his paper before the Institution of Gas Engineers last year, I will not attempt to give a full description of it, but merely indicate some points of difference from the Derby plant which Mr. Bell's further experience, and our special local conditions, led us to adopt.

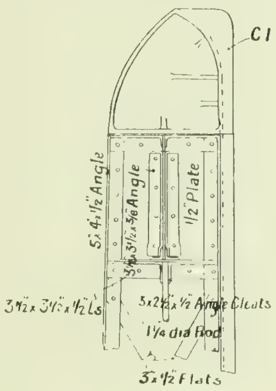
As the side walls of the new retort-house were built on the



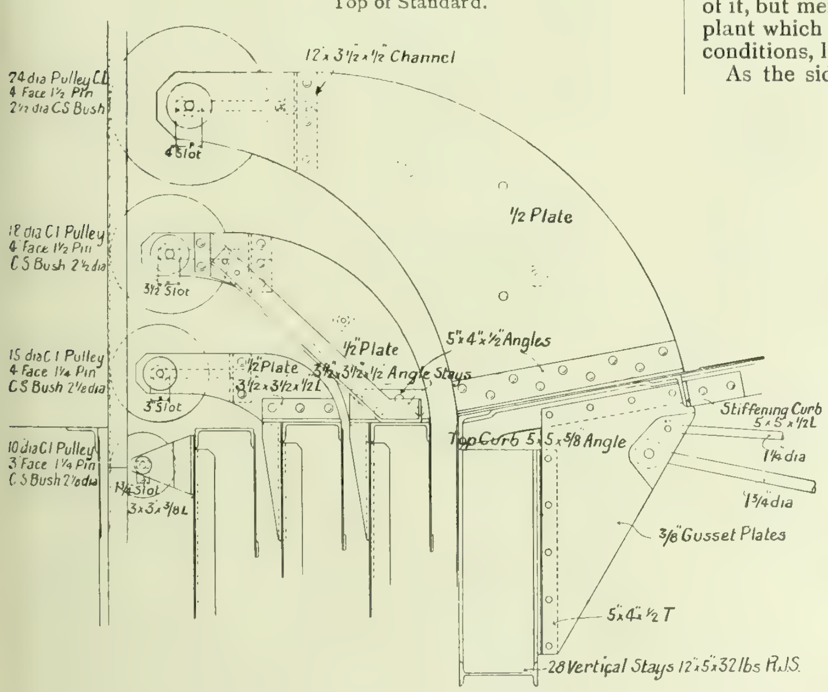
Plan of Standard at Tank Platform.



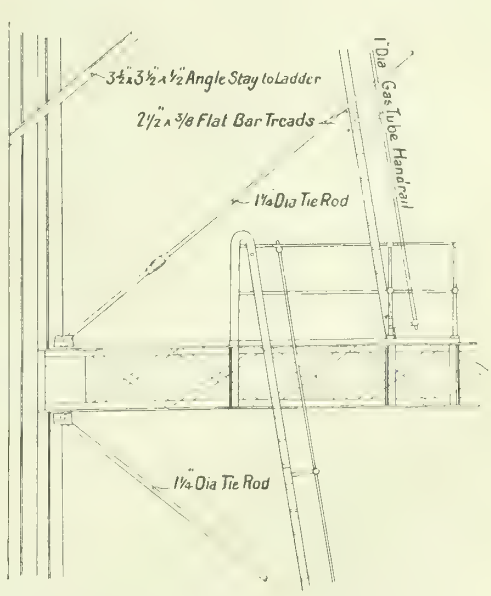
Standard at Top of Tank.



Top of Standard.



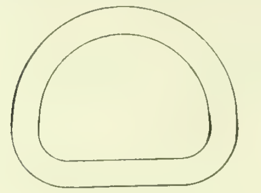
Gasholder Top Curb and Carriages.



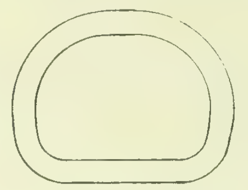
Sloping Ladders and Platform Secured to Girders.

Details of Four-Lift Gasholder and Steel Tank at Burton-on-Trent.

foundations (strengthened and renewed where necessary) of the end walls of the old houses, a width of 64 feet between the walls was obtained; and advantage was taken of this by putting in retorts 22 feet long. The retorts were also shaped so as to increase their cross sectional area, which, it will be seen, is considerably more than that of the ordinary 22 in. by 16 in. ⌂ retort. The object of this is to enable the retorts to be practically filled without the coke getting jammed.



Ordinary 22-inch by 16-inch Retort.



Burton-on-Trent 22-inch by 16-inch Retort

Instead of there being ascension-pipes, bridge-pipes, dip-pipes, and hydraulic mains on one side of the bench only, as at Derby, we have gone back to the old system of putting them at each side, but have reduced the size of the pipes from 8 in. to 7 in.; the reason for this being that, with a retort 22 feet long practically filled, there is thought not to be a sufficiently clear exit for the gas when there is an ascension-pipe at only one end. As at the time of writing all contracts in connection with the new retort-house are not completed, it is impossible to say what will be the effect of these alterations.

NAPHTHALENE TREATMENT.

Another interesting piece of work which we carried out last year was the erection of a naphthalene washer at the inlet to the gasholders. The washer is of the Livesey pattern, capable of passing 2 million cubic feet of gas per day; and in order to do away with the risk of stopping gas making with our then limited storage capacity for long enough to break through the gasholder inlet main, and insert tee-pieces for connecting up the washer, we had two 18-inch connections taken off the 24-inch main by the under-pressure drilling system. A blank saddle-piece reaching half-way round was first placed in position under the 24-inch main, and then another saddle with an 18-inch flanged branch was placed on top; the flanges of the two saddles being bolted together, and the annular spaces between the main and the saddle being yarned and caulked with molten lead, just as when two pipes are joined together with a slip socket. The 18-inch valve was next bolted on to the saddle, and the drilling machine was bolted on top again. The valve was then opened, and the 18-inch cup drill screwed down until it was in contact with the 24-inch main, and rotated until it had cut out an 18-inch disc, when the drill with the disc inside it was screwed up above the valve, the valve was closed, and the drilling-machine removed. Both connections were made successfully, without any mishap. The total cost of the washer, foundation, and connections was £204.

We use Derby solvene in the washer, and adjust it to throw a back-pressure of from 1 to 2 inches, either by altering the level of the liquid or by partly opening the bye-pass. From the end of May, 1909, when it was set to work, up to the end of August last, we used 1714 gallons of the Derby solvene, for which we paid £72 18s.; and during this time we made 427 million cubic feet of gas. So at Burton the process needs on an average 4 gallons of solvene, costing 3s. 5d., per million feet of gas. Until 1904, the naphthalene trouble was practically unknown at Burton. Then in the summer of 1906, it began to be a nuisance, affecting the public lamps first, and then consumers' services and meters—particularly in roads with shallow mains and services. We have about 10,000 consumers; and in 1908 we had 292 complaints from consumers due to naphthalene stoppages. In 1909, with the naphthalene washer in use from the end of May, we had ten complaints, and so far this year we have had only one. These figures testify, without comment, to the efficacy of the Derby process.

ACCIDENTS AND WORKMEN'S COMPENSATION.

In May, 1907, just before the Workmen's Compensation Act of 1906 came into operation, our Town Council considered the question of insurance, and, wisely, I think, resolved to take no steps to insure their workmen against accidents under the new Act. The lowest premium quoted at the time for insuring the gas-works employees alone was over £73 a year, and 5s. 6d. per £100 of wages if all the Corporation workmen were insured; whereas our record since the Act came into operation has been as below.

Period.	July, 1907, to June, 1908.	July, 1908, to June, 1909.	July, 1909, to June, 1910.	Total.
Total number of accidents.	18	14	16	48
Total wages after deducting pensions, sick, and accident pay	£12,693	£11,867	£11,885	£36,445
Amount of accident pay. Total. . .	£28 19s. 1d.	£59 6s 3d.	£22 11s. 8d.	£110 17s.
Amount per £100 of net wages . . .	4s. 7d.	10s. *	3s. 10d.	6s. 1d.

Over £27 was paid during the year 1908-9 to one man who was away for 50 weeks with a broken arm.

We make an allowance to a workman if he is away from work owing to an accident for three days or more, just as we do in the case of sickness, instead of keeping strictly to the Act and allowing nothing during the first week if the man is away for less than two weeks. To minimize the ill-effects of accidents as far as possible, we encourage our men to become qualified members of the St. John Ambulance Association.

MANTLES FOR STREET LIGHTING.

For the last five years, we have bought our mantles for street-lighting purposes on terms which, I think, are not in very general operation, so perhaps it may be interesting to state them. The Company who have supplied us have sold us the mantles at so much per gross, and guaranteed that if we required more than eight mantles per burner per annum on the average, they would supply the excess quantity free of charge, provided that we used no mantles but theirs during the contract. The Company have always accepted our figures without hesitation, and carried out their bargain most satisfactorily.

MAINTENANCE ON CONSUMERS' PREMISES.

With reference to the maintenance of consumers' burners and fittings, &c., I am inclined to think that, for a Corporation like Burton, who have not a regular private gas-fitting business, apart from stoves and installations in connection with prepayment meter supplies, the best course is to clean out and adjust burners, fires, stoves, &c., free of charge, and let the consumer find his own mantles and other materials. The drawback to the system is that not enough people take advantage of it, though we call their attention to it by gummed slips on the gas bills. We also call attention to the offer by periodical paragraphs in the local papers and by various other means. I am afraid I cannot see a remedy for this state of affairs; for if we had a staff of young men going to every consumer, house by house, adjusting burners, they would probably be simply annoying people whose burners happened to be in order, while other people would still go on for weeks dissatisfied with dirty burners, but not making a complaint at the proper quarter.

PREPAYMENT SUPPLIES WITH AND WITHOUT STOVES.

Prepayment meters were introduced into Burton in 1896; and we went into the business whole-heartedly from the start—laying services, fixing penny or sixpence in the slot meters, piping old (but not new) property, and supplying within reason as many brackets and stuffing-box pendants as were required, together with a useful griller 13½ in. by 12½ in. by 10 in., with two burners, insisting that the griller was fixed in every case. There is, of course, nothing out of the ordinary in all this; but I mention the matter with a view to recommending those of you who have not already done so to consider the advantage of supplying your prepayment consumers with stoves. We started doing this in 1908, on the advice of our Consulting Engineer; and the results have been quite satisfactory. We decided on a good sized stove, 31 inches high, with oven 26 in. by 15 in. by 12½ in., with packed sides and door and three burners on the top, restricting ourselves to two first-class manufacturers, and insisting on their making everything above the hot-plate interchangeable; these being the parts which most frequently want renewing, though it appears that this course does not meet with the unqualified approval of the Technical Press. We ordered 500 stoves at first; and after 300 of them had been in use for six months, the results were as follows.

		Cubic Feet a Year.
Prepayment consumers with stoves used 40 cubic feet a day, or at the rate of		14,600
Prepayment consumers with grillers used 25 cubic feet a day, or at the rate of		9,100
Increase due to stove, 60 per cent., or		5,500
	Per Annum. s. d.	s. d.
Increased revenue, 5500 cubic feet, at 3s. 4d. per 1000 cubic feet		18 4
Expenditure.		
5500 cubic feet of gas at 1s. 6d. per 1000 cubic feet (this being approximately net cost, including manufacture, purification, distribution, management, and establishment charges)	8 3	
Depreciation and maintenance of the stove, paid for out of revenue at a cost of 47s. fixed complete with piping, &c., as compared with 12s. 9d. for the griller, fixed complete—difference 34s. 3d. 12 per cent. on this amount	4 1	12 4
Annual profit on each stove.		6 0

Our Town Council were satisfied with the results, and ordered another thousand stoves, of which we have fixed rather more than one-half; and I see no reason why the system should not be extended in time to the whole of our prepayment consumers, who last March numbered 5508, as compared with 4834 consumers by ordinary meter. As far as possible, we sell the grillers which are displaced to ordinary consumers who are without stoves, at 5s. fixed complete; and the surplus we send to the makers supplying the stoves, who give us a small allowance for them as scrap iron.

INCANDESCENT FITTINGS FOR PREPAYMENT CONSUMERS.

Another innovation which we made this year was to supply for new prepayment installations a neat, well-designed harp-fitting suitable for either an upright or inverted incandescent burner,

instead of a stuffing-box pendant, which is really not suitable for anything but an obsolete flat-flame burner. We do not include an incandescent burner, but suggest to the consumer that he should buy this from one of the local tradesmen. This innovation is much appreciated by our consumers, and the difference in cost is only about 7d.

VOTE OF THANKS TO THE PRESIDENT.

Mr. JONES proposed a vote of thanks to the President for his interesting address, which, he said, the members would study with profit when it appeared in the Technical Press.

Mr. R. J. ROGERS (Birmingham) seconded the vote; and it was passed with acclamation.

AN INVITATION TO BURTON.

The PRESIDENT, after acknowledging the vote, said the members would see by the programme that on April 8 it was intended to visit a gas-works. Since the programme was printed, he had, with the acquiescence of the Council, brought before the Gas and Electricity Committee of Burton-on-Trent the question of a visit by the members of the Association to the works. The Committee had authorized him to say that they would be delighted to see the Association on that date; and if the members were agreeable, he would be pleased to make arrangements for an inspection of the works and for some little entertainment afterwards. The Hon. Secretary would make an announcement with regard to the first of the informal meetings to which he had alluded in the opening portion of his address.

TAR DISTILLATION.

Mr. A. R. WARNES, of Messrs. J. Hardman's Tar Distillery, Birmingham, then read a paper on "Tar Distillation," which will be found on pp. 131-35. The author amplified many of the points in the paper; and the description of the apparatus employed he accompanied by numerous sketches on the blackboard.

PROMOTIONS.

The PRESIDENT said he felt sure those present would like to hear read a list of the promotions which members of the Association had recently secured.

The HON. SECRETARY (Mr. G. C. Pearson), after referring to the fact that Mr. Hubert Pooley, an honorary member of the Association, was removing from Stafford to Leicester, went on to say that the following promotions had taken place among the members: Mr. James Hewett, to Distribution Engineer of the Birmingham Corporation Gas Department; Mr. T. Brooke, from Adderley Street to Superintendent at Nechells; Mr. C. C. Barber, from Adderley Street and Nechells to Superintendent at Adderley Street; Mr. H. E. Temple, from Nechells to Assistant Manager at Christchurch, New Zealand; Mr. R. Wardell, from the Council House, Birmingham, to Assistant Manager at Cambridge; Mr. T. H. Poulson, from Stafford to at Cannock; Mr. G. E. Holmes, from Saltley to General Foreman at Southampton; and Mr. W. Ault, a pupil at Tipton, to Junior Draughtsman at Saltley.

AN ALTERATION.—THE COFFEE MEETINGS.

The HON. SECRETARY said it was announced in the programme that in January there would be an evening visit to the Birmingham works of Messrs. Parkinson and W. & B. Cowan. He had, however, had a communication from the firm to the effect that they were making some alteration to the works, and that therefore it might be better for the visit to be put off for about two months. Under these circumstances, it had been decided that this visit should be put forward to March, and that the Council should make arrangements for another visit in January to take its place. The President had suggested that the Association should hold "coffee meetings;" and it had been determined that the first of these should take place immediately after the next general meeting, on Nov. 12. Of course, there would be no reporting; the idea being to make these gatherings as social as possible.

In a recent number of the "Comptes Rendus" of the Paris Academy of Sciences, MM. Ernest van den Broeck and E. A. Martel deal with the conditions of effective filtration of the underground waters in certain chalk formations. It appears that in Belgium the crinoidal chalk at the base of the carboniferous strata of the Dinant geological basin furnish filtered potable waters in a remarkably constant manner.

Cinders for stopping leaks in dams have been used, according to "Engineering Record," by a local Light and Power Company at Joliet (Ill.). On account of the absence of headgates in the plant, it is necessary, when repairing the water-wheels, to shut the water off from the wheel-bags by sliding 2-inch planks down through the frames of the trash racks. Such leaks as remain are filled by scattering a few sacks of cinders along the planks. Before the use of the cinders was hit upon, straw, canvas, sacks of sand and clay, and almost everything that could be thought of, were tried in the effort to close the leaks, but without success. Finally, cinders were used, and they closed the apertures completely. It is explained by the Chief Electrician of the Company that the large pieces of cinders seem to find the openings, into which they are drawn by the force of the water, and stick tightly in them, while the smaller pieces fill in the remaining cracks until the openings are entirely closed. Cinders, of course, will not be of any use where the openings to be filled are very large.

COAL-TAR DISTILLATION.

By ARTHUR R. WARNES.

[A Paper read before the Midland Junior Gas Engineering Association.]

Though coal tar is an accidental, but unavoidable, bye-product obtained in the process of the carbonization of coal, it is at the present day a valuable asset to the gas undertaking. The extent of the chemical industry of which coal tar is the starting point is enormous; and it is not possible to predict with certainty when it will reach its limit. It is said that the industry originated with a German Chemist, Johann Joachim Becher, and was followed up later by Clayton (1737-38), Accum (1815), and Bethel (1838).* In 1856, the late Sir William Perkin discovered the first aniline colour, mauve—benzene being the starting point; and this discovery gave impetus to the coal-tar distilling industry.

Coal tar is a black, viscid liquid possessing a characteristic smell. The specific gravity varies between 1·1 and 1·2 at 60° Fahr. It is a very complex mixture of chemical compounds, the number of which amounts to upwards of 190. Compounds of the aromatic series generally occur in the larger quantity, and those of the aliphatic series in the smaller. There also occurs in coal tar a substance known as "free carbon," about which a few words will be said later. The amount of each series of hydrocarbons and also the "free carbon" varies—the two series to a lesser degree, and the carbon to a greater—according to the temperature at which the tar is formed, to the kind of retort employed, to the sort of coal used, and, in all probability, to the pressure existing in the retort.

The nature of the raw material and the temperature of carbonization of the coal influence the quantity, and to a much greater extent, the quality, of the tar. As regards the nature of the raw material, coal tar obtained from cannel coals is of less value to the distiller than that obtained from the bituminous coals. It contains an excessive quantity of bodies of the paraffin series. Much shaley matter present in coal will result in the production of a tar containing an undesirable percentage of the same compounds. Coals from different parts of the country yield tars of a more or less different nature. North Country coals yield a tar containing a good percentage of creosote, naphthalene, and anthracene, and a lesser percentage of light oils; while the coals obtained from Lancashire, Yorkshire, and the Midlands produce a tar containing rather less creosote and naphthalene, and more light oils.

The quantity of tar yielded from coal appears to vary according to the percentage of oxygen in the latter. [Bunte, "Journal für Gasbeleuchtung," 1886.] This worker's results have received confirmation by the report on 1012 trials made on a working scale by the Paris Gas Company (1874-1884) with 59 different classes of coal.† As a result of these trials, the following conclusions were arrived at: "The higher the percentage of oxygen, the more tar and ammonia are formed, and the more hygroscopic water is contained in the raw coal. On the other hand, the yield of coke and gas is less with a rise in the percentage of oxygen." Newbigging, in his "Gas Manager's Handbook," also confirms that the production of tar increases with the percentage of oxygen in the coal. He states that the average percentage of oxygen in Newcastle coal is 5·69, and in Lancashire coal 9·53; and he points out that the yield of tar bears some ratio to these figures.

Considering, now, the effect of temperature of carbonization on coal tar, we find that high heat tars contain but mere traces of paraffins, small quantities of olefines, and acetylenes, benzene hydrocarbons, and naphthalene in large quantity. The nitrogen occurs principally in the form of pyridine bases; and the predominant phenols are carbolic acid and the cresols. Free carbon occurs in large quantity.

Low-temperature tars generally contain less naphthalene and hydrocarbons of the benzene series, a large quantity of the paraffin and olefine series of hydrocarbons, less free carbon, and the nitrogen occurs principally in the form of aniline. The phenols are more complicated than those occurring in high-temperature tars; those predominating being of the guaiacol and creosol type.

In connection with the effect of temperature on the quality of coal tar, Lewis T. Wright ‡ carried out a number of carbonization experiments on the same kind of coal, and examined the composition of the tars yielded. The temperatures used varied between 600° and 800° C. The results are given in the following table.

—	1.	2.	3.	4.	5.
Cubic feet gas per ton coal	6,600	7,200	8,900	10,162	11,700
Specific gravity of tar	1·086	1·102	1·140	1·154	1·206
Composition of tar (by weight)	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Ammoniacal liquor	1·20	1·03	1·04	1·05	0·383
Crude naphtha	9.17	9·65	3·73	3·45	0·995
Light oils	10·50	7·46	4·47	2·59	0·567
Creosote oil	26·45	25·83	27·29	27·33	19·44
Anthracene oil	20·32	15·57	18·13	13·77	12·28
Pitch	28·89	36·80	41·80	47·67	64·08

* Lunge "Coal Tar and Ammonia," Fourth Edition, pp. 6-11.

† "Journal de l'éclairage au Gaz," July, 1886.

‡ "Journal of the Society of Chemical Industry," 1888, p. 59.

The same worker* obtained the following results with a Derbyshire Silkstone coal.

Temperature.	Sp. Gr. of Tar.	Free Carbon.	Remarks.
		Per Cent.	
800° C.	1·000	about 15	
1100° C.	1·207	25–30	Quantity of tar fell

With a rise in the temperature of carbonization, Watson Smith* found that tar yielded more naphthalene and anthracene, and that carbolic acid appeared not only in the carbolic oil, but in the heavy oil also.

That the type of retorts used is responsible for variation in the quality of tar obtained is shown in the following table, compiled by Mr. R. O. Wyne-Roberts, M.Inst.C.E., of Westminster.

According to Mr. O'Connor,† Glover's chamber retorts yield a much thinner tar than that obtained from horizontal retorts. The

—	Tar from Horizontal Retorts.				Tar from Vertical Retorts.				Tar from Inclined Retorts.	Tar from Chamber Retorts.	Tar from Coalite Process.
	(1)	(2)	( )	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Sp. gr. at 60° Fahr.	1·2	1·25	1·22	1·25	1·1	1·12	1·119	1·13	1 095	1·18	1·07
Composition by distillation—	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Light oils below 170° C.	3·10	1·1	1·4	1·1	5·85	1·7	3·7	2·3	4·4	0·4	10·8
Middle oils 170–270° C.	7·68	13·1	10·5	13·1	12·32	21·9	20·2	16·5	28·5	10·2	20·0
Heavy oils 270–350° C.	10·15	13·2	16·14	13·2	11·95	21·6	23·1	20·8	19·2	30·1	30·0
Anthracene	11·64	—	—	—	15·95	—	—	—	—	—	—
Pitch	62·00	72·6	71·8	72·1	49·75	54·8	52·6	60·0	47·5	53·9	39·2
Naphthalene	—	—	—	9·0	—	3·6	4·8	3·6	—	4·7	—
Free carbon	about 20	—	—	28·7	2 to 4	0·4	4·2	0·6	2·6	11 1	—
Water in tar	—	—	6·0	—	—	—	—	—	2·2	10·1	—

proportion of light and heavy oils are increased, and the free carbon percentage decreased.

Local superheating of the gas is, according to Kunath,† the principal cause of the thickening of tar. He considers that thinner tar is to be obtained by charging the retorts with as much coal as possible, and thus reducing the gas space and contact surfaces. The result obtained by using heavy charges, as suggested by Mr. Charles Carpenter, has to a large extent confirmed Kunath's conclusions.

At this juncture, a few words on "free carbon" will not be out of place. To the tar distiller, this substance is a perfect nuisance. It reduces the quality of the pitch made from the tar, and is probably the chief cause of the burning of the plates composing the tar-still bottom. During the operation of distillation, a portion of the "free carbon" contained in the tar drops to the bottom of the still, and this bakes on. When the pitch is run off, this baked "free carbon" tends to hold a small quantity of the former; and the heat stored up in the brickwork surrounding the still carbonizes the pitch left behind, and this, together with the baked "free carbon," forms a hard coke-like layer on the still bottom. This layer is a bad conductor of heat. How the presence of this non-conducting layer—which increases in thickness with each distillation—materially assists in the burning and buckling of the plates of the still bottom, will be clearly seen when the high temperature necessary to finish the distillation process is taken into consideration. Several attempts have been made to remove the "free carbon" from the tar before distillation; but none of them has turned out a commercial success.

The name "free carbon" is somewhat misleading, as this material is not actually pure carbon, but contains other substances as well. I have carefully precipitated this material out of tar by the aid of crude naphtha, and have thoroughly washed it with 90's benzol. After allowing it to dry at the atmospheric temperature for some months, I obtained a brownish black powder. This material lost by volatilization, at 100° C., 6·74 per cent. of its bulk; 84·55 per cent. of this volatile matter being driven off during the first hour of heating. The volatile matter is of a heavy, oily nature, resembling somewhat the condensed vapours from hot pitch. The mean of several ash determinations is 1·59 per cent.; and this ash consists chiefly of oxide of iron. A portion of the "free carbon" is soluble in ether, alcohol, chloroform, and petroleum spirit.

A rapid method of determining approximately the percentage of "free carbon" in the high temperature tars of to-day is secured by the use of a Twaddel hydrometer and the following general formula.

$$\text{“Free carbon”} = 0{\cdot}8n - 10,$$

where n = the degrees Twaddel of the tar.

I have tested this method a large number of times, with excellent results; and the same good results have been obtained by some of my fellow workers, both with Yorkshire and Midland tars. The following are a few examples.

—	° Twaddel.	Free Carbon by Chemical Test.	Free Carbon by Formula.
		Per Cent.	Per Cent.
1	47	27·87	27·6
2	39	21·50	21·2
3	41	22·80	22 8
4	43	24·70	24·4
5	32	14·85	15·6
6	42	23·76	23 6
7	45·6	26·79	26·48

In this paper, I do not intend to deal with the coal tars obtained from coke-ovens, gas-producers, blast-furnaces, and the coalite process. I will, therefore, give you a few particulars of the yield of distillates obtained in the distillation of coal tar produced in the process of gas making, and then bring before your notice the plant used in the process of distillation.

Yorkshire Tars.

	(A.)		(B.)
Liquor	7·3 galls. per ton tar	..	1·8 galls. per ton tar
Crude naphtha	14·0 ,, ,, ,, ,,	..	10·5 ,, ,, ,, ,,
Light oil	23·4 ,, ,, ,, ,,	..	12·3 ,, ,, ,, ,,
Creosote	35·1 ,, ,, ,, ,,	..	53·5 ,, ,, ,, ,,
Anthracene oil	28·1 ,, ,, ,, ,,	..	6·0 ,, ,, ,, ,,
Pitch	9·3 cwt. ,, ,, ,,	..	11·5 cwt. ,, ,, ,,

Northern Tar.

Liquor	11·5 per cent.
Crude naphtha	0·9 ,,
Light oil	3·0 ,,
Creosote	15·6 ,,
Anthracene oil	10·4 ,,
Pitch	57·5 ,,

Metropolitan Tars.

[Lunge "Coal Tar," Fourth Edition, p. 412.]

	Silvertown. Per Cent.		Beckton. Per Cent.
Ammoniacal liquor	4·16	..	2·00
Crude naphtha	1·50	..	1·66
Light oil	1·16	..	1·62
Creosote and naphthalene	14·16	..	15·70
Anthracene oil	14·00	..	18·83
Anthracene	1·80	..	1·90
Pitch	60·00	..	56·29
Loss	3·22	..	2·00

Midland Tar.

Ammoniacal liquor	4·50 galls. per ton tar
Crude naphtha	4·36 ,, ,, ,, ,,
Light oil	18·20 ,, ,, ,, ,,
Middle oil	9·20 ,, ,, ,, ,,
Creosote and anthracene oil	31·80 ,, ,, ,, ,,
Pitch	12·90 cwt. ,, ,, ,,

In a modern tar distillery, the following plant is required for the distillation of tar: Storage tanks, steam-boilers, pumps, stills, preheaters, condenser coils and condenser tanks, collecting and dividing boxes, apparatus for dealing with foul gas, receivers for distillates, pitch-coolers, and a pitch-bay. It will not be necessary to deal with steam-boilers in this paper.

Dehydration Apparatus.—Although several types of apparatus have been invented to rapidly carry out the process of dehydration—and some of them are in use—the usual method, at least in England, is to allow the tar to undergo prolonged rest in large storage tanks or wells. Heating the tar and then allowing thin films to flow over inclined surfaces, centrifugalizing, and grinding between heated rollers, are examples of some of the methods suggested to secure the dehydration of tar. In a recent patent, Wilton (No. 26,910 of 1907) proposes the use of apparatus consisting of a series of coils, one end of which opens into a moderate sized chamber. The tar is freed from water in this apparatus as follows: As it flows through the coils, it is heated to about 130° C. under a pressure of about 30 lbs. to the square inch. On reaching the end of the coil, the hot tar drops into the chamber, and the pressure being reduced, steam and light oil vapours escape and are condensed by a suitable condenser. The hot dehydrated tar is conducted direct to the stills. This plant is said to be in use at the present time at the Beckton works.

Stills.—For the distillation of tar, stills of almost all sizes and shapes have been used. At the present day, however, horizontal and vertical stills are the chief kinds employed. In England and Germany, the vertical type finds the most favour; and experience proves that it is still the most economical to use. Horizontal stills do not work so rapidly, and more fuel is consumed per ton of tar distilled—*e.g.*, 3·5 cwt. of fuel per ton of tar distilled, against 1·5 cwt. when a vertical still is used. There is also greater risk of the still becoming injured by burning if this type is used.

* "Journal of Gas Lighting," Vol. LII., p. 169.
† "Chemiker Zeitung," 1885, p. 1893.

* "Journal of the Society of Chemical Industry," 1880, p. 950.
† "Proceedings of the Institution of Gas Engineers," 1900, p. 127.

The vertical still consists of a cylinder of nearly equal height and diameter, provided with a dome-shaped top and a concave bottom. The bottom is now usually made in sections, in order to facilitate repairs, and to give additional strength. The advantages of building a still with a concave bottom are: (1) A large heating surface is secured; (2) the metal can expand and contract with comparative ease; (3) the stiffness of the bottom is increased; (4) the pitch drains off more completely than with any other shape. The bottom is not sprung directly off the side of the still, but from a channel plate, which is itself attached to the inside of the still. A very large number of stills of this type are constructed with high-pitched domes; but this is a mistake. It does not add to the efficient working of the still, nor is it necessary from the point of view of strength; and it materially assists in the process of corrosion—the nightmare of the tar distiller. Low-pitched domes should be put in; and they should be built in segments. The shell plates should be between $\frac{3}{8}$ inch and $\frac{1}{2}$ inch thick, the bottom plates $\frac{9}{16}$ inch to $\frac{3}{4}$ inch, and the dome plates $\frac{7}{16}$ inch to $\frac{9}{16}$ inch, according to the size of the still. Wrought iron of the best quality should be used throughout the construction. All rivet-holes should be drilled, not punched—thus doing away with the risk of torn or strained plates next the rivet-holes, and consequent weakened seams. Cast-iron tar-stills have been suggested, and are sometimes put in; but this is not to be recommended. There is the almost certain risk of faults occurring in such large castings; and the danger of the bottom cracking is very great. They are more difficult to repair, when occasion requires, than wrought-iron stills; and the fuel consumption is larger, owing to the greater thickness of metal.

The still is provided with the following fittings: A safety-valve or similar contrivance, a charge-block for connecting up to the charging-pipe, a steam-pipe inlet-block and dipping-cock, a manlid stool and lid, a tail-pipe for running off the pitch, a swan-neck for leading off the distillates, and a steam-pipe inside connected to a perforated coil or criss-cross arrangement. A thermometer-pipe is sometimes fitted either into the dome or the top of the swan-neck. The safety-valve is provided in order to give warning of stoppage in the condensing-worm. If the still is working normally, there should be very little pressure inside the still. The swan-neck should be made of cast-iron, in order to resist to a greater extent the corrosive action of some of the distillates. The portion riveted on to the dome should be between 12 inches and 24 inches inside diameter, and should narrow down to between 4 inches and 6 inches, according to the size of the still. The manhole should be at least 16 inches, and the stool and lid of cast iron. The charge-block and steam-inlet block are also of cast iron. The tail-pipe is made of wrought iron riveted on to the still. The steam-pipe varies between 1 inch and 2 inches, according to the size of the still.

All exposed portions of the still should be carefully lagged; and this applies particularly to the spots where the cast-iron stools, &c., are connected to the dome. In addition to the saving in fuel secured by lagging, the corrosion trouble is to a certain extent alleviated. As was pointed out by myself and my Chief Assistant, Mr. W. S. Davey, in a paper recently before the Birmingham Section of the Society of Chemical Industry,* corrosion of tar-stills occurs at great speed where there is excessive condensation—for instance, under the manlid and charge block stools.

In order to protect the plates of the still-bottom, and to effect fuel economy, care should be given to the method of setting the still. It is advisable to protect the bottom of the still with a curtain-arch; and though a little more fuel is consumed per ton of tar distilled (0·18 cwt. per ton of tar distilled), this extra cost is more than covered by the saving effected in repairs. The best type of flue to use is that known as the "Wheel" flue. With this, the flames and hot gases pass from the furnace through several pigeon-holes, and up two short vertical flues into a lower annular flue. The flame and gases before entering this flue are divided into two portions by a baffle-wall. One portion of the current, therefore, passes round one-half of the lower portion of the still, and the other round the opposite half. The flame and gases are now led by means of a further two short vertical flues into the top annular flues, and thence to the downtake and into the main flue to the chimney-stack. The width of the annular flues varies from 9 inches to 14 inches, according to the size of the still.

The tail-pipe (or run-off pipe) of the still is protected from the hot gases by building the lower baffle-wall round it.

Preheaters.—The idea of preheaters seems to have originated with Ellison and Davis (Patent No. 13,929 of 1886). A preheater is very similar in shape to a tar-still, having a flat bottom and dome-shaped top. It holds a little more than a still charge. An overflow-pipe is placed in such a position that all surplus tar (that which reaches the overflow outlet owing to expansion when it gets hot) can be led away to a special tank, thus leaving in the preheater a correct still charge of hot tar. This apparatus is built of wrought-iron or mild steel plates; the thickness varying between $\frac{5}{16}$ inch and $\frac{3}{8}$ inch. It is not necessary to build of thick plate, as wear and tear is not very great. The mountings consist of a charging-block and dipping-tap, a vapour-pipe which leads to a common main and condenser coil, a discharge-pipe and cock, and an overflow-pipe. The position in which a preheater is placed is such that the first portion of the condensing coil from the tar-still can pass through it, and the hot tar be discharged into the still by gravitation. The amount of condensing coil used inside the preheater is usually five to eight laps of $2\frac{1}{2}$-inch to 4-inch wrought-iron pipe, according to size of still. The best pipe to use is extra thick steam, $\frac{5}{16}$ inch in thickness. If this thickness is employed, the top lap, which is the portion of the coil that suffers most severely from internal corrosion, will last between fourteen and sixteen months, against six months if only $\frac{3}{16}$ inch steam-tube is used. Cast-iron tube would be better from a corrosion point of view; but it is more cumbersome, and on account of its thickness the transmission of heat from the distillate to the tar in the preheater would be slower.

Condenser Tanks.—These are of various shapes—*e.g.*, square, rectangular, or cylindrical. The size depends upon several conditions—such as whether the tank is to contain more than one condensing worm, the size of worm, and the size of the still. Ordinary wrought-iron or cast-iron tanks will do. They should be provided with a drain-cock to run off the water in case the tanks or coils require to be repaired. An outlet is necessary near the top of the tank, to allow the cooling water to escape during the first part of the distilling operation. Some sizes of cylindrical tanks in use are: 5 feet to 8 feet in diameter and 6 feet to 9 feet deep, and square tanks 20 feet by 6 feet by 16 feet deep, and 8 feet by 8 feet by 8 feet.

Condensing Worms.—These consist of laps of pipe, each lap being circular, square, or rectangular in plan. The pipes are made of either cast iron or wrought iron, though the latter is preferable, as the thickness of the cast iron hinders somewhat the cooling or warming of the distillates, as the case may require. Some coils are made in sections joined by flanges; others are in one piece. The latter are considered the better type by some, as there is less chance of leakage. The coils generally corrode from the top downwards; and the top laps of coils last, on an average, about three years, if wrought-iron tube of $\frac{3}{16}$ inch thickness is used. Cast-iron tubes do not corrode anything like so rapidly as wrought iron. The bores of condenser tubes vary from 2 inches to 4 inches, and the length of pipe in the worms between 130 feet and 300 feet per still. For a 20-ton still provided with a preheater, about 130 feet of 3-inch wrought-iron pipe is sufficient. The length of pipe in the form of a coil in the preheater should be about 120 feet, if 3-inch bore is employed. A steam-inlet should be arranged for in a suitable position on the coil, in order to admit steam in case of stoppage.

Receiving and Dividing Boxes.—These vary a little in different works. In some cases, the receiving box has several outlets provided with cocks, and each outlet is connected to a separate main, by which the different distillates are conducted to their respective receivers. This is the best plan. Other receiving boxes are provided with two outlets only, one to the divider-box for use in the case of the first distillate—the liquor and crude naphtha—and the other for the various light and heavy oils. The latter outlet is connected by means of various T-pieces and cocks, &c., to the mains leading to the receivers for the several distillates. In size these boxes vary between 2 feet and 4 feet cube.

The divider-box is an apparatus generally cylindrical in shape, and varying in size between 20 inches and 24 inches deep by 14 inches and 18 inches in diameter; the top often being covered in. There is a hole in the cover, into which an inlet-pipe is fitted; and two holes in the cylinder, one on each side and almost at the top, into which outlet-tubes are screwed. The centres of the two holes in the cylinder are on the same level. One outlet-pipe bends down inside the divider-box, and reaches to within about 1 inch of the botton; and the other just enters. The ammonia water in the first fraction, sinking to the bottom, leaves by the former outlet-pipe, while the crude naphtha remaining on the top leaves by the latter outlet.

Before turning from this subject, it should be mentioned that the receiving boxes are covered, and are provided with outlets which are connected to a foul-gas main.

Foul-Gas Mains.—In accordance with the Alkali, &c., Works Regulation Act of 1906, it is required of the owners of any works specified in the schedule of the Act to use the best practicable means to prevent the discharge into the atmosphere of all offensive or noxious gases, or render such gases harmless before discharging into the atmosphere. During the distillation of the tar and the running-off of the pitch into the coolers, offensive fumes and noxious gases are given off; and it is necessary these should be dealt with according to the Act. The plant used in tar distilleries for this purpose varies somewhat according to the ideas of the management. In all cases, it is necessary to provide foul-gas mains to conduct away the gases and fumes from (*a*) the worm-ends and collecting-boxes, (*b*) the receivers, and (*c*) the pitch-coolers. Pipes are therefore connected to these portions of the plant; and they carry the gases, which are drawn forward by means of steam-ejectors or an exhaust-pump, (*a*) to the boiler-furnaces or a special furnace to be burned, (*b*) through special washing and absorbing towers, or (*c*) through oxide heaps or purifiers coming under this classification. An interesting paper on this subject was read before the Society of Chemical Industry, by J. Craven and W. H. Coleman, some time ago.*

Receivers for Fractions.—Any suitable tanks or old boilers may be used for this purpose. Some works employ specially made tanks of a size just sufficient to contain one of the various fractions worked off a single charge of tar; others use large flat-ended or egg-ended boiler-tanks. All the contents are removed from the receivers (*a*) by suction mains connected to a pump, or (*b*) by

* "JOURNAL," Vol. CX., p. 867.

* See "Journal of the Society of Chemical Industry," 1901, p. 200.

compressed air. In the later case, the receivers are built so as to enable the workmen to seal them completely. It is necessary to keep all openings in the receivers covered, to prevent loss by volatilization and the escape of foul gases.

Pumps for Transporting Oils and Tar.—There are various types of pump suitable for work in a tar distillery. Among these are the Evans-Cornish, Tangyes, Worthington, and Cameron pumps. In fact, any good make of pump fitted with piston or mitre valves will be found suitable. Some tar distillers employ an air-compressor, and transport practically all their liquid materials by the aid of compressed air. For carbolic and cresylic acids, and for caustic soda, this is by far the best plan.

Pitch-Coolers.—Cylindrical or square tanks or brick chambers are used to cool the pitch in before running to the pitch bay. The cylindrical type are the most common, and no doubt are the best to use. One cooler is provided for each still, or one for three or four stills, according to the quantity of pitch made. Each pitch-cooler is provided with a manhole, a manlid-stool, and lid, an inlet-pipe stool, an outlet-valve of the "treacle" or lever-plug type, and an outlet for connecting up to the foul-gas main. A form of pitch-cooler known as the "French Wier" is an excellent one, but is not at present used to any large extent in this country.

Pitch-Bay.—This is situated next to the coolers and below them, and is usually a brick or concrete lined pit; the depth and shape varying in different works.

Storage-Tanks.—These vary considerably both in shape and size. Tanks holding 1000 gallons to 800,000 gallons are now in use. They are generally made of wrought-iron plate; but some are made of cast iron, and others of reinforced concrete.

Process of Distillation.

Fuel.—Tar-stills are fired with (*a*) coal, (*b*) coke, and (*c*) producer gas. Coke is generally used in those cases where, calorific value compared with price, it is cheaper than coal, or when it is desired to use the furnace gases in some other process carried out in the works. Coal is the chief fuel used; producer gas coming second. By the use of producer gas, the operation of distillation can be controlled somewhat easier, and the risk of smoke prosecution brought about by careless workmen obviated. There is, of course, the question of cost; and taking all things into consideration, it appears that producer-gas firing is cheaper than coal firing. Less men are required to work a battery of stills if the former fuel is used; and the extra cost of the coal consumed per ton of tar distilled is small—not sufficient to neutralize that used in labour (*e.g.*, in one case the extra cost for coal when using producer gas approximated 0·48d. per ton of tar distilled, while the cost of extra labour when the furnaces were coal-fired approximated 0·84d. per ton of tar).

The object of distilling coal tar is to increase its usefulness, and therefore its commercial value. Broadly considered, the process of distillation is the same in all works. It differs only in certain details—such as (*a*) method of testing for the "cut" or "change-over point" for each fraction, (*b*) the number of fractions a certain tar will yield, (*c*) the desire to manufacture special products from the fractions, (*d*) the quality of pitch desired, (*e*) whether it is required to make special preparations from partly distilled tar, and so on. It is, on this account, impossible in a short paper of this nature to furnish a detailed account of the process of distillation as now carried on in the industry. A general description will, therefore, be given.

Assuming that the still and preheater are properly charged, all connections made, and the condensing-worms and the mains to the receivers perfectly clear—*i.e.*, not choked up with naphthalene and anthracene salts—firing is commenced. Extra care is used during the whole of the first, or crude naphtha and liquor, stage, in order to avoid "priming" or boiling-over of the tar. In an hour or so after the commencement of the firing (the time depending upon the size of the still), the tar will be thoroughly heated through; and as soon as the first drops of the distillate appear at the worm-end, the fire is slackened a little. The distillation is now proceeded with with caution, as it is at this stage in the operation that the tar generally boils over or "primes." Should this unfortunately happen, damping the fire and playing or else pouring cold water on the dome of the still will very soon stop it.

This fraction consists of ammonia water and crude naphtha; and these two liquids are passed, *viâ* the collecting-box, into the divider, where the water sinks to the bottom and is removed by the syphon-like pipe to the liquor main, and thence to a receiver, while the oil which remains on the top is run to the main leading to a naphtha receiver through an outlet near the top of the divider, as already described. As time goes on, the quantity of water in the distillate decreases—the oil, of course, increasing. It is yet necessary to continue careful firing, though the temperature can be raised a little. Towards the finish of this fraction, the water will change in colour from a greenish-yellow to a blood-red. Shortly after this change, the specific gravity of the oil running from the worm-end will stand between ·950 and ·955; and at this point, or at a point pre-arranged by the manager, the distillate is turned from the crude naphtha receiver into the light oil receiver—the distillate being "cut." In those works which use a thermometer, the "cut" temperature varies between 180° and 190° C. The water in the condenser-tank should be kept cold during the whole time this fraction is passing.

Soon after the change over, the distillate will begin to run from the worm-end in a moderately thick stream, and practically free from water. The fire is gradually increased, in order to keep the distillate running at an even rate. The flow of water through the condenser-tank is stopped, and that in the tank is allowed to gradually warm up by absorbing heat from the distillate as it passes through the condensing worm. It is necessary at times to bring the temperature of the water up by the aid of open steam conducted into the tank by means of a steam-pipe having an open coil at the end, which is able to rest on the bottom of the tank.

As the process continues, the amount of naphthalene salts in the distillate increases, and it is necessary to keep this material from crystallizing out and choking up the worm; hence the necessity of keeping the water in the condenser-tank at an elevated temperature. When the oil running from the worm-end reaches a specific gravity between 1·000 and 1·010, or, if a thermometer is used in the still, the temperature stands at between 210° and 215° C., the distillate is at once turned into another receiver. This fraction is known as light oil.

The distillate now begins to appear yellower in colour; and the smell of sulphuretted hydrogen, &c., gets stronger. The fire under the still is further increased; and the temperature of the water in the condenser-tank is allowed to rise. The point at which the distillate is "cut" to make this fraction—known as carbolic or middle oil—varies in almost every works. In those which use a thermometer, it is sometimes stopped between 230° and 240° C.; and where the "cut" point is determined by specific gravity, between 1·020 and 1·025 at the worm-end. Towards the end of this fraction, the oil generally shows a great tendency to set solid on cooling, due to naphthalene salts.

As the process continues, the distillate gets much yellower, the odour stronger, and the tendency to set solid on cooling sometimes decreases. This fraction, which is known as creosote oil, is stopped at a temperature of between 260° and 270° C., or at a specific gravity at the worm end of between 1·050 and 1·055. At this point, the distillate is turned into another receiver.

The process of distillation has now reached a point where it is necessary to allow the water in the condenser-tank to boil; and it should be brought up to this temperature, if necessary, by the aid of live steam. The distillate, as it runs from the worm-end, has a greenish-yellow colour, and appears viscid. The odour is generally very strong of sulphides; and it is necessary to see that the foul-gas mains, &c., are in good working order. As distillation proceeds, steam is introduced into the still, and the fire slackened. The point at which steam is introduced varies according to the tar being worked, and has to be found by experience. The introduction of steam helps to lengthen the life of the still bottom by reducing the tendency of the pitch to coke. It also reduces the time required for distillation, and, if carefully managed, increases the yield of oil. The passing of steam is continued until the finish of the distillation, which is determined according to the quality of pitch required—*i.e.*, soft, medium, or hard, or any intermediate quality. The finishing point has to be found by experience; and it is necessary to vary it frequently according to the quality of the tar being distilled.

The residue in the still—pitch—is allowed to remain for several hours before running into the cooler. This is necessary in order to minimize the risk of damage to the still and brickwork owing to the great heat stored up, to put less strain on the cooler (should this be of metal), and also to reduce the danger of the pitch taking fire. After the necessary time has elapsed, the pitch is run into the pitch-cooler, *viâ* the tail-pipe and discharge cock, and the empty still allowed to stand a further length of time, varying in extent according to whether or not a preheater is fitted to the still. If the former is the case, the time need not be long, as the tar in the preheater is already hot. To run cold tar into a hot still would not only start the rivets, but the danger of explosion would be extremely great.

It should be remembered that the stills will require cleaning—*i.e.*, the coked pitch scaled off the bottom and lower portion of sides—after they have been worked a few times. The formation of this scale is due partly to the heat retained in the brickwork surrounding the still coking the thin layer of pitch left in the still at the end of the "running off" operation, and partly to "free carbon" which deposits and adheres to the bottom during the first and intermediate portions of the operation of distilling.

The pitch is allowed to remain a number of hours in the cooler, after which it is discharged into the pitch bay, where it remains until it becomes quite cold, when it is broken up by the aid of hammers and wedges, and placed in railway waggons or carts for dispatch. When the pitch is first run into the coolers, the foul-gas main should be put into action, in order to draw off the acrid vapours and thus avoid a nuisance.

In the short time at my disposal it is not possible to deal with the subject of working-up the various fractions. It must suffice, then, to state briefly what they are worked up into. Considering the first fraction, the ammonia water is converted into ammonia or its salts, and the crude naphtha split up into the various grades of benzol, phenols, and pyridine bases. It also contributes a little towards solvent naphtha. The second fraction—viz., light oil—is split up into solvent and the other grades of naphtha, phenols, bases, and some creosote, and perhaps a little naphthalene. The middle oil—or carbolic oil—is treated to recover carbolic acid, cresols, and naphthalene, and sometimes bases. It also adds its quota to creosote. The creosote fraction is usually dealt with as it comes from the stills; but sometimes the naphthalene salts it contains is separated from it. The last fraction—anthracene oil

—is sometimes worked for the anthracene it contains, and at others mixed with the creosote fraction and sold as creosote oil.

The PRESIDENT (Mr. R. S. Ramsden, of Burton-on-Trent) remarked that Mr. Warnes had given them a comprehensive paper; but possibly there might be some points on which the members would like further information.

Mr. P. C. BALCON (Birmingham) said he was rather sorry to see that the author had not dealt more with the various types of tar obtainable from the different systems of gas production. It would have been extremely interesting to have heard whether he had had any experience with the distillation of vertical retort tar, or tar from chamber systems of carbonization. The tars obtainable from such plants were very different in specific gravity and composition from those which resulted from coal carbonized in ordinary horizontal retorts.

Mr. WARNES said he was afraid he had had no experience with the tars to which Mr. Balcon referred. It was rather early in the day to ask for the experience of tar distillery managers generally in this connection, for as yet it was only the fate of a few to possess it. He did not know how long it would be before Birmingham put in plant of the description named. At other places where he had been previously engaged, they worked up the ordinary horizontal retort tars. He wished he could get some vertical retort tar, because it contained very little free carbon; and free carbon was, of course, a great nuisance in many respects. The price of pitch was to a certain extent affected by the presence of free carbon; and then there was the serious action of free carbon in connection with the burning-out of the plates, and other troubles he had mentioned in his paper.

The HON. SECRETARY (Mr. G. C. Pearson) said that they were greatly indebted to Mr. Warnes for having prepared his paper at very short notice. There was a Council meeting about the middle of September; and it was found necessary to somewhat re-adjust the rough programme which had been drawn up. It was then decided to ask if he would prepare his paper for the first meeting of the session, which meant that he had about a fortnight in which to write it. The paper was a useful one to them; and it was the work of an expert. He proposed a hearty vote of thanks to Mr. Warnes.

Mr. F. J. WARD (Knowle), in seconding the vote, remarked that he was sure Mr. Warnes would rightly understand the reason why there had been really no discussion on his paper. There were very few tar distillers in the district, and gas managers generally were not in the habit of distilling their tars. Personally, he had had some experience of the matter at a Yorkshire gas-works. His connection with the work was somewhat limited; but he watched what others did. He could follow the paper with a certain amount of attention, because some of the things mentioned he had himself noticed particularly. It seemed that a new Act was passed in 1906 which prevented open cooling. At the particular works to which he had referred, the cooling was a perfect nuisance. It was impossible for anyone to live in comfort within 200 or 300 yards of the gas-works. But apparently now this would not be the case.

The vote having been carried with acclamation,

Mr. WARNES said it had been a pleasure to read the paper. He would have liked more discussion, and would have been pleased to answer such questions as he might have been able. Of course, it was impossible to give every detail; but the facts and figures he had included in his paper were all correct. Perhaps at a later date he might be able to give the Association some particulars as to the working-up of fractions.

Lectures on the Law Relating to Engineering.—The Council of the Society of Engineers (Incorporated), in conjunction with the Council of the Junior Institution of Engineers, have arranged for a course of six lectures on "The Law Relating to Engineering," to be delivered by Mr. L. W. J. Costello, M.A., LL.B. (Cantab), at Caxton Hall, Westminster, at 7.30 p.m. The first was fixed for last night; and the rest will be delivered on the following dates: Oct. 25, Nov. 9, Nov. 21, Dec. 7, and Dec. 19. At the close of each lecture, opportunity will be given for the asking of questions and for discussion. The lectures are not free; but the fees for admission may be learnt on application to the Secretary of either of the Societies named.

Students' Catechism on Book-keeping, Accounting, and Banking.—We have received from Messrs. Butterworth and Co. a work bearing the above title by Mr. F. Davey, A.S.A.A. It is based upon a new system of instruction, and is specially designed to enable anyone to acquire a practical knowledge of book-keeping, and to learn at the same time how to answer questions on the subject. It is composed of graduated and classified questions and answers so arranged as to form an easy, systematic, and complete course of instruction, and is the outcome of the author's experience of the requirements of students attending commercial classes. The work is intended to serve as a guide to all examinations in book-keeping and accountancy; and suitable materials for class instruction and practical work are provided in the appendix, which contains a graduated course of exercises and examination questions. The book covers a wide field of practical knowledge, and should appeal not only to students, but to all who are interested in commercial affairs and wish to acquire a useful knowledge of accounts with the least possible expenditure of time and trouble. The price is 3s. 6d.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The Opening Meeting for the Session of the Western District Division of the Scottish Junior Gas Association was held in the Technical College, Glasgow, on Saturday evening, and was very well attended.

Mr. D. CURRIE (Stirling) the retiring President, in commencing the proceedings, said that all that remained for him to do was to again thank the members for electing him to the position, and for the support they had given him during his term. He could assure them that the holding of the office had been a very pleasant experience to him; and he had benefited greatly by his occupancy of the chair. It was not necessary for him to introduce the new President, Mr. Fraser, as he was well known to almost every member of the Association; and, taking everything into consideration, he thought they were most fortunate in having him as President.

Mr. J. FRASER (Provan), on taking the chair, expressed his thanks to the Past-President for the courteous manner in which he had introduced him, and to the members for their reception. He then explained that the Vice-President (Mr. A. Kellock, of Alloa) had received an appointment at Pontefract, and it would therefore be necessary to elect someone in his stead.

Mr. F. Cuthbert (Kirkintilloch) was unanimously appointed Vice-President.

To fill two vacancies upon the Council, Mr. J. Wilson (Falkirk) and Mr. A. Wright (Greenock) were elected.

PRESIDENTIAL ADDRESS.

The PRESIDENT then delivered his address. Taking for his subject "Some Rambling Statements about Progress by a Gasman," he made the following remarks.

PROGRESS OF THE GAS INDUSTRY.

Regarding the rapid progress that gas has made within the last few years, a great amount of credit is due to the renowned countryman of our City's guests of the past two days—viz., Dr. Welsbach, who by his perfect incandescent mantle gave to the gas industry an impetus which it very much required, and which came just at the proper time, since many of us know that it was then considered doomed. But what a revival was in store! With the bunsen flame harnessed for lighting purposes came the reduced candle power, and as a consequence the use of a cheaper class of coal. This enabled gas undertakings to sell their gas at a greatly reduced price, which encouraged those who required power in a small way to instal gas-engines, the reduced price of gas making it permissible to do so. Cheap gas is also responsible for the great increase in the number of cookers and other gas apparatus and appliances which are now in use wherever there is a supply of gas. While this great transformation was taking place on the outlet side of the governor, let us look at the works and we shall also find a transformation just as great. The reduced candle power and the cheaper class of coal are two items in the long list of improvements and alterations which are responsible for the cheap gas of to-day. Mechanical stoking falls to be added to this list, as in large works it played a very important part at what we are inclined to call the critical period in the history of the gas industry. While in large and small works alike the system of heating, carbonizing, and purifying underwent great changes, yet, with all these changes to meet modern requirements, the inventive genius of gas engineers has not stopped, as the undreamt-of results obtained from the various kinds of vertical retorts at work prove that when this type of retort is fully developed—and it is being developed daily—gas will be sold at a price that will astonish even gas managers.

HEATING RETORTS.

In dealing with the progress of the industry, the cheapness and utility of gas, and the means by which the changes affecting its progress were brought about, I consider the heating of the retorts as of first importance. "How are your heats this morning?" is a question that is invariably asked by all gas managers on their arrival at the works; and little wonder, as heats play such an important part in the results obtained. Producers of various types are now recognized by all gas managers as the proper system by which to heat retorts; the old method of direct firing being almost, if not quite, wiped out. Of the various types of producers in use, I intend to confine my remarks to those with which I have had personal experience. These comprise three types—external, internal, and the outside gaseous producers as installed at the Provan Gas-Works. I shall begin with the external steel caisson brick-lined producer known as the Siemens, which gives good results so far as heating is concerned; its greatest fault being its large wages bill. (See Table I.) Next we have the internal producer well known to most of the members. This type of producer has played a very important part in the progress of the industry, having been the means of reducing the cost of labour wherever it has been installed. (See Table II.) Then we come to the outside gaseous producer, for which I claim greater efficiency and economy over every other system known to me for heating settings of horizontal retorts. (See Table III.)

TABLE I.—*Siemens Producers.*

	Firemen's Wages for 24 Hours.
22½ potmen, at 5s. 3d. each	£5 18 2
22½ ashmen, at 4s. 9d. ,,	5 6 10
	£11 5 0
Total wages paid from coal-hopper to coke-bing	£26 6 6

Coke used for fuel, 3·79 cwt. per ton of coal carbonized. This equals 32 per cent. of coke produced per ton of coal.

TABLE II.—*Internal Producers.*

	Firemen's Wages for 24 Hours.
9 potmen, at 5s. 3d.	£2 7 3
9 ashmen, at 4s. 9d.	2 2 9
3¾ potmen, for cleaning, at 5s. 3d.	0 19 8
3¾ ashmen, ,, ,, at 4s. 9d.	0 17 10
	£6 7 6
Total wages from coal-hopper to coke-bing	£23 9 6

Coke used for fuel, 3·75 cwt. per ton of coal carbonized. This equals 31·66 per cent. of coke produced per ton of coal.

TABLE III.—*Outside Gaseous Producers.*

	Firemen's Wages for 24 Hours.
3 producermen, at 5s. 3d.	£0 15 9
6 assistants, at 4s. 9d.	1 8 6
	£2 4 3
Total wages from coal-hopper to coke-bing	£14 9 2

Coke used for fuel, 4·21 cwt. per ton of coal carbonized. This equals 36 per cent. of coke produced per ton of coal.

VALUE OF GASEOUS PRODUCERS.

In the tables I have dealt with 360 retorts, 9 feet long, in all my comparisons—this being the full load for six producers; and as this number is all connected direct to one main gas-flue, they are practically as one. I have also done so to show at a glance the saving in wages effected by one system over the other, and also the percentage of fuel used. Table II. shows the results to be in favour of internal producers over the Siemens system—a saving of £4 17s. 6d. being effected in firemen's wages, while the fuel is almost the same. Table III. shows a further saving of £4 3s. 3d. for gaseous over internal producers. Against this we have an increase in the coke used for fuel from 32 per cent. for internal to 36 per cent. for gaseous producers. This at first sight seems rather alarming; but it in no way shakes my faith in the latter class of producers, as the money saved in wages more than equals the amount that would be realized by the sale of the extra 4 per cent. of coke used for fuel.

Another point which I should like to emphasize is that, in estimating the percentage of fuel, one should never lose sight of the coke value, as estimates are given from many places which appear to be very low compared with others; but when the percentage of ash is taken out, it puts quite a different aspect on the subject. We have instances of works reporting their average ash test as low as 5 per cent., while others report it as high as 12 per cent. Therefore, in making comparisons, we should take the difference in percentage, and call it coke. I consider this is proper, as we are dealing with the percentage of coke and not its value; and the value determines the per centage used for fuel, in this respect—that if coke has a low percentage of ash you will require less for fuel than if you had one with a high percentage to get the same heating value. What I claim is that, knowing the ash percentage to be high, this apparent saving of 4 per cent. in coke with the internal producer is not the last word in economy. Especially is it so when one takes into consideration the steadiness at which the heats can be maintained by gaseous producers; thus preventing the great contraction which takes place while clinkering and the expansion which must follow in settings heated by internal producers if the heat is to be brought up with any degree of rapidity. You have these fluctuations while clinkering internal producers, while there is no such thing with gaseous producers, as with six at work there is only one off at a time for cleaning. Each producer is cleaned once in 24 hours; the cleaning taking about 45 minutes to complete, during which period the even pressure of 3-10ths is maintained in the gas-flue by giving the other five producers a little extra to do.

The beneficial effects of an even temperature have been brought home to us at Provan by the extraordinarily good condition in which we find our settings after they have been at work over long periods, as follows:—

No. 2 Bench.

On Sept. 30, 1904 / Off Feb. 13, 1907	868 days.
On March 23, 1907 / Off Feb. 19, 1908	334 ,,
On April 30, 1908 / Off July 2, 1909	438 ,,
On Sept. 14, 1909 / Off June 30, 1910	289 ,,
Total	1929 days.

1929 days ÷ 365 = five years and three months.

The period during which the bench was out of action for repairs was:

	Months.	Days.
First	1	10
Second	2	10
Third	2	12
	6	0

First time under fire, Sept. 30, 1904 } 5 yrs. 9 m.
Last time let out, June 30, 1910 }

This table shows the actual dates on which the bench was put under fire and when it was put out; and when I tell you that the original regenerators and 68 per cent. of the original retorts are still in position, and that the bench was put under fire ten days ago to do a winter's work, without a new retort or piece of one being added since it went off in June last, you will probably be considerably astonished. The retorts were simply patched up and pointed, so as to allow us to run it to a finish in about six months' time.

From these facts, I think it must be admitted that the gaseous producer is all that I claim for it, for had this bench been heated by internals, the retorts and regenerators would have been renewed a long time ago. What I have said makes it quite clear that the apparent saving in fuel would have long since been swamped by the cost of material and the wages paid for renewals; thus proving that the gaseous producer is another step towards progress.

CARBONIZATION.

Next in the line of progress comes carbonization; and it is in the retort-house that we are led to understand by many authorities that the difference between profit and loss occurs. This argument is certainly true in many respects, as, by injudicious stoking, money can be thrown away with every pound of coal carbonized. On the other hand, by having a good system and careful supervision, this loss can be avoided, and every pound of coal made to yield every cubic foot of gas it contains. The question of light charges and a short period of carbonization or heavy charges and a long period is one that has been asked before this and kindred Associations on many occasions, and has never failed to create a healthy discussion, which it well merited, as it is a question fully worthy of great consideration and fair trial. Any alteration of an established system of doing a certain piece of work is often resented by those required to perform it. Consequently, many good ideas for improving both method and labour are never realized. The system of heavy charges over long periods is, I believe, an improvement both in method and labour, as the results obtained are satisfactory to the employer and beneficial to the employee.

A little more than two years ago, the period of carbonizing at Provan was four hours; the weight of charge per retort being 2·64 cwt. The coal carbonized per retort in 24 hours was 15·84 cwt.; the make of gas per retort, 7710 cubic feet; the make per ton, 9702 cubic feet; and the illuminating power 17·31 candles, tested by the flat-flame burner. After a period of experimenting as to time and weight of charge, the best results were found to be obtained from charges of 4 hrs. 48 min. duration; the results being as follows: Weight of charge per retort, 2·95 cwt.; coal carbonized per retort in 24 hours, 14·75 cwt.; make of gas per retort, 8099 cubic feet; make per ton, 10,915 cubic feet; illuminating power, 18·32 candles, tested by the No. 2 "Metropolitan" burner. The full value of the 4 hrs. 48 min. system does not end in the results obtained from the distillation of the coal. It has at least one other virtue, which the men in our retort-house were quick to observe. The introduction of 48 minutes' longer burning meant a readjustment of the time at which the retort would be drawn and charged. In short, it meant only five charges per day of 24 hours, against six under the old system. This, along with the readjustment of the time for drawing and charging, gave the men better facilities for taking their meals and attending to things in general (the plant included), since it allowed more time for the proper execution of necessary repairs to the stoking machinery, &c. I might also mention that the lives of the machines have been increased by this lessening of their labours.

PURIFICATION.

The progress in purification achieved by the introduction of mechanical scrubbers and washers for the purifying of coal gas is well known to all of us. In the final stage of purification, I consider that oxide of iron should be more favoured than it is. Possessing as it does the two great factors in competition—cheapness and utility—its more general use would, in my opinion, enable gas managers to still further reduce the price of gas without in any way lowering its value as a heating agent.

THE GLASGOW EXHIBITION.

While speaking of progress in connection with the gas industry, I cannot allow to pass unnoticed the wonderful exposition of gas appliances which we have had with us in Glasgow for the last three weeks. The practicability, the charm, and the excellence of the exhibits I am sure surpassed the imagination of many; and great credit is reflected on those who were responsible for bringing together so magnificent a display. This exhibition, through the generosity of Mr. Alexander Wilson, the Gas Engineer and General Manager to the Corporation of this city, we have all had the opportunity of seeing for ourselves; and I am sure I express the feelings of the members when I say that we are all greatly

indebted to him for his thoughtfulness. Let us hope that the exhibition will bear fruit equal to its blossoms, by increasing by leaps and bounds the output of gas in Glasgow and the surrounding district. Every thousand cubic feet of gas consumed for heating purposes will tend to show that Glasgow's Smoke Abatement Exhibition has served well the purpose for which it was intended—the production of a purer atmosphere.

THE PRESENT POSITION OF THE GAS INDUSTRY.

The progress of the gas industry of late years is seen from the large amount of money handed over annually by the various corporations throughout the kingdom in relief of the rates. This is a system which should be abolished, and more consideration given to the gas consumers and the producers of the money. In my opinion, the changes to which I have referred in the course of my remarks are responsible for the sound financial condition of the industry; and I consider that those who, by their energetic labours and attention to duty, were the means of keeping the industry in the premier place as an agent for heat, power, and light, are worthy of more consideration than they receive from those who are in a position to give, as it is only by paying for ability that you can obtain it, and by so doing hold out some inducement to men who have spent years in the study and practice of the one subject they have at heart—the gas industry—to continue their efforts to maintain it in its position.

Discussion.

Mr. D. VASS (Airdrie) said the excellent address to which the members had listened was one which not only those present but the gas profession throughout the country would study with interest. The economy shown as the result of outside producers was an eye-opener. Many of them had heard that this type of producer was very extravagant in working, swallowing up a great deal of fuel; but the figures now given brought out an economy which would surprise them. The question for them now would be how far they could narrow down outside producers to meet the needs of smaller works. It was a foregone conclusion that in large works they were a decided success, both economically and financially. From the point of view of durability of the retorts, they had there a very strong case. They had been hearing, during the past year or two, about the great length of time a retort made by the Germans would stand; but he thought when they looked at the figures in the address there was much to be said, when they talked about the life of a retort, of the conditions under which it was worked. There they had retorts lasting five years. They found that Scottish makers could produce retorts that would last almost as long as they would like, as one maker had said, "when they were agreeable to pay the price for them." He thought the President did well in drawing their attention to what had been done in Glasgow during the past three weeks. He had no hesitation in saying that in the Smoke Abatement Exhibition they had the best collection of gas appliances that had ever been placed, anywhere, before the public. He considered Glasgow had done a great work, not only for themselves, but for all, in bringing together such a collection. He himself was not slow in making it as well known as he could in his own district; and he knew that other gas managers had done the same. They all hoped to benefit by the exhibition. A few days previously, he happened to make use of almost the same words as the President had used regarding electricity, when, in speaking to an employee of the Electricity Department in their district, he (Mr. Vass) said there was room enough for them both. That official's duty was principally to canvass for business. He said he did not take the same view; but that, in his opinion, there was only room for one, and that his was the one. If this idea was to be held by their rivals, it was time that people in the gas industry were awakening, and adopting the view that if there was only room for one, that one was gas. They ought to push their business with all the vigour they could, for this was the only way to extend it.

Mr. A. SMITH (Tradeston) said, as one of the Station Managers in Glasgow, the portion of the address which had appealed to him most had been that which had referred to the heating of the retorts. The President had shown them clearly the economy of outside producers. No doubt internal producers had been a great advance upon those on the Siemens system; but there was always this to be said about them, that when cleaning was going on cold air got in and destroyed the settings. The life of the retorts could be considerably prolonged, as the President had shown, by the use of outside producers; and the question was how they could be adapted to existing works and to small works. The President had not said anything about the capital expenditure which an installation entailed; and he (the speaker) did not know how this would work out.

Mr. W. GRAFTON (Glasgow) said the part of the address which touched him most was the brief reference to the vertical retorts at Provan. He thought a good deal more might have been said in praise of them, not, perhaps, with regard to figures, but to their simplicity, and to the fact that they were one of those things which did a great deal in the way of smoke abatement. The quantity of smoke given out from an installation of vertical retorts was very small; and at the same time there was more gas, as well as better coke and other products. Some contended that vertical retorts were against the interests of the workers, because fewer men were employed. This might or might not be true; but the work was decidedly lighter and easier for them. With regard to their general working, very much could be said. Some were against, and others for, them. It remained to be seen what the Glasgow vertical retort would do during the next few months. At the Helensburgh Gas-Works they were adopting them. They hoped the Junior Gas Association would be able to visit that town and see the retorts at work; and he was sure their worthy Manager—Mr. Blair—who was present, would be the first to welcome them. Not one or two, but many, of their German visitors commented upon the uniformity of the heating of the retorts which was obtained at Provan. Not only at one part of the bench, but everywhere, and at the far end, which was always the most difficult to heat, the heat was the same. When they took into consideration that there were twelve retorts in these settings, and bore in mind the difficulty there was in heating twelves—and this was a point that was noticed at Provan—the uniformity of the heating was the more striking. Great credit was due to Mr. Webster for the able way in which the vertical retorts were worked.

Mr. W. BLAIR (Helensburgh) said it was well known among practical men that with a good system of gaseous firing they could keep up a uniform heating of the retort during its life. The question was as to getting as good results with small units. Some of their Irish brethren had side producers, and heated the ovens practically on the same principle as they did with outside producers; and very remarkable heating it was. He questioned whether much better heating was being obtained in the gas-works in Glasgow. The great difficulty with regenerative settings was the cleaning out of the furnaces. If they could get away from choked ascension-pipes and cold air, they might run their retorts up to 2000° or 3000° Fahr., whereas at present 600 or 700 days of actual working were about the lifetime of a retort. He should like to acknowledge the great advantages they had all derived from the Smoke Abatement Exhibition. It had been a considerable pleasure to him to attend it. He had had the opportunity of seeing nearly all the methods of firing vertical retorts, and he believed that the continuous system was the one of the future. When their vertical retorts were in operation at Helensburgh, he would be delighted to welcome the Association to see them.

Mr. S. B. LANGLANDS (Glasgow) said that many years ago that "grand old man" of the gas industry, Mr. George Anderson, introduced side producers, which gave very good results. They were certainly the forerunners of the outside producers. As to the marvellous results that were being obtained in small works, where the means at their disposal were small, he was told that in one works, a long way farther from the coalfield than Glasgow, they were making gas at 1s. 2d. per 1000 cubic feet. Of course, there was something behind this. It was a question as to what they put into the manufacturing costs. Till they had a standard method of making up manufacturing and distribution costs, the matter would never be satisfactory. Their rival, the electricians, unlike themselves, placed everything to capital, and put off to the farthest day the redemption of the capital. He considered that the profit upon the gas sold in a house of ordinary size, for lighting, cooking, and heating, was sufficient to justify them in furnishing the means for using the gas; and yet the Corporation grudged consumers a stove. To his own mind, a stove should be reckoned as part of the gas-works plant, just as a meter or a holder; for it was a means of distribution.

Mr. D. CURRIE (Stirling) remarked that the President had proved that outside producers were the most profitable—at any rate, at Provan. The figures given in the tables proved conclusively that they paid in large works. He noticed that the consumption of coke was higher with these producers; but no doubt this was due, to a great extent, to the radiation in conveying the gas from the producer to the retort-bench. With outside producers a retort-house was much more comfortable, and could be better supervised. He gathered from the address that they put a charge of about 3 cwt. in a stop-end retort. In Stirling, they should consider this a light charge. In a through retort, which was equivalent to two stop-end retorts, they put in from 10 to 12 cwt. of coal. They had invariably eight-hour charges; and they were able to maintain the illuminating power of the gas. Of course, they had to enrich with benzol; but it paid them to do it. They got as large an average yield as 11,800 cubic feet per ton of coal; so that it suited them to work a very heavy charge. In so doing they saved a lot of money in wages; and the work on their machinery was much lighter. In the event, for instance, of a breakdown, they had time to repair the machinery; whereas with short charges there would be only time to patch it up.

Mr. W. M. MASON (Glasgow) considered that the President's text of "Progress" was a most admirable one. He believed that gas was only getting on to its feet. It had been proved by the Smoke Abatement Exhibition that, instead of gas being a dying business, electricity had not a chance beside it. People who visited the exhibition, and saw the two things side by side, went away convinced of the superiority of gas. That evening a leading member of the Electricity Department admitted to him that gas was the thing for universal use. The President was a practical man, interested in the producer side of their business. But in the future the side in which there would be scope was not the production but the distribution side. The Smoke Abatement Exhibition had shown that there was abundant room for the whole of them.

Mr. D. FULTON (Glasgow) considered that while it would be useless to deny that outside producers gave results far better than internal ones, the tables in the address hardly did justice to the latter. The President made out firemen's wages, with the

internals, to be 5s. 3d., and a total of £23 9s. 6d.; with outside producers, the wages were £2 4s. 3d., and the total was £14 9s. 2d. There were no internal producers in Provan, and it did not require a Sherlock Holmes to discover that the figures as to internals applied to Dawsholm. He wished to point out that the internal producers heated only eight as against twelve retorts; but they received two more charges in a day, so that they carbonized 17·15 cwt. of coal in 24 hours, as compared with 14·75 cwt. by outside producers. This, taking also into consideration the extra quantity of coke used with outside producers, made the advantage not so great as would appear at first sight. At Dawsholm they had two through benches fired by internal producers, and two similar benches fired by outside producers; and he might say that the heats were very much better with the latter, and the working costs were considerably less, even than in the internal producers with eights. Of course, they carbonized less coal with the internals. At Dawsholm they had one bench, built in 1903, fired by Siemens producers. The following year it was found to be necessary to put two 9-feet lengths into each oven. After this, very few repairs were required till last year, when five of the ovens required to be repaired. The regenerators were the same, and they got heats in the bench equal to those in any bench in the works.

The President, in closing the discussion, said he did not know what the first cost of the outside producers was, but he could get it by inquiry. He was certain, however, that, from the amount that was saved, the difference in cost, if any, would be overcome within twelve months at least. The quality of the coke from vertical retorts he was inclined to doubt, because he thought that coke from long-period carbonization was not quite so good as it was when coal was carbonized in short periods. Outside producers could not be applied to small works, as each producer heated 60 retorts. He quite agreed with Mr. Langlands as to the necessity for having a standard method for the making out of gas accounts. The members would observe in his tables that in one case the costs were from coal-hopper to coke-bing, and in the other it was to the railway waggon. In the one case the coke was dumped down, and had to be lifted again; whereas in the other it was loaded into waggons. The charges at Provan were pretty nearly 3 cwt. In eight hours they ran 11¼ cwt. It was being talked about by many at the head of affairs that more attention must be given to distribution; and he believed that the men who went round to consumers' houses should be given more scope in their work. They should be able to tell consumers the best way to use gas. He considered there should be some form of maintenance of gas-fittings. Some corporations undertook maintenance for a given sum per annum; and he had often wondered why such a system was not in existence in Glasgow, either in the hands of a company or the Corporation. There would be money in it. The argument in favour of the long period of carbonization was that they carbonized 18 tons 11 cwt. less coal than by the old system; but they gained 1213 cubic feet of gas per ton, which was equal to 33 tons of coal and 9702 cubic feet per ton. He thanked the gentlemen who had offered remarks upon his address, and said he wished to bespeak the hearty co-operation of all during the session now commenced.

The business then concluded.

REMOVING CORROSION FROM WATER-MAINS.

Among the applications for letters patent contained in the "Journal" for the 24th of May last was one by Mr. R. A. Adamson, the Engineer-in-Charge of the Rivington works of the Liverpool Corporation, for the removal of corrosion from water-pipes. As readers are aware, one method employed in the past for effecting this object was to force a metal disc, slightly smaller than the bore of the pipe, along it by means of manual labour. By this means, about 50 yards per day could be cleaned; but it necessitated the employment of eight men. Another method was the use of a piston or plunger which scaled the main, and forced in front or dragged behind it scrapers formed of steel springs. By neither of these methods, however, was the pipe thoroughly cleared, as a ring of corrosion was left, which for some time afterwards affected the colour of the water. It is claimed for Mr. Adamson's system that by its adoption these defects are obviated, and the pipes are left with the black enamel lining practically untouched, and in almost as good condition internally as when they were laid. Mr. Adamson's specification has not yet been published; but we are able to give the following particulars in regard to it.

The apparatus consists of a petrol engine to revolve a bottom shaft. An opening of 9 feet having been made in the main to be cleaned, a bracket is fixed on each end of the opening. These brackets carry two rails and a coarse-pitch screw. The engine is then lowered into the hole in such a way that the wheels on the frame rest on the rails, while the screw passes through the centre of the machine. The bottom shaft is then central with the main. The frame of the machine is fitted with a hand-wheel to suit the pitch of the screw. By turning this wheel, the machine is propelled along the rails in either direction; the bottom shaft remaining central with the main in any position. A specially constructed knife, formed by means of a central bar carrying four cutters, is used for the scraping. Each cutter is held out by means of a spring, so that when the four cutters are extended, the knife is about an inch larger than the main. This allows for any inequalities in the pipe, such as a slightly oval shape—the knife opening or closing as required.

The knife having been inserted in the end of the main, the other end is attached to the bottom shaft of the machine. The engine having been started up, the driver turns the hand-wheel in the desired direction of travel; the result being that the revolving knife is gradually fed into the pipe after the manner of a boring-machine. The end of the frame having been reached, a similar knife is attached to the other end of the bottom shaft, and the hand-wheel is turned in the opposite direction until the other end of the frame is reached. A lengthening piece or rod is then fitted between the first knife and the bottom shaft, and driven up the pipe as before. This action is repeated backwards and forwards until the desired length is reached. In long lengths, it is possible to clean 200 yards in each direction, so that a space of 400 yards in all is cleaned from the one opening.

A small quantity of water is allowed to flow down the main both to wash out the dirt as the work proceeds and also to keep cool the knife, which is turning at some 80 revolutions a minute. The speed of work is about 50 yards per hour; but this depends largely upon the obstructions met with. In ordinary practice, it should be possible to average about 300 yards per day. After the cleaning has been done, the rods are drawn, and the valves opened full, so as to thoroughly flush-out any remaining dirt. It is found that ordinary bends can be driven round, as sufficient play for the purpose is left in the joints of the rods.

The machine has lately been inspected while in operation by members of the Water Committee of the Liverpool Corporation and a number of water engineers from surrounding districts. It is claimed for it that it is capable of doing in one day the work which would take eight men a week to perform; and it can be worked by three men. The saving in labour and time is consequently obvious.

A Reduction in Price at Wallingford.—A reduction in the price of gas from 3s. 6d. to 3s. 3d. per 1000 cubic feet has been made by the Wallingford Gas Committee. This is the third reduction within a short period.

Differential Gas-Rate for Belfast.—At the last meeting of the Belfast City Council, the Gas Committee submitted a recommendation that they should be authorized to charge a differential rate for gas for lighting and power purposes, also for additional borrowing powers; the extent of the difference to be arranged by the Town Clerk and the Cashier. Mr. Squire, in moving acceptance of the recommendation, said the Committee were anxious to increase the use of gas for power purposes; and there was scarcely a town in the United Kingdom which had not a differential rate. Councillor M'Cusker seconded the motion; and it was unanimously passed.

Additional Capital for the Redhill Gas Company.—From an announcement which appears elsewhere, it will be seen that the Redhill Gas Company are inviting offers for an issue of £5000 (nominal) of ordinary "B" stock, in sums of £10, or multiples thereof, at a minimum price of £101 per £100 of stock. The additional capital, which is required for the extension of mains rendered necessary by the continued development of the outlying parishes supplied by the Company, will rank for a standard dividend of 5 per cent. per annum, subject to the sliding-scale; and the price at present charged for gas will permit of the payment of the standard dividend.

Berwick Water Supply.—Complaint of default having been made by a number of ratepayers against the Berwick Sanitary Authority in regard to the water supply of Berwick, Tweedmouth, and Spittal, a public inquiry in regard thereto was opened at Berwick last Thursday on behalf of the Local Government Board. The petitioners were represented by Counsel, and the Town Council and Berwick Wards Ratepayers' Associations by solicitors. The Associations who oppose the complaint contend that Berwick's present water supply is adequate; while the petitioners' case is that the needs of the townships should be met by a joint scheme. The inquiry was adjourned for some days.

The First Incandescent Gas Lights in Worcester.—A Worcester newspaper draws attention to the fact that it is just seventeen years since the first incandescent gas-burners publicly seen in the city were used for the lighting of one of the shops. The enterprising tradesman who acted as pioneer of the new system of illumination was a Mr. Skan. Quite a sensation was caused by the peculiar whiteness and remarkable brilliancy of the new lights; and Mr. Skan's example soon found imitators. In those days, incandescent burners cost about 15s., and the mantles 2s. 3d.; but, says our contemporary, "the value of the new method was so obvious that the cost did not deter go-ahead tradesmen."

Buying Gas Coals at Stockport.—There was a long and unexpected discussion at the meeting of the Stockport Town Council last Wednesday on the subject of buying coals for the gas-works. The minutes of the Gas Committee contained the following remark: "The Engineer submitted offers of 20 waggons of Wharncliffe nuts, and of 25 to 30 waggons of Garswood Hall nuts." Mr. Allcock, a member of the Committee, called attention to this matter, and said he did not agree with the way in which the coal in question was being purchased. It was not wise for a Corporation to buy "spot lots" in this way, because it opened the door to so many irregularities. They never could tell whether the coal was good, bad, or indifferent. The principle was wrong, and he did not care to have anything to do with it. He moved that the minutes be referred back. The Chairman of the Gas Committee (Mr. J. Fernley) defended their action, and said that though Mr. Allcock did not agree with the principle of "spot" buying, the other members approved of it; and he had no hesitation in saying that it was a distinct advantage to the gas undertaking and the ratepayers. In the result, the action of the Committee was approved by 25 votes to 14.

REGISTER OF PATENTS.

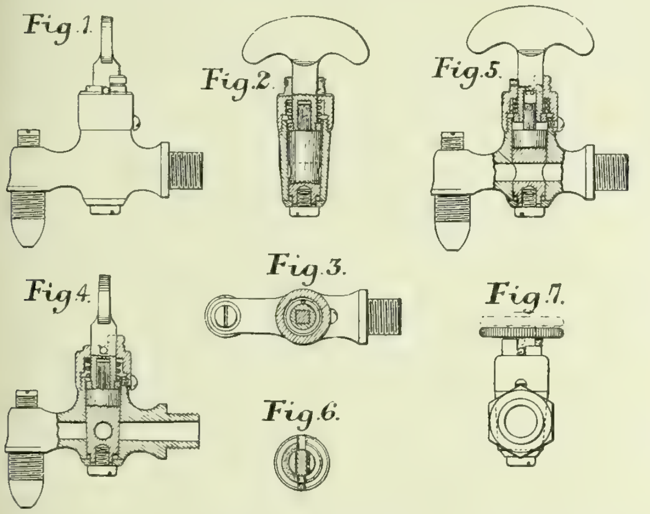
Taps and Cocks.

Parkinson Gas-Stove Company, Limited, of Birmingham, and Spreadbury, E. L., of Rochester.

No. 24,801; Oct. 28, 1909.

These taps or cocks are of the "safety" type, in which means are provided for automatically retaining the tap in its "off" or closed position and preventing it from being accidentally turned-on or opened. This is effected by arranging the shank or stem (to which the handle is attached) so as to be capable of being raised or lifted against the pressure of a spring, and providing the shank with a peg or like projecting part, which, when the tap is in its "off" position, is caused by the spring to engage within a notch or recess in the end of the body or a part attached thereto, thereby locking the tap in its closed position—it being necessary, before it can be turned on, to first raise or pull out the shank until the peg is disengaged from its notch.

Safety taps are known, the patentees point out, in which the handle is connected to the plug by a telescopic or pin-and-slot connection, and a coiled spring is arranged between the underside of the handle shank and the plug, so that the handle tends to be forced upwards or outwards—a pin being carried by the handle and working within a horizontal slot in the body; the slot having a short right-angled extension at one end. The arrangement is such that when the tap is turned into its "off" position the pin comes opposite to this extension, and the spring lifts the handle and takes the pin into locking engagement with the extension. In another form, instead of a pin working in a slot, the



Parkinson Stove Company and Spreadbury's Taps and Cocks.

handle has a flat which, when the tap is "off," comes coincident with the edge of a bar carried by the body, so that the handle can be raised by the spring and the flat taken into locking engagement with the bar. In both these forms, however, it is necessary to push the handle inwards in order to turn the tap on, whereas, according to the present invention, the handle is pulled out for this purpose; the spring being arranged between a cap fixed upon the end of the body and an abutment upon the inner end of the shank, so that the handle normally tends to be drawn inwards.

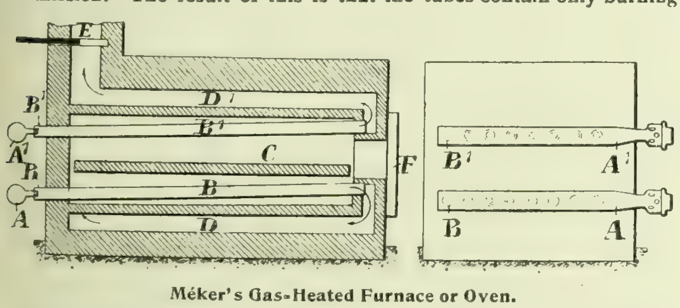
Fig. 1 is a side elevation of a safety cock for gas-cookers constructed in accordance with this invention. Figs. 2 and 3 are vertical and horizontal sections; fig. 4 shows the cock in its "off" position; and fig. 5 when turned full on. Fig. 6 illustrates the locking notches in plan. Fig. 7 is an end view showing the application of the invention to a cock for a gas-fire.

Gas-Heated Furnaces or Ovens.

Méker, G. A. H., of Asnières, France.

No. 28,603; Dec. 7, 1909. Date claimed under International Convention, Jan. 14, 1909.

In an oven or furnace constructed according to this invention, the gas is completely burned at the instant of its entrance to the circulating tube, or, at least, the flame has the necessary amount of air for complete combustion of the fuel, because each burner has its own air admission. The result of this is that the tubes contain only burning



Méker's Gas-Heated Furnace or Oven.

gases and hot products of combustion, while the burners themselves remain cool whatever the temperature in the circulating tubes.

The illustration shows a longitudinal section of the oven, and an elevation from the burner side.

A A¹ are sections of the burners, which may be of any suitable type. B B¹ are metal tubes whose diameter is in proportion to the size of flames produced by the burner—the flames being formed according to the result and the temperature to be obtained. In the present case, the tubes are shown arranged in two rows; one above and the other below the floor C, on which are placed the articles to be baked or heated. The tubes are placed in a slightly inclined position, and are (preferably) approximately straight—that is, they may be slightly curved or sinuous. The flames, on passing into the tubes, give up their heat to them; and the burnt and cooled gases arrive at their ends, where they are collected and sent to the chimney. Or as shown) they circulate through the channels D D¹ on their way to the chimney E. As required, the door F of the oven is placed on the most suitable side.

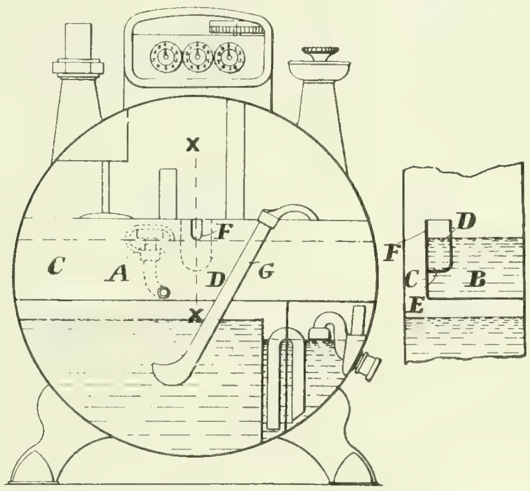
According to the operations to be carried out in the oven, the tubes may be arranged in one or in several rows; each row lying in a horizontal plane or on any surface of revolution whatever. The temperature required of each row of tubes is regulated by merely adjusting the consumption of the burner.

Gas-Meters.

Cowan, W., of Edinburgh.

No. 26,277; Nov. 12, 1909.

This invention relates to wet meters in which means are provided for elevating water from the waste-water chamber, so as to automatically maintain the water-level in the measuring chambers, and prevent changes of level, due to evaporation. In such meters, the patentee states, it "has not hitherto been found practicable to apply the syphon method of determining the water-level in the meter under atmospheric pressure, because such syphon was liable in some circumstances to be brought into action, while under pressure, so that the accuracy of measurement was liable to be upset." The present invention consists in providing means for the discharge of water at a small rate from the water-level adjusting space at a point about the syphon level, "which has the function of discharging at that level the automatic feed water, so that the latter cannot bring the syphon into operation."



Cowan's Wet Gas-Meter.

A transverse section through a wet gas-meter (of the spoon-feed type is shown; also a section on the line X.

The syphon A is of the kind described in patent No. 1665 of 1886, adapted to determine the water-level in the measuring chambers. This is placed in the front part of the water space B next the gas measuring chambers, the water-level in which determines that in the adjacent measuring chambers. In the side wall C of this front part (which overhangs the waste-water space of the meter), there is provided a pocket D with a small hole E in the bottom. The edge F of the pocket communicating with the tank is cut down to the water-level determined by the syphon when operated at atmospheric pressure. The diameter of the hole E must be so adjusted that it will discharge the quantity of water automatically fed by the spoon-feeding device G, so that when it has filled up to the syphon level, it cannot produce any further rise of level, and therefore brings the syphon A into operation. The quantity of water which this hole can discharge is so small that it does not interfere with the operation of the syphon when water is poured in at a greater rate—as happens in re-charging the meter with water at atmospheric pressure.

The device further "renders unnecessary the provision of an additional device to prevent the meter being improperly charged with such small quantities of water as would adversely affect the accuracy of measurement of the meter without operating the syphon."

Blast-Tube Burners.

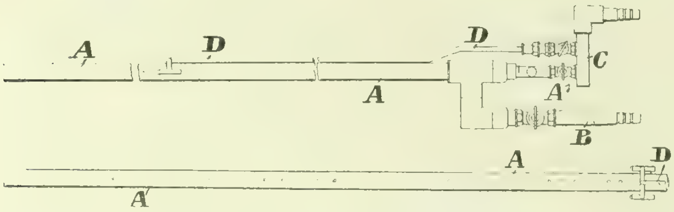
Fletcher, Russell, and Co., Limited, and Fletcher, T. W., of Warrington.

No. 4490; Feb. 23, 1910.

This invention relates to blast-tube burners as employed for heating calender rollers and the like. It has been found, the patentees state, that in the centre and the far end of the roller, owing to the confined area in which combustion takes place, the spent gases accumulate at the end of the burner-tube, "resulting in imperfect combustion, and the heat being unequally distributed." The object of the present invention is "to cause the heat to be more equally diffused along the length of the roller in which the burner is inserted, and to obtain improved results without any increase in the quantity of gas consumed."

In the side view of the device and part plan of same (p. 140), A is the ordinary blast-tube burner with air-regulating tap A¹; and B is the gas inlet to the tube in which the air and gas are mixed. Connected

to the air inlet C is an auxiliary air-tube D (with an air regulating tap). It extends along the top, or by the side, of the tube A to about the commencement of the jets in the tube; and at the end of the tube D branch nozzles are fitted through which an additional volume of air is caused to pass, which assists the combustion of the mixed air and gas



Fletcher, Russell, and Co.'s Blast-Tube Burners.

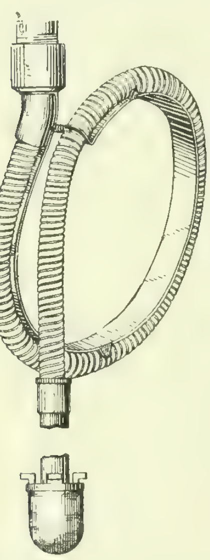
that is passed through the burner-tube A "by creating improved ventilation between the roller and the burner-tube." In order to equalize the heat from the jets of flame from the burner A, the size of the perforations in the burner-tube is decreased, or the distance between them is increased—the perforations being larger and more numerous near the inlet end of the burner-tube.

Anti-Vibrators for Gas-Burners.

HANWELL, H. W., of Northampton.

No. 5384; March 3, 1910.

This anti-vibrator for gas-burners is of the type already known. But in such devices it has before this been proposed to employ a spiral or loop of flexible tube (constituting part of the gas-conduit) disposed in an approximately vertical plane, having one end pendent from the supply conduit and the other end connected to the burner; the resiliency of the flexible tube being depended upon to give the anti-vibratory effect. With such an arrangement, however, the weight of the burner puts a lateral strain upon the tube that is likely to result in fracture and leakage. According to the present invention, however, such a loop or spiral is reinforced by a resilient support in such manner that the weight of the burner puts no side-strain upon the conduit. This is preferably effected by providing a strip of resilient material wound (as shown) into a supporting coil whose axis is approximately horizontal, and having one end secured to the support or supply pipe and receiving the weight of the lamp or burner at the other end; the flexible conduit or wire being held in position by ears or lugs formed integrally with the supporting coil.



Hanwell's Anti-Vibrator for Pendant Lights.

The coil may be variously constructed. For example, instead of the band shown, a spiral of wire may be used, the whole of which is curved to form the coil. In this case, the flexible conduit may be threaded through the spiral if desired. The band may also take the form of a trough, in which the conduit can lie.

APPLICATIONS FOR LETTERS PATENT.

22,227.—Cox, G. J., "Recording and computing the value of meter-index movements." Sept. 26.

22,268.—HAMMOND, W. P., "Pressure-gauges." Sept. 26.

22,282.—KRAUSE, P., "Production of air-gas." Sept. 26.

22,303—LEGGE, A. Di, "Indicating the escape of gases." Sept. 26.

22,310.—ARTHUS, J. A., WRIGHT, W. L. F., and CALDWELL, J. D., "Pipes and connections for gas and other purposes." Sept. 26.

22,317.—HALLE, M. A., "Appliances for kindling." A communication from A. B. Fröhlich. Sept. 26.

22,335.—BURKHEISER, K., "Separating sulphuretted hydrogen from gases." Sept. 27.

22,379.—FAIRBROTHER, H., "Heating burners." A communication from J. B. Colt Company. Sept. 27.

22,384.—MICHL, R., "Burner headpiece." Sept. 27.

22,397.—RORKE, T. J. & E., "Controlling valves by electro-magnetic means." Sept. 27.

22,413.—GREATOREX, W. H., "Cocks." Sept. 27.

22,420.—SCHNEIDER, A., "Burners." Sept. 27.

22,433.—THEISEN, H. E., "Purifying, cooling, and mixing gases." Sept. 27.

22,459.—WRIGLEY, H., "Continuous conveyors." Sept. 28.

22,469.—LLOYD, E. F., "Gas-scrubbers." Sept. 28.

22,515.—PRICTOR, H. T., and WILKINS, E. E., "Sealed union for gas-pipes." Sept. 28.

22,524.—NOBLETT, A., and KITSON, A., "Incandescent vapour lamps." Sept. 28.

22,533.—PROSSER, H. R., "Bye-pass." Sept. 29.

22,546.—HOPKINS, J. H., and STANSFIELD, A. M., "Manufacture and treatment of gas." Sept. 29.

22,551.—HUNT, S., "Non-crushing coke-filler." Sept. 29.

22,563-4.—CROSSLEY, K. I., and RIGBY, T., "Internal-combustion engines." Sept. 29.

22,586.—BUEB, J., and DEUTSCHE CONTINENTAL GAS-GES., "Manufacture of ammonium carbonate." Sept. 29.

22,598.—BENKISER and Co. G. M. B. H., "Taps or cocks." Sept. 29.

22,610.—ARON, E., "Acetylene generators." Sept. 29.

22,646.—YARROW AND Co. (BOLTON), LTD., and YARROW, M., "Joints of pipes." Sept. 30.

22,663.—KILBURN, J., FAIRLEY, J. W., KIDNER, T. B., IRVINE, W. H., and CHESTNUT, W. T., "Gas-generating apparatus." Sept. 30.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Testing of Gas-Fires.

SIR,—After a long series of experiments undertaken to ascertain and improve the thermal efficiencies of gas-fires, more especially in relation to their radiating efficiency, I have been struck by the regularity of the "factor for radiometer value" (see "Report of the Gas Heating Research Committee," June, 1909, p. 16). This number, which I find in over fifty tests of one fire under varying conditions of gas pressure, consumption, and "fuel," averages 24·5—the highest being 25·6, and the lowest 23·7—has led me to investigate the subject, and to form the opinion that the use of the thermopile and galvanometer as at present operated leads to considerable error, especially in the testing of very wide gas-fires.

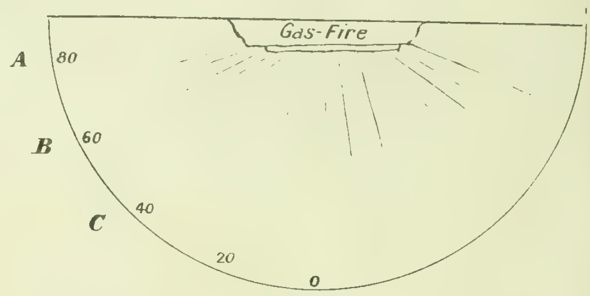


Diagram 1.

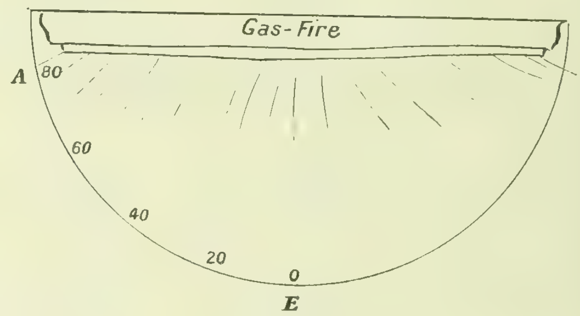


Diagram 2.

For instance, the readings on the galvanometer when the thermopile is at A, B, or C (Diagram 1), seem to be those that affect the "factor for R γ" most; and this appears to be due to the thermopile being closer to the fire at these points, and so giving a higher reading than it would do if the distance between the fire and thermopile was the same all round the semicircle—viz., 34·4 inches.

Now, referring to Diagram 2. Suppose we take a fire having (say) a 20-inch fire-front. By the apparatus in use at the Leeds University, and which is duplicated by nearly all gas-stove manufacturers, the distance from the centre of the fire to the thermopile when taking the centre reading is 34·4 inches or thereabouts. But (and herein is the main point of my contention) this distance is kept only when the thermopile is in front of the fire, in the position E. It gradually becomes less as the thermopile is moved to the side. Naturally, the radiant energy at the sides falling on the face of the thermopile is considerably more intense than it would be if the latter were kept at its first distance of 34·4 inches—thereby giving a high reading on the galvanometer.

To take an extreme case, we will suppose a fire wide enough to fill in nearly the whole of the diameter of the semicircle and the thermopile to be 1 inch from the side of the fire at A. In this position, it would be about 34 times nearer the source of energy than it would be when at E; and it is quite reasonable to suppose that the galvanometer reading when the thermopile is at A would exceed the reading taken when at E by a considerable amount. But the total—including these high side-readings—would still be governed by the reading of the galvanometer when the thermopile is at E.

EXPERIMENTER.

Oct. 7, 1910.

Automatically Lighting and Extinguishing Public Lamps.

SIR,—It is nearly six years since the above was reintroduced to the gas engineering profession—viz., at Earl's Court Exhibition, where different designs of apparatus were on view. Since then, the system has made considerable strides on the Continent—more particularly in Germany; but with our usual conservatism, we have moved slowly in the matter.

From the references made to the subject in your last issue, it would appear that the system is now likely to make better headway, and (to quote Herr Dobert, of Geestemünde) will enable gas to "compete more effectively with electricity for public lighting."

The results of the trials made at Newcastle, according to Mr. John Lewis's report, appear to prove that the experimental stage has been passed; but, on the other hand, the author of the article "Automatically Lighting Street-Lamps" has raised several objections to the various systems in use.

Being interested in a certain design of "controller," the use of which will, I think, overcome some of the difficulties mentioned by the author, I venture to endeavour to reply to certain of his objections—the article being too long to reply to *seriatim* without unduly encroaching on your space.

Referring to "pressure lamplighters," the author states that, owing

to the force required to turn the gas-plug, such apparatus is "useless with low pressures." The controller I am interested in (which for purposes of reference I will call the "Eureka," and not by its trade term) has no plug-cock; the supplies to the burner and bye-pass being controlled by mercury valves.

In regard to "mercury seals," it would appear from trials made at Newcastle and elsewhere that the author is somewhat too pessimistic as to their reliability and as to the mercury splashing on the lead weights and increasing their weight. The "Eureka" has the weights outside the bell; and it is practically impossible for the mercury to come into contact with them.

As to "gas atmosphere" affecting the mechanism, in the "Eureka," what little mechanism there is, is not in contact with the gas.

Referring to the "ordinary pressure lighter" requiring a reduction of pressure and an increase of same for extinguishing purposes, the "Eureka" is made in two patterns—one to light with increase of pressure and extinguish at low, and the other to light at increase of pressure and to extinguish at a second increase, but not so high as that required for lighting.

With reference to the objection raised as to the pilot lights being inefficient, I would say that the "Eureka" operates somewhat slowly when commencing to act—giving a slower cut-off than would appear to be the case with the controllers referred to by your correspondent.

If your correspondent has no objection, I should much like to get into communication with him. I enclose my card.

Oct. 6, 1910. EUREKA.

SIR,—Referring to the article on "Automatic Gas Lamplighting," which appeared in the last issue of the "JOURNAL," the writer stated in dealing with the question of pressure controllers that almost all of those on the market were limited in their action, and could only meet one set of gas pressure conditions.

It may, however, be pointed out that the "Automaton" is not limited in its action, and is no doubt one of the exceptions your contributor had in view. It has no liquid seals of any description. The mechanism does not work in a gas atmosphere. It is not affected by the accidental variations of pressure caused by consumption and the cessation of consumption. Its motive power is separate and distinct from the gas pressure; the latter being used only to start it into operation. The pilot-flame is extinguished after the burner-flame is lit, and lit before the burner-flame is extinguished; ample time being allowed for the one to light the other. The "Automaton" is not affected by vibration. Its minimum range is 4-10ths of an inch water pressure; and this may be indefinitely increased. It can be adjusted to light and extinguish at the same pressure—engaging at 4-10ths or 4 inches as may be desired below that pressure; or it may be lit at one pressure and extinguished at another, either higher or lower. It may also be so adjusted that a high mid-day pressure—as high as, or higher than, the evening pressure—will not affect the apparatus. The lamps may be lit and extinguished on a fall of pressure; or they may be lit on a fall and extinguished on a rise of pressure. The lamps of one district may be lit later and extinguished earlier than the lamps of an adjoining district in the same gas-works area. The pressure may be put up an hour before lighting time without affecting the apparatus; and the lamps may be lit after the consumption has started, even if the consumption makes the difference of an inch or two inches in the pressure.

At some future time, if thought of sufficient interest to readers, fuller information could be given of how these changes are effected, with pressure charts illustrating same.

Victoria Street, S.W., Oct. 8, 1910. AUTO LIGHTER, LIMITED.

SIR,—The interesting, critical, and unbiassed article under the above heading, appearing in your issue of the 4th inst., would have been of greater utility had the writer supplemented his very correct criticisms of the different forms of existing apparatus with suggestions of the lines to be followed (as well as those to be avoided) in any attempt to attain a satisfactory solution of the problem.

A concise tabulation of virtues and vices should be of inestimable value to the harassed engineer, who, although anxious to secure the economies resulting from automatic lighting, is threatened with mental paralysis in his honest endeavour to discriminate between the relative merits and demerits of the horde of different appliances with which he is being daily bombarded. Such a tabulation might also assist the experimenter and manufacturer in perfecting pressure-control apparatus.

The following suggestions might serve as a basis which the experience of other correspondents will, no doubt, amplify and revise: 1. Pressure control should be limited to those districts that previous local charting has proved to be satisfactorily conditioned. 2. Lamps in pressure-controlled districts subject to vagarity of pressure due to irregular draft, should be clock-controlled. 3. Where naphthalene troubles are frequent and serious, it is useless to attempt pressure control. 4. In order to work with the minimum rise over the maximum normal pressure, all pressure-control apparatus should be operated by the full pressure and not by the surplus pressure. 5. Where a recurrence of the operating pressure cannot be avoided, the operating apparatus should be provided with both inlet and outlet control. 6. All mechanism, excepting the supply valve, should be accessible, and should not be situated in the gas-chamber. 7. The use of mercury, or other sealing fluids, should be avoided, if possible. 8. Weights should be employed for adjustment; and they should correctly represent the variation they are intended to effect. 9. No diaphragm apparatus should be placed within the lantern. 10. If the diaphragms are of leather, the smooth surface of the leather should be in contact with the gas. This considerably reduces the evil of drying. 11. All metallic surfaces in contact with leather should be enamelled or varnished. 12. Oiled silk seems to be preferable to leather; but a longer experience of its lasting qualities appears to be required.

The following points express views which are not in entire agreement with those of the writer of the article referred to: 13. The pilot flame should be permanent, because its occasional failure is so serious a matter in pressure control that the saving effected by an alternate pilot flame is more than counterbalanced by the loss and inconvenience that failures involve. Further, an alternate pilot burner, when extinguished, allows dust to deposit, which is difficult to remove, and which would be consumed or driven off by a permanent flame. 14. The time of lighting should be accommodated to atmospheric conditions, and should be effected earlier on foggy or cloudy days. This will, of course, reduce the saving effected generally at lighting time; but there is no such loss at extinguishing time. Although the estimate of savings is adversely affected, it should be remembered that all days are not prematurely dark.

The general adoption of automatic lighting can scarcely be expected until some competent and independent body is created which can, as an advising authority, relieve the engineer from his present perplexity in attempting a selection of the method and the means to be employed.

Oct. 8, 1910. INTERESTED.

SIR,—In your issue of Oct. 4, your contributor, under the above heading, takes a very pessimistic view of the attempts which, during the last few years, have been made to deal with the automatic lighting and extinguishing of street-lamps; and, incidentally, he arrives at some very strange and incongruous conclusions.

The engineers who, according to your contributor, have "turned in despair from pressure lighters to clock controllers," which "have not been entirely successful," are indeed (if such be the case) entitled to commiseration and sympathy; but I think we may safely trust these gentlemen to know what is most suitable for their own requirements, and allow them to act as they think best.

There is no doubt that the pressure or "group" system possesses many advantages which are not to be found in the clockwork or "unit" system. The possibility of taking advantage of exceptionally brilliant or late sunsets to defer the lighting, and of lighting earlier in the case of sudden fog or early darkness, and the fact that the lighting and extinguishing can be done independently of the time-keeping of men or clocks, gives the gas engineer the feeling of security that comes of the knowledge that he is not depending on some outside and uncontrollable agency, but that the public lighting of his town is an integral part of the gas undertaking he is in charge of.

While admitting the truth of many of your contributor's criticisms of pressure apparatus in general, some of his conclusions are not, even from a logical point of view, entirely sound. For instance, he states that those types of pressure apparatus which utilize the whole of the gas pressure to develop the necessary motive power to turn the cock or valve, "are useless with low pressure." What then can be said with respect to the pressure apparatus which only employs a portion of the gas pressure for the above purpose?

Apart from the objections which affect solely the principles employed in the various types of pressure controllers, the criticisms deal mainly with details of mechanical construction, and are therefore not vital in their bearing upon the question at issue.

The trouble of the intermittent pilot-flame not lighting when the gas is turned off from the burner, is easily overcome by the proper timing of same—*i.e.*, it must, in comparison with the burner, be made to light early and extinguish late. This, of course, entirely depends upon the mechanical construction used; or it can be arranged to be augmented by a flash arrangement taking place at both lighting and extinguishing times. This not only allows the pilot-flame itself to be kept clear of the mantle—thus running no danger of blackening same—but ensures, by the sudden rush of gas through the pilot-tube at the time of extinction, the thorough expulsion of the accumulation of the products of combustion in the pilot-tube, which takes place during the lighting hours.

With reference to the danger of the mercury seals blowing through an excess of pressure being given, there is absolutely no fear of this happening with any reasonable increase of pressure, providing the apparatus is constructed in a correct manner.

Assuming the annular space which contains the mercury to be (say) 3 inches in depth, the travel of the bell to be restricted to ½-inch rise, and the bell itself to accurately divide the annular space, then 1¾ inches of mercury seal is capable of withstanding approximately 20 inches of pressure without either allowing the gas to force its way through from the inside, or being raised to a dangerous level outside the bell. The danger of the "oily exudations of the gas" breaking up the mercury into minute globules (thus destroying its sealing power), and the risk of the mercury dissolving the leaden weights (thus destroying the adjustment of the apparatus), are non-existent with at least two types of pressure apparatus, because the mercury-sealed bell being merely used as an "operator," the gas is only admitted to its interior twice daily; and as in this case no leaden weights are used on the bell at all, they cannot be dissolved. The writer, who has had years of experience with the latter class of apparatus, does not remember a single instance of the mercury seal failing to perform its proper function.

While it is quite true that leather diaphragms in gas-meters keep soft much longer than those used in automatic lighting apparatus, the reason is not that the larger diaphragm acts as a sponge, but that in the case of gas-meters it is not in contact with the air. In automatic lighting apparatus, the diaphragm is either alternately exposed to gas and to air, or one side is constantly in contact with gas and the other side with the atmosphere. Oxidation therefore takes place more rapidly. The remedy is to not only soak the leather in oil which is not materially affected by constant contact with the atmosphere, but to coat it with some compound which, while not detrimentally affecting the oil or leather in any way, is not itself affected by exposure to the atmospheres. This can be done, and is being done to-day.

The placing of the mechanism for opening and closing the valve inside the apparatus is decidedly bad policy, as all working parts and works likely to be affected through wear and tear should be easy of access—especially as, in case of apparatus getting out of order, it is often an advantage to correct same *in situ*. Here, again, it is only a question of mechanical construction, as there is an apparatus on the market where all the working parts are easy of access and outside the main gas supply. The question of corrosion, due to the gas atmosphere, is easily overcome by making the necessary provisions against it. Innumerable instances can be cited where delicate movements entirely

enclosed in gas have been found to be perfectly free from corrosion after three or four years' running.

In dealing with the class of pressure lighter which relies upon a pressure being reached at lighting and extinguishing times far in excess of what takes place during the day, your contributor is substantially correct in stating that it is impossible for some gas-works—owing to restricted holder capacity or inadequate mains—to give the necessary 1½ inches excess pressure for successful working. This objection, of course, only applies to apparatus which depends upon the margin over and above maximum day pressure for the motive power required. With this type of lighter, the maximum day pressure becomes the minimum night pressure, below which the pressure must not drop, or the apparatus engages ready for the next operation, when a rise in pressure on the district (due in many cases to decreasing consumption) will raise the bells and extinguish the lights. In other words, the permissible fluctuations of pressure after lighting time are governed by the margin existing between the maximum day pressure and the lighting pressure; but to state, as your contributor does, that "this range cannot be mechanically altered" shows lack of knowledge of what has been, and is being, done in this branch of the gas industry.

There are, to the writer's knowledge, four different methods of achieving the above result; but, without attempting to describe them all, perhaps he may be pardoned if he explains the one with which he is most intimately acquainted—*i.e.*, the apparatus invented by Mr. A. E. Broadberry.

This apparatus achieves the result which your contributor implies could not be attained, because it renders inoperative any increase of pressure which is given comparatively slowly; and at the same time it only responds to a sudden increase of whatever strength is arranged for. The pressure after lighting may thus fall and rise, according to increasing or decreasing consumption, without any fear of the lamps being extinguished, because variations due to the above cause always take place (comparatively speaking) slowly; while a sudden increase can practically always be given from the governor-house.

Even where the holder capacity is restricted, and no sharp excess increase can be given, by a special arrangement in the apparatus it can be made to work by lowering the pressure a few tenths for (say) two or three minutes, and then raising it quickly to the same level as before.

The point raised *re* cooking pressures is usually met, when it is given every day, by the provision of an extra blank, so that the apparatus simply works but no lighting is produced.

The seriousness of this objection is only fully realized when the increase of pressure at luncheon time is merely given one day in the week—say, Sunday—as is done in very many districts; but with the apparatus named all that is required to be done is for the engineer to give instructions for the necessary increase to be given at a rate not quicker than 2 inches rise in twenty minutes. This is being done Sunday after Sunday in numerous districts, with entirely satisfactory results to all concerned.

With reference to the saving effected by automatic lighting, it is not necessary to add anything other than to say that the mere fact that all over this and other countries gas engineers and lighting authorities are displacing hand lighting in favour of the new method, is proof that the financial return on capital invested justifies the change.

Although our friend has laid his finger on many of the weak points of automatic lighting, his criticisms only apply forcibly to the past efforts of automatic lighting apparatus manufacturers, and not to those who, realizing years ago these weaknesses, have persevered—improving here and improving there—in order to give the gas engineer the same facility of simultaneously lighting and extinguishing the whole of his street-lamps that has previously been the monopoly of his electrical competitor.

Farringdon Avenue, E.C., Oct. 8, 1910. ARTHUR H. FRANCKS.

LEGAL INTELLIGENCE.

METROPOLITAN WATER BOARD AND THEIR CONSUMERS.

Cutting Off a Supply—Overcharge for Water on a Revaluation.

At the Old Street Police Court last Wednesday, before Mr. Cluer, the Metropolitan Water Board answered adjourned summonses taken out by a Mr. Bibby, who alleged that the Board had unlawfully cut off the water supply of the premises, Nos. 44 and 46, Wilmer Gardens, Hoxton, for non-payment of the water-rate, contrary to the Water Companies (Regulation of Powers) Act, 1887, sec. 4, and the Metropolitan Water Board (Charges) Act, 1907, sec. 26.

Mr. GIVEEN (instructed by Mr. George Kebbell) appeared for the complainant; Mr. COURTHOPE-MUNROE represented the Water Board, whose ASSISTANT-SOLICITOR (Mr. Desmond Collins) was in attendance.

Mr. GIVEEN, in opening the case, said that under the old legislation the purveyors of water had power to cut it off on failure to obtain the rate due in respect of the premises supplied. The Act of 1887, however, made the owner and not the occupier liable when the rateable value of the premises was below £20, or where the occupier or occupiers held by weekly tenancies. By the Act of 1907, it was specially provided that where a house or building, or a portion thereof, was let for a quarter of a year or less, the Water Board could, by passing a resolution at a meeting, make the owner liable for the rate. This, he admitted, had been done in the present case. Mr. Bibby was the freeholder of the two sets of premises named in the summonses; but as to No. 46, he had let it to a tenant named Le Grand; while No. 44 was in the hands of a caretaker, who occupied a portion of the premises as part of his remuneration. Le Grand got into arrears with his rent, and Mr. Bibby, though having a right of entry for non-payment, allowed Le Grand to continue in occupation. When the water-rate for the quarter ending June was not paid, a collector named Hare sent to Mr. Bibby a demand note for it, and also for the quarter ending September in advance. Some correspondence (read by Counsel) followed; Mr. Hare being made acquainted with the fact that Le Grand was tenant under a lease, and that Mr. Bibby had not been able to get his rent. The contention on the other side was that Mr. Bibby had resumed possession, and was therefore liable. This, however, was denied; and it was not until the 1st of August that Mr. Bibby took possession. He had no beneficial possessions at the time the rates claimed were running; and though this was pointed out in the correspondence, the Board, without further notice, cut off the water supply to both premises on the 19th of August. More correspondence followed; the Board holding to their contention as to Mr. Bibby's liability, and demanding £2 8s. as expenses for reconnection. The present proceedings resulted. As to the law upon the matter, Counsel said he had to contend that the Board were in the wrong in cutting off the supply, as, under the Act of 1887, which was known as Forrest Fulton's Act, as it was passed at the instance of the present Recorder of London, the Board had the special privilege of making the unpaid rate a charge upon the premises supplied. Further, he cited the case of *Kellerman v. East London Water-Works Company** to show that the liability for the outstanding rates passed to the purchaser of any house or premises.

Mr. BIBBY was called, and said he was the freeholder of the premises in question. He let No. 46 to a Mr. Le Grand in November, 1907, on a term for seven years. At that time a Mrs. Gray was in possession of No. 46 as a weekly tenant; and she continued to reside on the premises as tenant for Le Grand; while a man named Fisher was caretaker of No. 44.

Mr. CLUER: Your contention is that the Board's remedy was against the people in possession?

Mr. GIVEEN: Exactly.

In answer to further questions, witness said Mrs. Gray left the place about six weeks ago, and Fisher about two weeks later; Le Grand being in possession up to that time. The complainant added that, owing to the water being cut off, he could not let the premises.

In cross-examination by Mr. COLLINS, witness said that Mrs. Gray paid her rent to Le Grand, and Fisher paid no rent.

Mr. CLUER said that, in his opinion, Fisher was not a tenant, but a servant; and as there was no occupier, this would make the owner liable.

Mr. Collins having submitted at the former hearing that he had no case to answer in the absence of proof of Le Grand's lease and the sub-tenancy of Mrs. Gray, this evidence was now supplied.

Mrs. *Gray* deposed that, having been tenant before Mr. Le Grand entered into possession, she continued, and paid him 13s. 6d. weekly for her holding of No. 46, Wilmer Gardens. She produced her rent-book, and said the landlord paid the rates and taxes.

Mr. *Le Grand*, who described himself as of St. George's Square, Pimlico, glass bottle stopper manufacturer, said he took a lease of the premises in question in 1907. Mrs. Gray was his tenant at No. 46, and a man named Fisher, who was employed as foreman, was in possession at No. 44, but paid no rent—it being included in his wages. Witness carried on business in the name of Messrs. Bibby and Co., as this was the trade name already up. He was not any relation to the complainant. He received Mrs. Gray's rent till about a month before he gave up possession. He had to pay rates and taxes for all, as the cottages in question were part of the factory premises.

Mr. COURTHOPE-MUNROE, for the defendants, said the question was whether there was liability to supply empty houses. There was no such provision in the Water-Works Clauses Act of 1847, but only a liability to supply where pipes were laid on and the rates paid.

Mr. CLUER: Do you suggest that if, having paid my water-rate to (say) the 1st of July, and I then go away for my six weeks' holiday, seven days later you may cut off my supply on the ground that the house is empty?

Mr. MUNROE: Yes; but if the furniture is there it would be an unreasonable act.

Mr. CLUER: In respect of a house for which the owner is liable, you may not cut it off at all.

Mr. MUNROE argued at some length that at the time the water was cut off the premises were empty. Le Grand had gone, Bibby refused to pay, and the Board could not get the rate from anybody.

Mr. CLUER said he thought Bibby was not liable until Aug. 14, when he took fresh possession.

Mr. MUNROE: My contention is that we are not bound to go on supplying water from the time the premises are empty till they are let again. We are summoned for cutting off the supply.

Mr. CLUER: "Unlawfully." Yes; and it is unlawful, because you had a right of action against Bibby. At the public expense, you take up the road and cut the pipes. If you had done it before the caretaker went out, Mr. Bibby would have had a difficulty.

Mr. MUNROE: At what date would you say Bibby became liable?

Mr. CLUER: For the whole rate from the 9th or 10th of August. You demanded the rate from Le Grand in July. Fulton's Act says the rate may be recovered from the owner for the time being—that is Le Grand. When we come to the 14th of August, Bibby was the owner, and liable for the whole rate. Instead of going to him and demanding it, someone suggests cutting off the water. That was a wholly illegal act; and the only possible defence is that the rent of the premises included the water-rate. The cutting off entitles the complainant to damages, as he had been unable to relet the premises. Continuing, his Worship remarked that rent, as was well known, was not always all profit; and, after consideration, he had come to the conclusion that to order the Board to pay a sum of 1s. 9d. per day for the six weeks during which the water had been off—about £3 12s. in all—would be a fair award. He also ordered them to pay 15 guineas costs.

Mr. MUNROE asked for a case to be stated on the law; and his Worship agreed to this.

Mr. GIVEEN said the Board ought to reconnect the supply at once; and he asked for a promise that it would be done without expense to the complainant.

Mr. MUNROE: If we have done anything illegal, we shall not charge.

At the Lambeth Police Court, before Mr. Hopkins, the Metropolitan Water Board were summoned last Wednesday to answer the complaint of Frederick Richard that they had wrongly charged him for water-rate

* See "JOURNAL," Vol. LIX., p. 918.

in respect of the quarter from July 1 to Sept. 30 last; and he claimed the return of £1 15s. paid by him under protest.

Mr. Richard, who conducted his own case, said he was the licensee of the Britannia public-house, High Street, Peckham. Up to March last, the valuation of the premises was £425 gross and £355 rateable; but it was reduced under the quinquennial valuation to £300 gross and £250 rateable. Up to March last, the amount of the water-rate was £8 17s. 6d. for every six months, payable in advance. A demand was made for £8 17s. 6d. up to next Christmas; and he refused to pay it. On the 16th of September he paid the amount, on the Board's men coming to cut off the supply. A provisional list came into operation on July 1; and he contended that for the quarter ended Sept. 30 the Board had overcharged him to the extent of £1 15s.

Mr. A. B. Shaw, who appeared for the Board, argued that, under their Charges Act (section 13, sub-section 1), they were entitled to make the rate upon the figures standing in the rate-book on July 1. He submitted that the valuation list which was in force on that day and for 27 days afterwards was the old one. On the 28th came the alteration made by the provisional list. His submission was that section 13 fixed for the whole of the quarter the rateable value on which the water-rate was to be assessed, and that it did not alter until the next quarter by reason of the alteration made by the provisional list.

His Worship said the learned Counsel's proposition struck him as being a bold one, as it led to this—that no payer of water-rate could ever get his first quarter's reduction. He decided to make an order for the return to the complainant of £1 15s., with 3s. costs.

At the same Court last Friday, before Mr. Baggallay, the Board summoned Mr. John Lockhart for the recovery of £1 4s. 3d. for water supplied to him at Nos. 141 and 143, Lordship Lane, East Dulwich, for the quarter ended Sept. 30. Mr. W. E. White, one of the Board's collectors, stated that the defendant had paid 16s. 6d., and the Board were prepared to withdraw their claim for the balance of 7s. 9d.; but they asked for the costs of the summons—3s. The defendant objected to pay the costs, and said he considered he had been wrongly summoned. Mr. White said the defendant entered into occupation of the premises on July 1, and the Board's claim was in respect of one quarter's water-rate to Sept. 30, on a rateable value of £55 in respect of No. 141, and of £42 in respect of No. 143. On these values the rate came to £1 4s. 3d.; but they had since been reduced. In answer to the Magistrate, Mr. White said the Board withdrew the 7s. 9d. because of a case decided in the Court on the previous Wednesday, when the Magistrate held that the provisional list was in force from July 1. The Board claimed on the rateable value in force at the beginning of the quarter; their contention being that this was not altered until after that date. The case recently decided was, he believed, to be taken to the Divisional Court. The summons was then withdrawn, without costs.

Unsuccessful Claim for Compensation.

A claim for £300 for compensation from the Oldham Corporation, for the death of one of their gas workmen, was heard in the Oldham County Court a few days ago. It was made by the widow of deceased on behalf of herself and her three children. The man was employed at the Higginshaw Gas-Works, and he met with two accidents—one on the 23rd of June, when he was struck on the head by a large piece of coal; and the other on the 28th when he bumped his head against a wall. Cerebral hæmorrhage resulted, and this caused the man's death. As he was only 31 years of age, it was submitted, on behalf of the claimant, that cerebral hæmorrhage did not usually occur at this time of life unless as the consequence of an accident. The medical evidence, however, showed that there were no external signs of injury, but that there was sufficient indication of disease of the brain to justify the conclusion that death had resulted from natural causes. In giving his decision, the Judge pointed out that it was for the applicant to prove injury done in the course of her husband's employment. There were no witnesses of the second accident, upon which stress had been laid; so that it was necessary to draw inferences from the facts, and consider the medical evidence. As this was to the effect that there was long-standing disease, he was satisfied the man's death was due to natural causes. He accordingly gave judgment for the respondents.

Illegal Tapping of a Corporation Water-Main.

A motor-waggon driver named Harris, in the employ of the Palatine Haulage Company, Guide Bridge, was, at the Stockport County Sessions, before Lord Newton (presiding) and other Magistrates, summoned for taking water from a hydrant of the Stockport Corporation main at High Lane. Mr. Hall, the Deputy Town Clerk of Stockport, stated that the Corporation had made arrangements whereby drivers of motor-waggons could obtain water at various pointson the road; but though the defendant knew this, he took it from a hydrant. It was a serious matter for an unauthorized person to take water from the main in this manner, because the pressure was very high; and this case had been brought as a warning. One of the witnesses for the Corporation said that if defendant had obtained the water from the Rising Sun Hotel he would have had to pay 1s. 3d.; but he took it from a hydrant about 300 yards away. The Bench imposed a fine of 10s. and costs.

Bolton Corporation Gas Statistics.—Mr. Percy Farnworth, the Borough Treasurer of Bolton, has just issued his annual abstract of accounts, together with a prefatory note by Mr. S. Horrocks, the professional Auditor, who says: "The accounts of the various trading departments have been carefully examined, and are, in my opinion, charged with an adequate amount for depreciation and renewals." The net result on the working of the gas department was a disposable balance of £24,243, of which £4243 is set apart for depreciation and £20,000 handed over in relief of the rates. The reserve balance now stands at £56,194. This year £7344 was allocated to reserve, compared with £11,294 last year.

MISCELLANEOUS NEWS.

HARROW AND STANMORE GAS COMPANY.

Developments at the Gas-Works.

During the past week some important developments have taken place at the works of the Harrow and Stanmore Gas Company. Early in August, a gasholder of about 1¼ million cubic feet capacity was completed by Messrs. S. Cutler and Sons, and the workmanship has given great satisfaction to the Company's Engineer (Mr. J. L. Chapman, Assoc.M.Inst.C.E.). A feature of the structure is a staircase leading to the top of the guide-framing; and, so far as we are aware, this is the first holder in the country to be furnished with such means of reaching the upper portions. The holder was brought into use for the first time last week. Another noteworthy improvement has been effected in connection with the manufacturing branch of the Company's operations. Hitherto the whole of the raw material and products, amounting to something like 18,000 tons annually, has had to be carted to and from the railway station, which is about 1¼ miles from the gas-works. This heavy traffic has now been removed from the public roads by the construction of a siding in connection with the Metropolitan Railway; and this also was opened last week. Great economy is expected to result from these changes; and the one just mentioned will doubtless be appreciated by the Local Authority as well as by the residents in the district.

STAFFORD GAS AND ELECTRICITY DEPARTMENTS.

Mr. Pooley's Resignation—Suggested Separation of the Departments.

The presentation of the report of the Gas and Electricity Committee of the Stafford Corporation at the meeting of the Town Council last Tuesday afforded Alderman Wright, the Chairman of the Committee, an opportunity of paying a tribute to the work of Mr. Hubert Pooley, the Gas Engineer and Manager, who, as already announced, has been appointed Gas Engineer and Manager to the Leicester Corporation. He said it was with very great regret that the Committee had received news of Mr. Pooley's resignation; but they must congratulate him on his new appointment. He was sure the whole Council had appreciated the faithful, energetic, and capable way in which Mr. Pooley had discharged his duties at Stafford. Since he was appointed, the gas-works had materially increased; and the last report was a record so far as the profits and capacity of the works were concerned. They gave £3500 to the rates—which was equal to a 9d. rate—the highest sum on record. As to Mr. Pooley's successor, the Committee proposed to start him at the salary Mr. Pooley received when he was appointed ten years ago. But seeing how the department had increased, they suggested that whereas the salary was then limited to a maximum of £450 per annum, the new maximum should, after six years, be £500. He moved the adoption of the report.

The motion having been seconded by Alderman Mottram, who, with other members of the Council, supported Alderman Wright's eulogy of the services rendered by Mr. Pooley, Mr. Bedford suggested that this would be an opportune time for the Council to divide the Gas and Electricity Departments, and put them under separate management. Alderman Wright acknowledged that the Committee were divided on this matter, but said a large majority were against the proposal. Some of them thought the Electricity Department would cease to exist if it were brought into active competition with the Gas Department. But they decided that the accounts should be made up at the end of the year under the instructions of the Borough Treasurer, and that the electrician at the electricity works should in future report personally and direct to the Committee, instead of through the Gas Engineer. This practically made him head of the department, leaving only the commercial side to come under the control of the Gas Engineer. The electrician would be independent of the Gas Engineer, so far as the technical part of his work was concerned. The report was adopted.

PUBLIC LIGHTING OF PADDINGTON.

Gas v. Electricity.—Proposed Scheme of Improved Gas Lighting.

At the Meeting of the Paddington Borough Council last Tuesday, a report presented by the Works Committee on the subject of the public lighting of the borough was under consideration. It was originally submitted on the 21st of July; but no action was then taken upon it, owing to the non-suspension of the Standing Orders.

The Committee reported that the Gaslight and Coke Company had written submitting a scheme for improving the street lighting of the borough by using inverted burners instead of the existing upright burners. The matter was considered so important, that a copy of the letter was given in an appendix to the report; and the Committee pointed out that the improvement could be carried out without any additional cost to the borough, either annually or in the way of capital expenditure. The Borough Surveyor had been in communication with Mr. F. W. Goodenough, the Controller of the Sales Department of the Company, and had ascertained that the Company would provide the necessary new bracket-irons to take circular lamps in lieu of the present square ones; bear the cost of the paving works in connection with the removal of the present meters—viz., about £50 or £60; and undertake all responsibility with regard to knocked-down lamps, provided the Council gave the Company all reasonable assistance in recovering costs from the persons causing the damage. The price per lamp was to be a fixed one, and not vary with the price of gas. As to the Council's employees, the Company would take them over subject to good behaviour. They could not guarantee pensions to men over 35 years

of age; but the lighters would receive 23s., 24s., and 25s. per week, against the borough's rates of 22s., 23s., and 24s.—service with the Council counting as with the Company. Further, the men would have the chance of becoming co-partners in the Company. As to street name tablets on the lamps, the Company would provide these to a total of one in five. Generally, the Company were prepared to pay any other cost or charge usually included in the borough's annual statement of expenditure.

The Company said they would be prepared to light the lamps in foggy weather; and if the Council decided to instal lights in the private roads of Westbourne Terrace, they would provide 16 single-burner lamps there instead of 13, as mentioned in their letter, without altering the total cost of their scheme. As an alternative to providing the 16 lamps referred to, the Company's Engineer would consider the possibility of utilizing the high standards in Westbourne Terrace, though he did not hold out much hope of being able to do so. He had undertaken to have the following specimen lamps fixed in the borough, in order to enable the members of the Council to inspect them before the Council meeting: Three-light burner lamps in Edgware Road (between Harrow Road and Oxford and Cambridge Terrace); two-light burner lamps in Harrow Road, from Edgware Road; and one-light burner lamps in Oxford and Cambridge Terrace and Westbourne Terrace.

The Committee recommended the Council to enter into an agreement with the Company for lighting the borough in accordance with the conditions mentioned in their letter and the arrangements made by the Borough Surveyor with the Controller of the Sales Department of the Company.

The following is the letter from the Gas Company to the Town Clerk (Mr. A. W. J. Russell) referred to in the report:—

I have pleasure in submitting the following proposals for improving the street lighting of the borough of Paddington.

The borough is at present lighted by 4014 lamps fitted with upright incandescent gas-burners, 49 of that number containing three burners, 14 containing two burners, and the remaining 3951 containing one burner. The total effective average illuminating power is about 200,000 candles. The light obtained for the gas consumed can be materially increased by the substitution of inverted for upright burners; the former giving from 30 to 50 per cent. greater efficiency than the latter. For the installation of inverted burners, new lamps throughout the borough would be necessary; and circular lamps of the type recently inspected by the Works Committee in other parts of the Company's district are strongly recommended.

For the further improvement of the lighting of the main thoroughfares, in view of the higher standard of street illumination that has been adopted in other districts since the lighting of Paddington was last revised, the substitution of two-burner and three-burner lamps for one-burner lamps is recommended. It is suggested that three-burner lamps should be adopted in Bayswater Road, Edgware Road, and Maida Vale, which carry the heaviest and fastest traffic in the borough, and that two-burner lamps should be installed throughout the Harrow Road. For the improvement of the lighting of the inner carriage drives in Westbourne Terrace, the installation of about 13 single-burner lamps in these drives is recommended, in preference to increasing the number of burners in, or the height of, the lamps in the main road. If these suggestions were adopted, the numbers of lamps would stand as follows: 3534 one-burner lamps, 225 two-burner lamps, and 268 three-burner lamps; and the total illuminating power would be equal to over 380,000 candles, or 90 per cent. increase over the present light.

If granted a contract for the lighting of the whole borough with approximately this number of lamps for a period of ten years, the Company would be prepared to carry out the whole of the installation of new circular all-copper lamps and burners at their own cost; the lamps becoming the property of the Council at the conclusion of the contract, and the old lamps and burners becoming the Company's property as and when replaced by new. Also for the supply of gas for the usual lighting hours; the lighting, extinguishing, cleaning, painting annually two coats, repairing and renewing of lamps and burners; and the maintenance of mantles in good lighting condition, to charge the following inclusive and fixed prices per annum:—

Lamp with one inverted burner consuming 3½ c. ft. per hour . .	£2	12	6
Lamp with two inverted burners consuming 7 c. ft. per hour . .	4	0	0
Lamp with three inverted burners consuming 10½ c. ft. per hour .	5	10	0

At these prices, the total annual cost would be—

3534 lamps, at £2 12s. 6d.	£9,276	15	0
225 ,, at £4	900	0	0
268 ,, at £5 10s.	1,474	0	0
Total	£11,650	15	0

This compares with an average annual cost for the past three years (excluding capital charges) of about £11,650; so that an immense improvement in the lighting would be effected at no increase in annual cost, and without the borough incurring any capital expenditure whatever.

I should add that these terms are only applicable to the whole, and not to a part, of the borough, as the Company could not offer such exceptionally liberal terms except in consideration of their securing the lighting as a whole for a reasonable term of years. If entrusted with the work, the Company would spare no effort to carry out the installation in a thoroughly satisfactory manner, and to maintain the lighting subsequently with credit to themselves and to the entire satisfaction of the Council and ratepayers. If the Committee desire any information on any point arising out of this proposal, the Chief Inspector (Mr. F. W. Goodenough) would arrange to attend before them at any time appointed.

After the preparation of the report, a letter was received from the Gas Company stating that after the expiration of the ten years' contract it was the Company's intention (provided the costs of gas manufacture and street-lamp maintenance did not increase during this period) to reduce their charge by at least £1000 per annum.

The Finance Committee also brought forward a report on the matter which had been previously presented and adjourned. They stated that they had had under consideration the report of the Works Committee, in conjunction with communications from the Gas Company with reference to a scheme for improving the street-lighting of the borough by using inverted instead of the existing upright burners. The effect of the proposal was that the Council should be responsible for an expenditure of £13,000 on capital account—the amount of such expenditure to be provided in the first instance by the Gas Company, and afterwards to be repaid by the Council by annual instalments of £1300 for ten years. This £1300 would form part of the total annual charge, estimated at £11,650, for lighting the borough. As the first-named proposal practically involved the borrowing of money, the Committee said it would be necessary to apply to the London County Council for sanction to the loan before any contract could be entered into. The following other points were submitted for consideration: (1) The contract should provide that the quarterly payments should be made subject to a certificate from the Borough Surveyor that the lighting was satisfactory. (2) That in event of the Gas Company failing, in the opinion of the Borough Surveyor, to carry out the terms of the contract, and subject to an appeal by the Company to the Engineer of the London County Council, the Borough Council should be at liberty to terminate the contract without incurring any liability whatever, either on revenue or capital account. The Committee also pointed out that if the Council should desire to change the system of lighting during the period, the balance of capital expenditure would probably have to be a charge on the rates for the year in which the change took place. They concluded by recommending that application should be made to the London County Council for sanction to a loan of £13,000, for a period of ten years, for carrying out the scheme.

After a short discussion, a resolution was submitted that the report should be referred back to the Works Committee for them to consider the questions of obtaining a shorter period than ten years for the contract, paying off the capital outlay, and taking advantage of any reduction in the price of gas.

The former Chairman of the Works Committee (Alderman Whur) said the Council had had under consideration for years the question of the street lighting of the borough; and, having investigated and inspected the lighting of London, they had come to the conclusion that gas in its latest form was by far the best method. According to the wording of the contract, they were actually able to effect a saving in the rates owing to the powerful resources of the Gas Company. Electric light was nowhere, with regard either to illuminating power or cost, in comparison with gas. Under the proposals of the Gas Company, they were to have double the present lighting power. With respect to statements about the unhealthiness of gas, all he could say was, considering that nearly every person in the Metropolis was a user of gas in some form or other—for heating, lighting, or cooking—there must be a large number of sick people in the London area.

The Chairman of the Works Committee agreed to take the report back to consider the questions raised, though he said his opinion was that the lighting under the proposed contract was the best the Council could have, as, owing to the new developments in gas lighting, the Gas Company were able to supply light with the smallest amount of gas. The Electric Light Company had had an opportunity of making a demonstration in the streets of the borough, and the result justified the report presented by the Committee.

ELECTRICITY SUPPLY FINANCES AT NEWPORT (MON.).

Illegal Overdrafts.

The records of the various Committees of the Newport (Mon.) Corporation, which were issued last Thursday, contain some rather interesting information as to the financial position of the Electricity Department. It is set forth that Messrs. Elvy, Robb, and Welch, Solicitors, who have been consulted by the Newport Ratepayers' Association, have written to the Town Clerk with reference to the financial transactions of the borough. They state that for several years past there have been borrowings by the Council from their bankers upon the electricity revenue account; that interest has been paid in respect of such borrowings; and that it has been established by a number of decisions that borrowings of this kind are entirely illegal. After dealing with the accounts, they say they gather that it is proposed to include the amount in the next rate to be levied; but they declare that such a course would be quite illegal, inasmuch as the expenditure to be covered was incurred more than six months prior to the making of the rate, and, moreover, has not been included in any estimate for the rate. They request the Council to give an undertaking: (1) That the overdrafts of the electricity and revenue account shall not be paid, or, as regards the bank, received out of the revenue or the general district fund, or any other public funds not legally applicable towards the payment of the same. (2) That all sums already paid for interest in respect of overdrafts on the electricity revenue account shall be restored to the revenue account forthwith, or to the other accounts from which the payment was made; and that no further sums shall be paid for interest on such overdrafts. (3) That the Corporation will not make or enforce or receive payment of any rate made for the purpose (*inter alia*) of paying off these bank overdrafts or of paying interest in respect of such overdrafts. (4) That the Corporation will not make, enforce, or receive payment of any rate for the purpose of paying off the sum of £3500 standing to the debit of the electricity capital account.

The Committee, having considered the letter, the Town Clerk has been directed to reply to the following effect: It is true that, by reason of the receipts of the electricity revenue account not being equal to the expenditure, there has been from time to time at the end of the financial year an overdraft representing the deficit on the year's trading, and the requirements, as soon as the actual loss for the year was correctly ascertained, have been paid off out of the general district fund. Upon such overdraft the bankers have charged, and, of course, have been paid, any interest due. The Council, in passing the resolution as to the sum of £3500, were acting expressly in accordance with the requirements of the Local Government Board. It cannot be admitted that the statutory provisions have been entirely ignored, since an account of such deficiencies is kept in the books of the Corporation; and while the Act says that interest shall be payable (not paid) thereon, the Committee leave it to the judgment of the Corporation as to when this should be done. Dealing with the suggested undertaking, the letter concludes that the Corporation recognize the serious change which the recent case of *Attorney-General v. Corporation of West Ham* must make in the mutual relations between them and their bankers, and the question will receive their early consideration. But they are not prepared voluntarily to repudiate their just debts and liabilities to their bankers in respect of the past; nor can they think, knowing the *personnel* of the Newport Ratepayers' Association, that this body would wish them to dishonour themselves and the town by so doing.

CO-PARTNERSHIP AT WATFORD.

Presiding recently over the first general meeting of the Watford Gas Company's co-partnership members (at which there was an attendance of about sixty), Mr. E. J. Slinn, the Chairman of the Company, said he must congratulate the employees on the really substantial amount of their financial interest in the undertaking. It was, indeed, most gratifying to see that no less than forty members had already qualified for £10 of the Company's stock. This meant that in a little over a year £400 of the Company's stock fell to be divided between forty members of the co-partnership fund. In brief, it would be seen from the balance-sheet that, while the employees had contributed £374, the Company had added to this a sum of £446, making a total saving of no less an amount than £820. It was as well to remember that, had the contributions been paid into the Post Office Savings Bank, they would not have amounted to more than £384, as against £820. It was not therefore altogether as a savings bank that they must look at the co-partnership fund. It was not a concession given by the Board. It was not an allowance for extra labour. The employees were being given the opportunity of becoming their own masters. Whatever profit the Company made, the men must share in it, not only by their wage, but by their interest in the Company as shareholders. Everything they did, every real earnest effort put into their work, returned to them twice over. They reaped not only what their manual or clerical labour was worth, but also their share in the divisible profits earned by them, as shareholders of the Company. Most of them were gas consumers; and therefore if the undertaking was prosperous, they were "thrice blessed." They reaped the advantage of a low price gas, of their weekly wage, and of their interest as shareholders. Be true co-partners, and the whole work would go with a will; be drones, and they would be a drag, not only on the Company, but on every co-partner who was now, or soon would become, a shareholder of the Company. There was no half-way; and the Board were very glad to see that, with few exceptions—and these they could believe were only through not having a thorough grasp of the scheme—the co-partners meant to get on.

The adoption of the report was seconded by Mr. E. A. Smith, and carried unanimously. Votes of thanks to Mr. A. Temple Rowe for serving as professional auditor to the fund, and to the Chairman for presiding at the meeting, were carried with enthusiasm.

PUBLIC LIGHTING OF WATFORD.

The Question of Electricity or Incandescent Gas.

At the last Meeting of the Watford Urban District Council, Mr. Tripp moved—"That it be referred to the Finance Committee to prepare a comparative statement showing the present cost of lighting the streets of the town by electric light, and the cost of lighting same by incandescent gas, in accordance with the suggestion of the Local Government Board." He said that the Board had informed the Council that they had sanctioned the last sum required for public electric lighting "with some hesitation," and they added: "The Council should continue to give the question as to the advisability of lighting the streets with electricity their careful consideration, as the Board would have considerable difficulty in sanctioning further loans for the purpose unless the position is materially improved." This, said Mr. Tripp, was a very strong letter from a Government Department; and it was particularly so when the fact was borne in mind that the President was one of the strongest supporters of municipal trading in the country. Before such a letter was sent out, Mr. Burns must have had very strong reasons for believing that the Council's policy in regard to street lighting was not in the best interests of the ratepayers. As he (Mr. Tripp) understood, the Local Government Board made a similar suggestion three years ago; but apparently nothing was done. It must be remembered that the local inquiries into loans were held by Local Government Board Inspectors who were electrical engineers of great experience; and on two occasions these gentlemen had emphatically pointed out that the Council should seriously consider the matter of public lighting. The Committee had, however, ignored the suggestions of the Board. Electricity had made great strides in the last few years; and for private lighting and power purposes it no doubt had a great future. But in regard to public lighting the case was different. The City of London—the first city to light their streets by electricity—had found that it was infinitely more costly than gas, and had gone in for an extensive system of incandescent gas lighting. Precisely the same thing had happened in Westminster; and many other boroughs had followed the examples of these two places. Wherever an investigation had been made as to the comparative cost of gas as against electricity, the figures had come out in favour of gas. Liverpool was said to be the best-lighted city in the country; and there the Corporation, in spite of the fact that they owned an electricity undertaking, lighted the streets by gas. Most of the Watford streets were badly lighted; and he suggested that the Council should go to the Gas Company and say that whatever proposals they were prepared to submit would be carefully considered, and if the Company could give them a better light at a lower cost, the Council, in the interests of the ratepayers, would adopt gas for street lighting. They were asking now for a loan of £7000 for electrical purposes; and this loan, he contended, ought not to be taken up until the Council had the investigation proposed in his motion.

In formally seconding the motion, Mr. Long suggested that if the Council moved in the direction of gas they should endeavour to buy out the Gas Company. The Chairman of the Electricity Committee (Mr. Goodrich) said he had recently been on the Continent with some other members of the Council, and all the best street lighting they had seen had been done with electricity. After denying that the suggestions of the Local Government Board had been ignored, the speaker went on to say that if there was any real anxiety to have the whole question investigated he for one would not put any obstacles in the way. With regard to the last words of the motion, one would think the Local Government Board were anxious that the Council should consider the whole question of public lighting, with a view to superseding electricity by gas. As a matter of fact, the Board had never made any such suggestion. In a letter from them three years ago, they said: "The Board thinks the District Council should carefully compare the cost and advantages of lighting by electricity and gas before proceeding any further with extensions of the system of lighting the streets by electric incandescent lamps." The Council had not proceeded any further with lighting by electric incandescent lamps; their extensions had been with the new metallic filament lamps. The Board's remarks did not apply to the system generally, but only to further extensions. At the time of the inquiry, they had 921 lamps, with a total illuminating power (including that of the arc lamps) of 18,000 candles; and for this the Council were paying £4124. To-day they had 1012 lamps, with an illuminating power of 41,000 candles, and all for the same money they paid three years ago. With reference to the £7000 loan, only £300 of it was for public lighting in the next three years, and £400 was for excess expenditure on public lighting. Whatever else they spent would be taken out of revenue. In regard to the Cities of London and Westminster, neither of these had electricity undertakings, and, of course, they bought in the cheapest market. If Watford were in the same position, they would do likewise. Out of the 29 Metropolitan boroughs, only ten now used gas exclusively for street lighting.

In reply, Mr. Tripp said his whole point was that the Local Government Board Inspector had heard all Mr. Goodrich had told them, and a great deal more. These Inspectors had a most extended experience of electricity undertakings, because they were always going from town to town holding inquiries. The objection of the Board was not altogether that the Electricity Department was not properly conducted; they said that the cost of public lighting was so far excessive that the Council ought seriously to consider the matter before they spent more money, and see whether they ought not to adopt incandescent gas.

In the result, Mr. Tripp's motion was carried by seven votes to five.

IPSWICH WATER SUPPLY.

New Source at Akenham.

In the summer of last year, the Water Engineer of the Ipswich Corporation (Mr. C. W. S. Oldham) reported to the Water Committee that the maximum weekly consumption of water had then risen from 10,646,000 gallons in 1898 to 14,451,000 gallons in 1908, or from 1,521,000 gallons to 2,064,000 gallons per day. This, he pointed out, clearly indicated that the town would in a few years require more water than was available to supply the maximum demand, seeing that the largest quantity that could be obtained from the existing sources was 2,180,000 gallons per day. It was not thought advisable to attempt to increase the supply from the present wells and boreholes, but to go outside the town, and draw water from the chalk. Eventually a site at Akenham was secured, and a trial borehole 24 inches diameter, to yield 500,000 gallons a day, was sunk. The work was started about a month ago; and at a depth of 12 ft. 6 in. the chalk was entered and water soon met with. The work was pushed on; and in twenty working days a depth of 300 feet had been reached.

The bore is lined with steel tubes to the extent of 54 feet, at which depth the chalk was found sufficiently hard to stand. The natural rest-level of the water is 34 feet from the surface. The official test in the contract before the sanction of the Local Government Board can be obtained for the construction of permanent pumping works is generally that 500,000 gallons a day shall be pumped for 14 days. But it soon became evident that there was more water available than would satisfy this requirement; and, as a matter of fact, nearly 750,000 gallons have lately been pumped daily without any serious lowering of the level of the water in the bore. The pump is 15 inches diameter, with a 3-feet stroke, and works at the speed of 25 strokes to the minute; and according to the terms of the contract it has to keep on for 14 days and nights continuously, with no longer stop than an hour at a time, and a total stoppage in the 14 days and nights not exceeding three hours. When pumping 860,000 gallons a day, the water in the bore was only depressed about 15 feet from its natural rest-level. The water as it comes to the surface is received in a large tank constructed of the chalk taken from the borehole, whence it runs into a wood channel, by means of which the flow can be easily measured and checked. The water at present is milky, because the pumping is being done actually in the chalk; but when the lining is continued to the requisite depth, it is expected that the water will be quite clear. The Public Analyst reports that it is fit for drinking and all purposes of a public supply. The work was carried out by Messrs. F. Smith and Son, of Grimsby.

At the meeting of the Town Council last Wednesday, the Water Committee presented a report on the subject of the new supply, and asked for confirmation of their action in regard to it. The Chairman of the Committee (Mr. R. G. Bennett) said they presented their report with the greatest possible pleasure. The satisfactory result recorded had been entirely due to the care and trouble taken by the Water Engineer; and they could congratulate themselves upon having such an officer. They had obtained more water than they expected—at least a million gallons a day—and he should be glad when the supply was connected with the reservoir. He moved the adoption of the report; and the motion was carried unanimously.

Position of the North Oxfordshire Water Company.—The following remarks appeared among the City news in the "Daily Mail" on Monday last week: "While the failure of the Mid-Oxfordshire Gas Company has just been before the public, a debenture-holder in the North Oxfordshire Water Company asks to be put in communication with his fellows. Complaining to the Company of the absence of his interest, he received no reply to his first letter; in reply to his second letter, regret was expressed at the delay in payment; and in reply to his third, it was stated that a Receiver had been appointed. As we have before pointed out, the losses on these small gas and water undertakings are numerous enough to instil extreme caution."

METROPOLITAN WATER BOARD.

The Financial Position.

The Metropolitan Water Board re-assembled last Friday for the first time after the summer recess, under the presidency of Mr. E. B. Barnard, the Chairman.

The Law and Parliamentary Committee presented a long report on the Water Supplies (Protection) Bill, 1910, which now awaits consideration by the House of Lords. Sir Melvill Beachcroft moved that the consideration of the report be adjourned; remarking that the matter was one of vital importance. The Board had arranged for supplies of water for the next thirty years; but this period was not a long one in the history of the Empire's capital. The Board had to realize their responsibilities; and something should be done to stop the filching of London's underground water supply by sinking private wells. Consideration of the report was eventually adjourned.

A motion was submitted by Mr. D. R. Paterson that it be an instruction to the Appeal and Assessment and Finance Committees of the Board to report as to the propriety of taking steps to ensure that the Board's expenditure in respect of interest and sinking fund and Imperial and local rates should be borne by the ratepayers generally. His argument was that, the supply of water having a distinct sanitary value, and providing a safeguard against fire, the ratepayers should contribute to its cost, whether or not they were consumers. As things were, the water charges were borne by those interested in property to the value of £37,000,000, against a total rateable value of £45,000,000. Mr. Musgrave said the Board had to be regarded as a commercial undertaking. There was a deficiency, already ascertained, in respect of the year 1909; and it was certain that there would be deficiencies for 1910 and 1911. These would, no doubt, have to be met by a precept. But as to the future the position was this—that Parliament had imposed certain restrictions in the matter of charges which made it impossible for the Board to meet their expenditure. The Board had, for instance, in some cases to supply water for 6d. per 1000 gallons, whereas the cost price was 8½d. He thought the time had come to consider as to whether steps should not be taken to secure a revision of the Board's Charges Act. In the course of further discussion, Mr. Fitzroy Doll said he had been placed in the position—humiliating to a member of the Board—of being instructed by clients to include in his plans for the building of two large hotels in London the provision of private wells. This meant a loss of £800 or £900 a year to the Board in each case. Mr. J. Gunton mentioned that he had sunk six wells in the City for clients; and the consequent loss to the Board was very great. Mr. Karslake regarded it as a false proposition that the whole of the cost of the water supply should be cast upon the consumers. The general body of ratepayers should contribute, as in the case of paving, lighting, and sewerage. It was stated by Mr. Tozer that a report upon the whole subject was shortly to be presented by the Finance Committee; and Mr. Paterson's motion was approved.

QUALITY OF HOLYHEAD WATER.

A Pure and Wholesome Supply.

An answer to the much-discussed question of the quality of the Holyhead water supply was given by Mr. J. H. Burton, the Chairman, at the recent half-yearly meeting of the Holyhead Water Company. He said the supply from Lake Traffwll was now in excellent condition, and the quality of the water was continually improving. When they succeeded in getting the Traffwll supply into good order, they found its quality superior to that of the water obtained from the mountain reservoirs. Coming to the controversy between the Council and the Company concerning the purity of the water supply, the Chairman explained that, at the instance of the Council, a sample of water was analyzed, with the result that it was found to be badly contaminated; and a very strong letter was addressed to the Company by the Town Clerk. As a result, the Company ordered a thorough investigation of the system, including all the sources of supply and the filtered products, to be made by Drs. Thresh and Beale. As the result, they found that the water furnished to Holyhead was of good quality and perfectly wholesome. Further samples were taken by the Council, some of which were satisfactory. Reporting on one sample, in which the water was found by the Council's Analyst to be bad, Drs. Thresh and Beale said it was of "good quality, and well adapted for all domestic purposes." On Aug. 20, the Council also took three more samples, and forwarded them to their Analysts. This time they had two good reports, and one that was perhaps less satisfactory. The Directors were much puzzled at this, and the Chairman put before the shareholders the following as a probable and sufficient explanation: The greatest precautions were necessary when taking samples of water, especially for bacteriological examination. However careful one might be, it was actually impossible to ensure that a sample should not be contaminated by germs after it had left the main. It naturally followed, therefore, that when several samples taken from the same main were found to vary, the favourable reports described the true character of the water, and the bad ones were inaccurate. He felt sure that in some such manner as this the present alarm had occurred, and that the Company's water, notwithstanding the Council's suggestion to the contrary, was, and would be, proved to be of excellent quality, and pure and wholesome for all domestic purposes. The Company's Engineers had written a letter, in the course of which they said: "You will no doubt make a statement to the shareholders at the general meeting on the position of affairs, and can then say with confidence that the water the Company are supplying is of excellent quality, as is proved by the reports of Drs. Thresh and Beale." The alarm had been damaging both to the Company's revenue and reputation, for the complete survey of their property that was necessary to convince them that their water was not in fault entailed heavy expenditure, which was not altogether balanced by the fact that the exhaustive report received would be useful to the Board in many ways for some time to come.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. J. Fraser, of the Provan Gas-Works, this evening opened the session of the Western District of the Scottish Junior Gas Association with a very thoughtful address, chiefly upon retort heating. This is a subject in which Mr. Fraser has had a large experience—an experience almost unique. His conclusions, therefore, are worthy of attention. As in the Eastern District a fortnight ago, there was an indication in the tone of to-night's meeting that the members mean business this session. The prosperity and advancement which have been showered upon members of the Junior Association quite sufficiently account for the resolve to make more of membership in the Association than some have hitherto sought to do. The Junior Association is already an undoubted power; and a power for good.

The Smoke Abatement Exhibition in Glasgow was closed to-night, without ceremony. It has been a very great success, from all points of view. As an educative influence, when it is stated that in the course of the three weeks in which the exhibition was open it was visited by over 60,000 people who paid for admission, free-list visitors—and there were a great many—being over and above, it will readily be realized that an appeal has been made to a very wide circle indeed. To the organizers of the exhibition, it has been exceedingly gratifying that the attendance throughout has been of the class to whom it was the intention to appeal—that is, the middle class of the community. The exhibition was not run as an entertainment; consequently it proved no attraction to triflers or frivolous persons. Those who visited it came with inquiring minds, which had the effect of keeping stall attendants busy; and this, in turn, led to orders. The influence upon the public has been great; but that is almost exclusively local. There is another influence, very much wider, which has been exerted through the medium of gas undertakings. The exhibition has been a subject of great interest to gas managers, not in Scotland only, but beyond her borders. Managers and other officials of gas undertakings came from near and far to see the latest which there was to be seen in the exhibition in the application of gas. The most complete of all these bodies who made the exhibition an educational objective was the Corporation of Arbroath, a large representation of whom paid a visit on Wednesday. Coming as a Corporation, they received particular honour. The same has to be said of a deputation from the Corporation of Manchester, for whom entertainment was provided by the Gas Committee of the Glasgow Corporation. There were also what may be termed official visits from Aberdeen, Dundee, Airdrie, Coatbridge, Rothesay, and other places; and, in addition, there were many unofficial visits. All these will have a powerful effect in disseminating the notion, which is at the present moment possessed of the community, that in the matter of lighting and heating coal gas is the housewife's best handmaid. During the run of the exhibition, the commercial side of the business has been very active; but it is the experience in other places that orders come in more freely after the event than during the currency of an exhibition. To a very large extent fires and cookers sent out in connection with an exhibition act as advertisements, and bring in further orders; while it is no uncommon experience that in some households the feeling is to give the vendor of gas appliances the go-by, but that when it is discovered that a neighbour has taken to gas for heating, and is delighted with it, the doubting ones come round, and another stove or heater is asked for. The experience of the Glasgow Gas Department, there is no reason to doubt, will be as it has been elsewhere; and we may rely upon it that before the year is out the demand for gas fires of all sorts will have very largely increased. There can be no doubt, also, that the exhibition will have given a help to undertakings outside Glasgow, and that the current twelvemonth will see, in consequence of the holding of this exhibition, a large increase in the use of gas appliances throughout the country. In this way, and for these prospective benefits, the gas industry are under a debt of obligation to the Corporation of Glasgow and the officials of the Gas Department for the way in which they have organized and managed the exhibition. To Mr. Alexander Wilson the very highest praise is due for his energetic and thoughtful action all through—first in the making of the arrangements for the exhibition, and afterwards in the close touch he kept himself in, in all matters relating to it. There can be no blinking the fact, even by those who may be disposed not to see so much good in gas as in other modes of lighting and heating, that gas has, by means of this exhibition, been given a lead in the minds of the people. No other single exhibit was in itself equal to the lighting or heating effects obtained from a single gas apparatus; and no other mode of lighting and heating which was on view could be made applicable to so many of the services of the home, factory, or street. This is very gratifying; and surely the industry which a generation ago was all but universally regarded as being played out, and has now, by inherent merit, rehabilitated itself in public estimation, will be able to keep its present happy position against all comers.

It perhaps ought to be mentioned that the exhibitors last night held a dinner in the Windsor Hotel, which was presided over by Bailie Paxton, the Sub-Convener of the Gas Committee. The company numbered nearly eighty, and included a large representation of the Gas Committee. There was much happy conviviality, for which the great success of the exhibition was accountable. The Chairman congratulated the exhibitors and all concerned on the remarkable success which had attended the exhibition. From the commercial point of view, he said, it had far exceeded their most sanguine anticipations; the sales of appliances for heating and cooking and other purposes having immensely increased during the past three weeks. More than one attempt had been made by the citizens of Glasgow to remedy the smoke nuisance; but this was the first determined and united effort on their part to educate the public in methods by which a purer atmosphere might be obtained. That these endeavours had not been in vain was clearly shown by the very large attendances of the public, and by the satisfaction felt by the exhibitors with the results. Though the exhibition was closing next day, he believed the

opinion was widely entertained that the education of the citizens in regard to air purification should be carried further by the promotion of a similar exhibition in the near future in another part of the city. It was only by such efforts that they could hope to advance towards the object they had in view.

Besides the Smoke Abatement Exhibition, the people of Scotland have this week had, as a means of drawing their minds gaswards, a small share in the entertainment of the German Gas and Water Engineers. The proceedings in the course of the visit are narrated in other columns, and need not be enlarged upon here. All I need say about it is that, both in Edinburgh and Glasgow, the visitors impressed our people with a sense of the thoroughness with which the Teutonic mind applies itself to business. A cursory glance was not sufficient for them. Details were sought for, and were noted with apparent intelligent satisfaction. The visitors received a hearty reception in Scotland; and I am told that when they left for the South they expressed themselves in no unmeasured terms of appreciation of the attention which had been paid to them.

The Gas Committee of the Falkirk Town Council, who a fortnight ago recommended that the price of gas should be reduced by 2d. per 1000 cubic feet, and who agreed to take the subject back for reconsideration, on the suggestion being made that the reduction might be greater, came forward on Monday with a recommendation that the reduction should be 3d. per 1000 cubic feet. This was agreed to without comment. The prices now are: For lighting, 2s. 9d.; for power, 2s. 4d.; and for gas used through prepayment meters, 3s. 2d.

In Hawick several years ago the Corporation had all the streets of the town lighted by electricity, which superseded gas. The lighting has not been a success; and its lack of satisfaction was voiced in the Town Council on Tuesday, when Bailie Lawson said "he thought the lighting of the town might be improved. It was not what they expected at all. The electric arc lamps were going out in their faces every night. The sooner they were back to gas the better." The Town Clerk was asked to write to the Electric Lighting Company on the subject.

PRICE OF SULPHATE OF AMMONIA.

From the "Financial Times."

Considerable interest is being taken at present in the market for sulphate of ammonia, which has recently developed marked strength. Since the beginning of the current month, quotations have been advanced by a further 5s. per ton; raising the price to £12 15s. for delivery in the second quarter of 1911. The principal buyer at the moment is America, which is not only purchasing for prompt but also for forward delivery; large lines having been done at between £12 10s. and £12 12s. 6d. per ton for the first quarter of next year. In addition to the naturally strong position of the commodity following upon an increase in the demand, quite a lot of forward selling was indulged in, it appears, when prices were fully £1 per ton below the present level. These forward sales are now being covered; and this, taken in conjunction with the increased demand from the United States, and the fact that two of the leading consuming countries—Spain and Japan—have not yet begun to cover their needs for next season, has brought about a sharp upward movement. The increase in the American demand is due partly at least to the reduction of the tariff by 25 per cent. under the Payne-Aldrich Bill.

Despite a steadily increasing production and the ever-present competition of nitrate of soda, the output of sulphate of ammonia continues to be readily absorbed. Not only so, but the outlook is regarded by the best informed authorities as distinctly promising, both as regards the consumption and values. It was feared at one time that the success of the propaganda work in connection with nitrate of soda would detrimentally affect sulphate of ammonia. But this has not proved to be the case; and every successive increase of production has but apparently extended the area in which the utility of these fertilizers has been proved. . . . Even at the present level of values—which, by the way, shows a very fair margin of profit to producers—it cannot be said that prices are unduly high, as last year's average price was £11 5s. per ton, and the average for the past ten years £11 5s. per ton.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 8.

Sulphate of Ammonia.

In the early part of the week the tone became rather quieter, although there was no decline in values; but during the last two or three days the keen demand has again set in, and the market closes strong at £12 15s. per ton f.o.b. Hull, £12 16s. 3d. per ton f.o.b. Liverpool, and £12 18s. 9d. per ton f.o.b. Leith. The bulk of the requirements have been for the covering of contracts made previously, but consumers both in this country and abroad have shown more disposition to operate at the present level of prices. Several transactions have taken place for delivery in equal monthly quantities October-December, 1910, at full prompt values; and it is reported that the same figures are being paid up to April next year.

Nitrate of Soda.

The position of this article is unaltered, and the quotations are still given as 9s. 4½d. per cwt. for 95 per cent. quality and 9s. 7½d. for refined, on spot.

LONDON, *Oct.* 10.

Tar Products.

The markets for tar products have been fairly steady throughout the past week. Pitch remains about the same, though reports from some quarters are that buyers have been able to purchase at rather lower prices. In some quarters makers are asking slightly improved prices for 90 per cent. benzol; but no orders are reported at the higher

figures. Reports on the Continent show that the Belgians and Germans are easily able to undersell, and accept lower prices than those which are being quoted on this side. There is very little fresh business in solvent naphtha. Creosote does not show any signs of improvement yet. Crude carbolic acid is still of very little interest.

The average values during the week were: Tar, 18s. 6d. to 22s. 6d. *ex* works. Pitch, London, 36s. 6d. to 37s.; east coast, 36s. to 36s. 6d.; west coast, 38s. to 40s. Clyde ports, 35s. to 36s. Manchester, 36s. to 37s. Liverpool. Benzol, 90 per cent., casks included, London, 7d. to $7\frac{1}{4}$d.; North, 7d. to $7\frac{1}{4}$d.; 50-90 per cent., casks included, London, $7\frac{1}{2}$d. to $7\frac{3}{4}$d.; North, $7\frac{1}{4}$d. to $7\frac{1}{2}$d. Toluol, casks included, London, 9d. to $9\frac{1}{2}$d.; North, 9d. Crude naphtha, in bulk, London, $3\frac{1}{2}$d. to 4d.; North, $3\frac{3}{8}$d. to $3\frac{1}{4}$d.; solvent naphtha, casks included, London, 1s. to 1s. $0\frac{1}{2}$d.; North, 11d. to 1s.; heavy naphtha, London, casks included, 11d. to $11\frac{1}{2}$d.; North, $10\frac{3}{4}$d. to 11d. Creosote, in bulk, London, $2\frac{3}{8}$d. to $2\frac{1}{2}$d.; North, 2d. Heavy oils, in bulk, $2\frac{3}{4}$d. to $2\frac{7}{8}$d. Carbolic acid, 60 per cent., casks included, east coast, 1s. $0\frac{1}{2}$d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s., bags included. Anthracene, "A" quality, $1\frac{1}{2}$d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market continues very firm; and at the close improved prices were reported as having been paid in some quarters. Actual Beckton is now quoted at £12 8s. 9d.; and for forward they are asking a little more than this. Outside London makes are £12 2s. 6d. to £12 5s. Hull is £12 15s. to £12 16s. 3d.; Liverpool, £12 15s. to £12 16s. 3d.; and in Leith, £12 17s. 6d. is reported to have been paid. In Middlesbrough, the price is £12 15s. to £12 16s. 3d.

From other sources we learn that tar product prices are looking brighter. Benzol is increasing in price; Continental buyers being very prominent. Heavy orders for naphtha have been placed; and the price has improved. Creosote shipments are maintained. Carbolic is a shade better. Tar has responded to the increase in values. The average prices are as follows: Tar, 20s. to 26s. 6d. per ton. Pitch, London for export, 41s. per ton; Manchester, 39s. per ton; Liverpool, 40s. per ton; Glasgow, 40s. On the east coast, during the last few weeks, it is reported that a large order has been placed at 40s. per ton. Creosote sells at 2d. to $2\frac{1}{4}$d. per gallon, according to position of makers' works; bulk oil $2\frac{3}{4}$d. firm. Benzol, 50-90 per cent., fetches $7\frac{1}{2}$d. per gallon, casks included; solvent naphtha, 1s. per gallon naked; crude naphtha, $3\frac{1}{4}$d. per gallon naked; light oil, $3\frac{3}{8}$d. per gallon naked; carbolic acid, 60's, 1s. $0\frac{1}{2}$d. per gallon; drained salts, 50s. per ton, naked.

The Gas Committee of the Bolton Corporation have approved of a recommendation put forward by the Sanitary Committee that the Town Council should appoint an Analytical Chemist for the purpose of all Corporation analyses. The different Committees have appointed a small Sub-Committee to act jointly in the matter.

COAL TRADE REPORTS.

Northern Coal Trade.

With a fair demand for coals, there is an ample supply, and the prices show a little ease for some kinds. In the steam coal trade, best Northumbrians are from 9s. 6d. to 10s. per ton f.o.b.; second-class steams are 8s. 3d. to 8s. 6d.; and steam smalls are steady at from about 5s. 3d. to 6s. 6d. The output of the collieries is now heavy, and, as the exports to the Baltic are decreasing, there is a little difficulty in finding an outlet for all the steam coals raised. In the gas coal trade, there is that growing demand which usually shows itself at this time of the year. The price of Durham gas coals is, for the usual classes, from 8s. 9d. to 9s. 9d. per ton f.o.b., according to quality; while for special "Wear" sorts, from 10s. 3d. per ton is the current quotation. Among the contracts, those for the Stockholm gas supply have been in treaty for some days; and while the exact prices are not known, it is thought that the bulk of the contract will be placed with Durham collieries at prices not much differing from those at present ruling in the market. Sales forward do not appear to be so numerous as about a month ago; but it is believed that the termination of strikes in several centres may stiffen the market. In coke, there is a steady tone; but gas coals are in heavier supply, and the prices for good gas coke vary from 13s. to 13s. 6d. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Ell for shipment has been in slightly better request. There is a full supply of splint, and prices have shown a tendency to drop. Small sorts are not in demand. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 6d. to 9s. 9d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 344,916 tons—an increase of 12,261 tons upon the previous week, and of 13,923 tons upon the corresponding week of last year. For the year to date, the total shipments have been 12,137,572 tons—an increase upon the corresponding period of 720,736 tons.

Newton Ferrers Water Supply.—The Plympton Rural District Council have just had before them plans for a new scheme of water supply for Newton Ferrers, the estimated cost of which is £1928. It was decided that the Council's Engineer should confer with the architect (Mr. Worth) on the scheme, and report to the Newton Ferrers Water Committee thereon.

Suicides by Gas.—At Dewsbury, last Tuesday, Fred Holgate, a musician, was found dead in his bedroom; the loose end of an india-rubber pipe attached to the gas-bracket being in his mouth. On the previous Saturday, Richard Little, of St. Helens, who had suffered from depression, went into his kitchen and, after turning the gas on, knelt upon a chair and placed his face over the gas-stove. When discovered, he was quite dead.

Inventors of Gas-Stoves.

Under this heading, the following remarks are made in the "Co-Partnership Journal of the South Metropolitan Gas Company" for the current month: The "Strand Magazine" recently alluded to a Mr. Robert Martin, of Liverpool, a gentleman who is in his 87th year, as "the inventor of the gas-stove." We wonder which gas-stove—there are several kinds about. If cooking-stoves are concerned, it may be of interest to mention that as early as 1833—when Mr. Martin was about nine years old—an apparatus for roasting by gas had been patented by a Mr. Hicks, of Wimpole Street, W. With this apparatus, 16 cubic feet sufficed to roast 12 lbs. to 14 lbs. of meat. In the "Mirror" of Feb. 16, 1833, there is the following comment on the invention of Mr. Hicks: "The whole business, therefore, of the preparation of human food by the application of heat may be performed by gas, and that with great economy, in all families who roast and bake at home. This is only realizing what was long ago anticipated by the late William Strutt, Esq., of Derby. . . . How far the art of cooking by gas will be suitable for country inns may be considered uncertain in the present infancy of the invention; but as, on calculation, it is found in London to be much cheaper than roasting by open fires of coal, and, for small joints, equally cheap with sending meat to be cooked in a baker's oven, it appears highly probable that, wherever gas is used for lighting, it will answer to employ it also for cooking." We should like to know more about William Strutt, whose anticipations concerning gas cooking date back to a time which was considered "long ago" in 1833.

Penrith Rural Water Scheme.—Last Thursday, Mr. A. W. Brightmore, M.Inst.C.E., one of the Inspectors of the Local Government Board, held an inquiry at Greystoke in regard to an application by the Penrith Rural District Council for authority to borrow £23,000 for works of water supply in connection with the western district scheme, which includes several parishes. Mr. J. Graham, of Carlisle, the Engineer of the scheme, furnished details of it; and the Clerk to the Council (Mr. J. W. Smith) explained how the cost would be apportioned between the parishes, from some of which objections had been received. He said the £23,000 should be divided into two sums—viz., £18,069 for common benefit and £4931 for exclusive benefit. The length of common benefit pipes would be 33·3 miles, and exclusive benefit pipes 15·3 miles. The average amount per head for the whole area was £5 6; but taking the parishes separately, there was a considerable difference, ranging from £2 6 to £17·6. There was really one valid appeal only against the apportionment; but the Council were anxious that the whole matter should be thoroughly gone into, because they did not pretend to be experts in the matter, and the Engineer would not pose as an authority. Mr. Graham was examined at some length upon the details of the apportionment. At the close of the inquiry, the Inspector accompanied the Engineer to view the source of the scheme.

The Reported Sale of the Coalite Plant at Hythe.

Referring to the paragraph on this subject which appeared in the last number of the "Journal" (p. 18), the "Chemical Trade Journal" on Saturday made some remarks under the heading of "Current Topics." After expressing the sincere hope that the rumoured sale of the Hythe plant is unfounded, our contemporary said: "If rumour speaks truly, we regret that the coalite process should have met with so ignominious a fate. It is, perhaps, timely for us to state that our constant advocacy of coalite and similar fuels has been actuated solely by a desire to free the atmosphere from smoke. Coalite, in our opinion, promised to do much in the direction of smoke abatement; hence our support of the scheme. We wonder, if the reception accorded to coalite when it was first introduced to the gas industry had been less frigid and distrustful, whether we should have heard the melancholy news of the fate of the Hythe plant? We have become convinced of one thing—*i.e.*, it is extremely hazardous for any inventor to attempt to introduce revolutionary methods into an old-established industry. He is liable to be severely mauled by those who dread the introduction of any change in their ordinary routine. Sometimes he recovers, and finds out eventually that as he grows stronger his former enemies will eventually flock to his side, eager to adopt his suggestions. The news, whether true or not, confirms the opinions recently expressed in the financial press as to the approaching hopeless state of the coalite co-operations. That such a large sum of money as represented by the Coalite Companies' capital should have been subscribed at all showed an amount of confidence in the process by the public and experts that should have spelt success. The difficulties that we foresaw at the commencement of the process, attending the remunerative disposal of the large quantities of rich gas produced, have evidently been too much; and the endeavours to transform the gas into other commodities have brought about the ruin of the Coalite Companies. One thing is certain: Any serious attempt to remove the smoke nuisance without the active and cordial co-operation of the gas interests is doomed to failure. We can only hope that such responsibility on the part of the gas companies will be appreciated at its true value."

The West Hartlepool Town Council have decided to enter into an agreement with the Seaton Carew Iron Company, by which the Corporation will be able to utilize the waste heat from the blast-furnaces at the Seaton Carew Iron-Works for generating electricity. A new power station will be erected near the works at a cost of from £17,000 to £20,000.

In the course of the Inaugural Address of Mr. John Lewis at the meeting of the North of England Gas Managers' Association, as given in the "Journal" last week, he described the method of checking the men's time, which is done by the card system and time recorders, one of which was illustrated. We learn that twelve of these instruments have been supplied to the Newcastle and Gateshead Gas Company by the International Time-Recording Company, of City Road, E.C.

Local Government Board and Municipal Loans.

A reply has been received from the Local Government Board by the Secretary of the Manchester Ratepayers' Association to the letter inquiring the source of the legal authority by which the Department dispensed with a local public inquiry in respect of loans amounting to £40,000 for the electricity undertaking of the Manchester Corporation. The communication does not give the information asked for, but states that the question of holding a local inquiry was a matter entirely within the Board's discretion. It is added, however, that the Board have received a further application for sanction to a loan of £30,000 for the provision of a turbo-alternator at the Stuart Street station, and have decided to hold a local inquiry in regard thereto. At the annual meeting of the Ratepayers' Association, the action of the Secretary was approved. Mr. J. C. B. Percy, who supported the motion, referred to the competition existing between the Gas and Electricity Committees. The present position was, he declared, that these Committees were using the ratepayers' money and credit, to bring forces against each other which would practically annihilate both; and the ratepayers would have to "pay the piper."

Remuneration for Extra Services.—At the meeting of the Teignmouth Urban District Council last Tuesday, some discussion took place upon a recommendation of the Gas Committee that the extra services rendered by Mr. J. A. Gray, the Gas Engineer and Manager, in connection with the new purifiers, were deserving of consideration. Mr. Bird proposed that the salary of Mr. Gray should be raised next quarter by £25. Mr. Wheatley, in seconding the motion, pointed out that the Council's suggestion had been satisfactorily carried out by the Gas Manager. Objections having been raised to the proposition, the Chairman said if any man deserved an *honorarium* it was Mr. Gray, who had handled the gas-works in a creditable manner. He (the Chairman) had, however, never voted for an *honorarium* to an official, and did not intend to do so now. He maintained that if the salaries of their officials were not sufficient, they should be raised. Mr. Bird reminded the Council that when the purifiers were being put up, the question arose as to whether the Gas Manager should do the work or have outside help. If the Council had had to engage the services of an outside engineer, they would have had to pay him a great deal more than they were now being asked to give the Gas Manager. The motion was carried by four votes to three.

Messrs. R. & A. Main, Limited, have appointed Mr. J. W. Defries as an additional representative of the Company for the London district.

The Directors of the Primitiva Gas Company of Buenos Ayres have announced an interim dividend of 3s. per share on the ordinary shares, free of tax, for the half year ended the 30th of June.

Under the title of "Prepared Cokes," a company has been formed with a capital of £4000, in £1 shares, to take over the business of a breeze coke manufacturer carried on by Mr. R. E. Vickerman at Castleford.

With the view of still further extending their gas consumption for domestic purposes, the Newport (Salop) Gas Company have arranged to supply free of cost to their consumers complete "slot" installations, including cooking and lighting fixtures. This work has been placed entirely in the hands of Messrs. John Wright and Co.

By 33 votes to 7, the Rochdale Town Council on Thursday last confirmed a recommendation of the Water Committee that the contract for the construction of a new service reservoir at Buersil be let to Mr. Hyslop, of Oswaldtwistle, near Accrington, whose price was £13,400. On two previous occasions, tenders have been accepted and subsequently withdrawn.

Our attention has been called to a rather curious juxtaposition of announcements in the opening pages of the catalogue of a large drapery firm in South London. On the left-hand page it is stated that the premises are "lighted throughout with electric light," and on the opposite one that they are "protected against fire by sprinklers." In view of the recent serious conflagrations in drapery establishments in the portion of the Metropolis lying south of the Thames, the two announcements have a peculiar significance.

At last Wednesday's meeting of the Manchester City Council, Mr. Jennison (who has frequently advocated, but without success, in the Council Chamber that consumers of gas by prepayment meter should only be charged at the same rate as ordinary meter users) asked Alderman Gibson, the Chairman of the Gas Committee, whether "science" had not caused a reduction in the price of automatic meters. "I do not know what science has done," replied Alderman Gibson, "but diplomacy has enabled us to get them several shillings cheaper."

Fred Marshall, a mechanic, of Windhill, died some days ago from injuries caused by an explosion which occurred while he was at work altering an acetylene plant. From the evidence given at the inquest, it seemed that the deceased had a light close to the apparatus, which had quite recently been in use. The District Coroner (Mr. E. H. Hill) remarked that the circumstances of the case showed how dangerous it was for men to meddle with things which they did not properly understand. He thought it was not sufficiently known how dangerously explosive was this kind of gas.

We have received from the Centenary Gas Company, of Glasgow and London, a pamphlet containing illustrated descriptions of their petrol-air gas turbine generator and of the various lighting and other appliances with which the gas can be used. It is claimed that the mixture of air and petrol vapour produced by the Company's plant is non-explosive, burns with a soft and brilliant light, and is low in cost; a light of 1000-candle power being produced at the cost of 1d. per hour. Readers of the "JOURNAL" are probably aware that Mr. William Key, formerly Superintendent of the Tradeston Gas-Works, Glasgow, is associated with the Company; and their turbine generator is the outcome of his long practical experience as a gas engineer.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEER AND MANAGER. Stafford Gas and Electricity Department. Applications by Oct. 24.
HEAD FITTER. Pembroke Docks and Town Gas Company.
STOKER. No. 5299.

Plant, &c. (Second Hand), for Sale.

GAS-WORKS (DISPOSAL OR LEASE), Beaumaris. Particulars of Mr. Cripwell, Birmingham.
GAS-WORKS (South of England). No. 5296.

Plant (Second Hand) Wanted.

EXHAUSTER. No. 5297.
PURIFIER. No. 5298.
RETORT MOUTHPIECES AND RETORT-HOUSE GOVERNOR. No. 5293.

Meeting.

IMPERIAL CONTINENTAL GAS ASSOCIATION. Cannon Street Hotel. Nov. 1. 2.30 o'clock.

Stocks and Shares.

BOGNOR GASLIGHT COMPANY (BY AUCTION). Oct. 25.
DORKING WATER COMPANY (BY AUCTION). Oct. 18.
GRAYS AND TILBURY GAS COMPANY (BY AUCTION). Oct. 25.
HORNSEY GAS COMPANY (BY AUCTION). Oct. 18.
NORTH MIDDLESEX GAS COMPANY (BY AUCTION). Oct. 18.
REDHILL GAS COMPANY (BY TENDER). Nov. 1.
SOUTHEND WATER COMPANY (BY AUCTION). Oct. 18.
SOUTH STAFFORDSHIRE WATER COMPANY (BY TENDER).
TENDRING HUNDRED WATER COMPANY (BY AUCTION). Oct. 25.

TENDERS FOR

Benzol (Crude).

BRIDGEWATER COLLIERIES COKE-WORKS. Tenders by Oct. 24.

Fire-Clay Goods, &c.

LLANDUDNO URBAN DISTRICT COUNCIL. Tenders by Oct. 29.

Oxide of Iron (New and Spent).

DARWEN GAS DEPARTMENT. Tenders by Oct. 21.

Retort Ironwork, &c.

DEVONPORT GAS DEPARTMENT. Tenders by Nov. 5.

Tar-Towers, &c.

BARNSLEY GAS COMPANY. Tenders by Oct. 11.

Washers.

DEVONPORT GAS DEPARTMENT. Tenders by Nov. 5.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 94.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,863	Stk.	Apl 1	5	Alliance & Dublin Ord.	88-90	+1	5 11 1
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95–98	..	4 1 8
200,000	5	May 12	7	Bombay, Ltd.	6⅜–6⅝	..	5 5 8
40,000	5		7	Do. New, £4 paid	5–5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½–29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16–16½	..	4 4 10
75,000	10		6	Do. Pref. 6 p.c.	14¾–15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246–249	..	5 0 5
330,000	,,		9½	Do. New	184–186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215–218	..	5 0 11
246,320	,,	..	8	Do. A Ord. Stk.	155–158	..	5 1 3
460,000	20	Sept. 29	10⅝	British	44–45*	..	4 12 4
109,000	Stk.	Aug 12	6	Bromley, A 5 p.c.	117–119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88–90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	106–108	..	5 1 10
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85–87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97–99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5½–6½	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	50½–51½	..	5 16 6
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½–111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk.	105–108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do.	101–103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79–81	..	3 14 1
800 000	Stk.	June 10	5	Continental Union, Ltd.	97–99	..	5 1 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122–124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104–105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord.	105–107	+9	4 13 6
486,090	10	July 14	12	European, Ltd.	23¾–24¼	+¼	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾–18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	106–107	..	4 7 2
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87–89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	104–106	+1	3 15 6
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80–82	..	3 13 2
258,740	Stk.	Sept 15	5	Hastings & St. L. 3½ p.c.	92–94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	17¼–17¾	+¼	6 4 0
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145–148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112–114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental	187–189	..	4 15 3
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94–96	+1	3 12 11
200,242	Stk.	Aug 31	6	Lea Bridge Ord. 5 p.c.	120–122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	220–222	+1	4 10 1
718,100	,,	,,	7	Do. B	162–164	..	4 5 4
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4 9/16–4 13/16	..	6 4 8
560,000	100	Oct 1	5	Met. of Melbourne 5 p.c. Deb.	99–101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd.	12½–13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	101½–102½	−½	4 5 4
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90–91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½–14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138–140	..	5 14 4
60,000	5	Sept 15	8	Ottoman, Ltd.	6–6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A.	131–133	..	5 3 0
60,000	50	,,	13	Do. B.	124–126	..	5 3 2
100,000	50	,,	12	Do. C.	117–119	..	5 0 10
114,800	50	,,	10	Do. D and E.	99–101	..	4 19 0
398,490	5	Apl. 29	7	Primitiva Ord.	7¼–7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅛–5⅜	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97–99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd.	15¼–15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼–11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51–52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229–231	..	4 6 7
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
70,000	10	May 27	7	South African	11–11½	..	6 1 9
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80–82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121–123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141–143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112–114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9–9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98–100	+1	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112–114	+½	4 7 9
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c.	139–141	..	4 15 9
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Payable in advance. If credit is taken, the charge is 25s. a year.

Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

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ZWOLLE, HOLLAND.
DIGGERS AND SUPPLIERS OF THE
FINEST DUTCH BOG-ORE.
(Natural Oxide of Iron.)
Best Percentages. For lowest Quotations to any Port, Station, or direct into Works, please apply to—
LONDON OFFICES: 6, LEATHER LANE, E.C.

COAL TAR wanted,
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

CITY and Guilds—Courses in Gas Engineering and Supply (over 100 Passes and 6 Medals in Two Years), Structural Engineering and Heating and Ventilating (two new subjects) for the 1911 Examinations.
CORRESPONDENCE COLLEGE COMPANY, Dept. W. 26, Green Street, CAMBRIDGE.

TAR WANTED.

THE BURNDEN TAR COMPANY (BOLTON), LIMITED.
Hulton Chemical Works, BOLTON.

PEMBROKE DOCKS AND TOWN GAS COMPANY.
WANTED, a HEAD FITTER for the Company's District.
Applications, stating Age, Wages, and Qualifications, to W. B. MIMMACK, Manager, Gas-Works, PEMBROKE DOCK.

WANTED, a Good Stoker, used to Shovel Charging, Regenerative Settings, Engine and Exhauster, and General Routine of a Gas-Works. Permanency for a suitable Man. None but Steady and Reliable Men need apply.
Apply, by letter, stating Age and Experience, with *Copies* of Testimonials, to No. 5299, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF STAFFORD.
(GAS AND ELECTRICITY DEPARTMENT.)
THE Corporation of Stafford invite APPLICATIONS for the Appointment of ENGINEER and MANAGER to take Entire Charge of the Gas Department and Supervise the Electricity Department.
Applicants must possess a thorough knowledge of Gas Engineering, and be capable of Designing, Superintending, and Carrying Out any Extensions or Alterations that may be required at the Gas-Works, and undertake the General Supervision of the Electricity Department.
Salary to commence at £350 per Annum, rising (subject to satisfactory services) by annual increments of £25 to £500 per Annum.
Candidate's age to be between 28 and 45.
Applications, stating Age, Training, and Experience (with *Copies* of not more than Three recent Testimonials), to be sent to me on or before Monday, the 24th of October instant.
Canvassing in any way whatever will be a disqualification.
RICHD. BATTLE,
Town Clerk.
Borough Hall, Stafford,
Oct. 4, 1910.

WANTED—A Second-Hand Exhauster, to Pass 50,000 Cubic Feet of Gas per Hour.
Send Price and Particulars to No. 5297, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED—A Second-Hand Purifier, in good Condition, for 150,000 Cubic Feet per Day.
Address No. 5298, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—As a Going Concern, a small GAS-WORKS and PLANT in the South of England. Annual make about One Million Cubic Feet.
For Particulars Apply to No. 5296, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RE THE BEAUMARIS GAS-WORKS, BEAUMARIS.
THE Trustee of the above Estate will be pleased to receive OFFERS for the above BUSINESS, together with the PURCHASE OF PLANT, &c.
The Works and fixed Plant may be had upon Lease. Full Description and Particulars, including turn-over, &c., on Application to Mr. ALBERT CRIPWELL, Accountant and Auditor, 12, Cherry Street, BIRMINGHAM.

FOR SALE—Complete Gas-Making PLANT, including New Gasholder and Steel Tank, 10,000 Cubic Feet capacity, ready for delivery, with Condensers, Scrubber, Purifiers, &c. Erected complete in England for £1200. Detailed Plan and Specification submitted.
TWO PURIFIERS, 12 ft. by 8 ft. by 5 ft. deep. Three Purifiers 5 ft. 6 in. square, complete with Four-Way Valves and Connections. Re-Erected cheap for immediate Sale.
GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.
STORAGE TANK, 18 ft. long, 13 ft. 6 in. wide, 6 ft. deep, of ⅜-inch thick Boiler Plate. Also CAST-IRON TANKS. Inquiries Solicited.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Thornhill, DEWSBURY.

THE Llandudno Urban District Council invite TENDERS for the Supply of RETORTS, FIRE CLAY GOODS, &c., delivered free at Llandudno.
Full Particulars may be obtained upon Application to the Gas Manager.
Sealed Tenders, endorsed "Retorts," to be sent in to the undersigned on or before Saturday, the 29th of October, 1910.
The Council do not bind themselves to accept the lowest or any Tender.
(Signed) ALFRED CONOLLY,
Clerk to the Council.
Town Hall, Llandudno,
Oct. 6, 1910.

COUNTY BOROUGH OF DEVONPORT.
(GAS DEPARTMENT.)
TENDERS are invited for the carrying out of the following work:—
1—The Supply and Erection of new IRONWORK for Twelve Benches of Through RETORTS.
2—The Supply and Erection of Two ROTARY WASHERS and One LIVESEY WASHER.
Full Particulars may be obtained from the undersigned.
Tenders, endorsed "Tender No. 1" or "No. 2," to be sent, addressed to the Town Clerk, Devonport, on or before the 5th of November, 1910.
W. P. TERVET,
Engineer and Manager.
Gas-Works, Devonport,
Oct. 3, 1910.

BRIDGEWATER COLLIERIES COKE WORKS.
(THE EARL OF ELLESMERE.)
TENDERS are invited for a quantity of from 8000 to 12,000 Gallons per month of CRUDE BENZOL, testing 80 per cent. at 120° C., during the next Six Months, delivered into Contractor's Tanks at the Bridgewater Collieries Wharton Hall Siding (Pendleton and Hindley Branch of the Lancashire and Yorkshire Railway) or at the Brackley Siding (Little Hulton Mineral Branch of the London and North Western Railway).
Tenders, endorsed "Tender for Crude Benzol," to be received at The BRIDGEWATER COAL OFFICES, 4, Chapel Walks, MANCHESTER, not later than the 24th inst.
Manchester, Oct. 11, 1910.

BOROUGH OF DARWEN.

SPENT OXIDE.
THE Gas Committee of the above Corporation invite TENDERS for the Purchase of about 350 to 400 Tons of SPENT OXIDE.
All Particulars and Samples may be obtained on Application to Mr. A. H. Smith, Gas Engineer, Darwen.
Sealed Tenders, endorsed "Spent Oxide," to be delivered to the undersigned not later than Saturday, the 22nd day of October, 1910.
No Tender necessarily accepted.
By order,
WILLIAM P. HALLIWELL,
Town Clerk.
Town Clerk's Office, Darwen,
Oct. 7, 1910.

BOROUGH OF DARWEN.

TENDERS FOR THE SUPPLY OF OXIDE OF IRON.
THE Gas Committee of the above Corporation are prepared to receive TENDERS for the Supply of 250 Tons of OXIDE of IRON, delivered at their Siding, for Gas Purification purposes at their Works.
All Particulars may be obtained from Mr. A. H. Smith, Gas Engineer, Darwen, to whom all Samples are to be sent.
Sealed Tenders, endorsed "Oxide of Iron," to be delivered to the undersigned not later than Saturday, the 22nd day of October, 1910.
The lowest or any Tender not necessarily accepted.
By order,
WILLIAM P. HALLIWELL,
Town Clerk.
Town Clerk's Office, Darwen,
Oct. 7, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.
MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 1000 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 18, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Trustees of Chas. King, Esq., decd. and other Owners.
DORKING WATER COMPANY.
80 £10 FIVE PER CENT. "B" PREFERENCE SHARES.

NORTH MIDDLESEX GAS COMPANY.
10 £10 ORIGINAL ORDINARY SHARES AND 60 £10 ADDITIONAL ORDINARY SHARES.

HORNSEY GAS COMPANY.
£200 "A" STOCK AND £400 FIVE PER CENT. PREFERENCE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 18, at Two o'clock.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

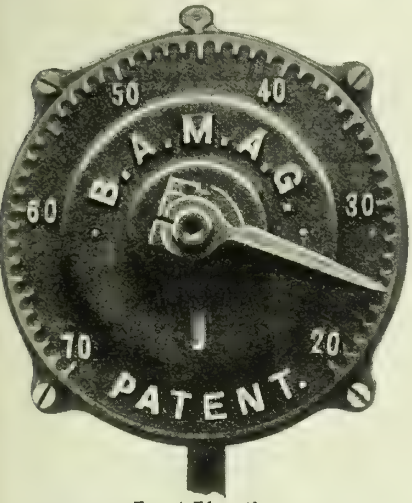
By order of the Directors of the
TENDRING HUNDRED WATER-WORKS COMPANY.
(Supplying Harwich, Parkeston, Dovercourt, Walton-on-Naze, Frinton-on-Sea, and adjacent places.)
NEW ISSUE OF 351 £10 "B" SHARES.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GRAYS AND TILBURY GAS COMPANY.
NEW ISSUE OF 400 £10 "B" SHARES.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BOGNOR GASLIGHT AND COKE COMPANY.
NEW ISSUE OF £4000 ADDITIONAL ORDINARY CONSOLIDATED STOCK "A"
AND
£2000 FOUR-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK.
MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

THE REDHILL GAS COMPANY.
SALE OF ORDINARY "B" STOCK.
NOTICE is Hereby Given, that it is the intention of the said Company to SELL BY TENDER £5000 of ORDINARY "B" STOCK of and in the Redhill Gas Company. The last day for the reception of Tenders will be Tuesday, the 1st of November, 1910, at Twelve o'clock at Noon.
Forms of Tender, with Particulars of Sale and Conditions of Tender attached, can be had upon Application at the Company's Office, Brighton Road, Redhill.
By order of the Directors,
HORACE LONG,
Secretary.
Redhill, Surrey,
Sept. 30, 1910.

SOUTH STAFFORDSHIRE WATER-WORKS COMPANY.
SALE BY TENDER
OF
£7000 NEW ORDINARY STOCK, CLASS "B,"
AND
£13,800 NEW FIVE PER CENT. PREFERENCE STOCK, CLASS "F," IN LOTS OF £100 EACH.
(Under the Provisions of the South Staffordshire Water-Works Order, 1901.)
Trustees are empowered by Act of Parliament to invest Trust Funds in this Preference Stock.
THE Directors Hereby Give Notice that, in accordance with the provisions of the South Staffordshire Water-Works Order, 1901, they offer for Subscription, by TENDER, the above-mentioned amount of NEW ORDINARY and NEW PREFERENCE STOCK, in lots of £100 each.
The New Ordinary Stock will rank for Dividend with the existing Ordinary Stock of the Company on which Dividends are limited to £7 per centum per Annum.
The Holders of the New Ordinary Stock will have the same privileges as to Voting and Qualification as the Holders of the existing Ordinary Stock.
The Holders of the New Preference Stock will be entitled to Dividend, payable half-yearly, at the rate of, but not exceeding, £5 per centum per Annum out of the profits of the undertaking in each Year.
Tenders may be made for any number of lots of £100 each for either or both classes of Stock. The latest date for receipt of Tenders is fixed for Thursday, the 10th day of November, 1910.
Notices of Allotment will be sent out by the Company on or before Tuesday, the 15th day of November, 1910, and the date for payment of the whole amount of the Stock and Premiums to the Company's Bankers is fixed for Wednesday, the 30th day of November, 1910, after which day the Stock will rank for Dividend.
The Allotment will be made and Certificates will subsequently be issued free of all costs to the Allottees, who will thus acquire the Stock without payment for Stamps, Commission, or Fees of any kind.
Forms of Tender and any further Information may be obtained upon Application at the Company's Office.
By order,
G. J. SPARROW,
Secretary.
Paradise Street,
Birmingham, Oct. 10, 1910.



Front Elevation.

Over 67,000 in actual Use.

Most Substantial Construction.

Guaranteed for Years.

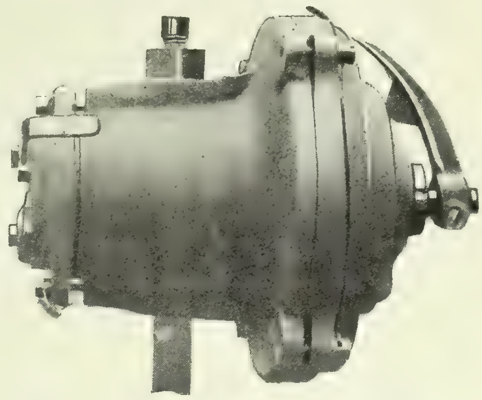
Reliable and Accurate.

For Prices and Particulars apply to

DISTANCE LIGHTING CO.

69 FARRINGDON ROAD,
LONDON E.C.

Telegrams: "DISTANCING LONDON."
Telephone: HOLBORN 2139.


Side Elevation.

"LUX"

Gas Purifying Material.

Further Reduction in Cost of Gas Purification.

TRY IT.

Purifier changes are less by over one-half when using "LUX" as compared with Bog Ore, and it requires considerably less turning than Bog Ore for revivification.

As a labour saver, this speaks for itself, but in addition there is lessened risk, worry, and anxiety for the management.

"LUX" is easily charged with Sulphur 55/60°/₀. Once used, always used, is the verdict of many Gas Engineers in this country who have tried it during the past 18 months.

Descriptive Circular and Laboratory Sample free on Application.

WRITE FOR PRICES.

SOLE AGENTS for England, Wales, and the Colonies—

THOS. DUXBURY & CO., 16, DEANSGATE, MANCHESTER.

Telegrams { "DARWINIAN MANCHESTER." "DUXBURYITE LONDON."

Telephones { 1806 CITY MANCHESTER 4026 CITY LONDON.

ASHMORE, BENSON, PEASE & CO., LTD.,

STOCKTON-ON-TEES.

Telegrams: "GASHOLDER."

London Office: 39, Victoria Street, Westminster, S.W.

MANUFACTURERS AND ERECTORS OF

Gasholders, Purifiers, Condensers, Washers, Steel Mains, Roofs,

AND ALL OTHER GAS-WORKS PLANT.

PROFESSOR DR. STRACHE'S

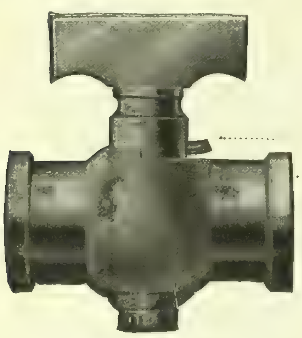
WATER GAS AND PATENTS COMPANY, LTD.,

71, Alserstrasse, Vienna (VIII.).

STRACHE'S GAS CALORIMETER

measures, through observations on a Pressure Gauge of the increase of Pressure of the Air surrounding an explosion pipette, the heat imparted by the latter to that Air.
It works without Water Supply and Waste-Pipe.
No Preparation requ red. Readily Portable.
A Test is made in Three to Five Minutes.
Great Exactness.
Suitable also for Suction Gas and Power Gas.

PRICE £15, *ex* Vienna, Packing Extra.



A

Fig. 1. The Old Style with the Old Trouble.
Note the Pin **A.**

EVERED'S PATENT "SAFETY STOP."

Buyers of Gas Fittings are familiar with the trouble constantly arising through the Stop Pin of the Tap or Cock getting bent or broken, or falling out, thus leaving the Tap without a Stop, and leading to great danger of an escape of Gas.

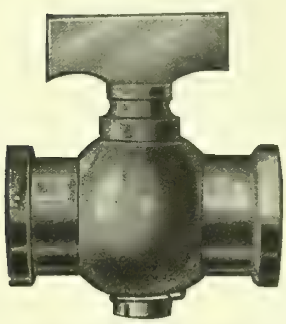


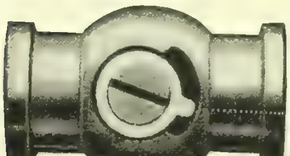
Fig. 2. **Evered's Patent "Safety Stop."** No Pin, No trouble.

EVERED'S PATENT "SAFETY STOP"

renders the old Stop Pin unnecessary and is an absolutely **Safe and Permanent Stop.**

The projection shown in Fig. 3, marked **B,** working in the recess shown in Block, allows the Tap to be turned only so far as the recess extends. There is no possibility of the Tap turning further round as there is no Pin to become displaced or broken.

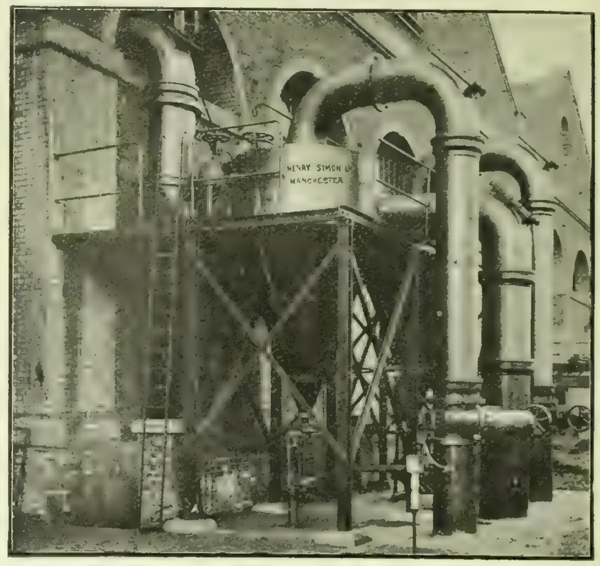
Any fitting specifically so ordered will be made with the "Safety Stop."



B

Fig. 3. Underside showing "Safety Stop" in lieu of Pin.

EVERED & CO., LTD.,
27 to 35, DRURY LANE,
LONDON, W.C.
Surrey Works, SMETHWICK.



"CYCLONE" TAR EXTRACTOR.

No Steam.
No Moving Parts.
No Power.

HENRY SIMON, LTD.,
20, Mount St., Manchester.

RETORTS

Of our Manufacture

STOP WASTE AND LEAKAGE

They are guaranteed not to contract and do not readily split and fracture but retain apparent wholeness after a long period of work.

Top Quality FIRE-BRICKS, QUARRIES, &c.

High Grade Silica Bricks and Blocks for Combustion Chambers and Special Work.

WILLIAMSON, CLIFF, LTD., STAMFORD.

MECHANICAL COAL HANDLING PLANTS OF ANY MAGNITUDE MADE AND ERECTED BY GIBBONS BROTHERS LTD DUDLEY & LONDON

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

BRITISH MADE.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Welsbach-Kern (Patent) Inverted System

BRITISH MADE.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

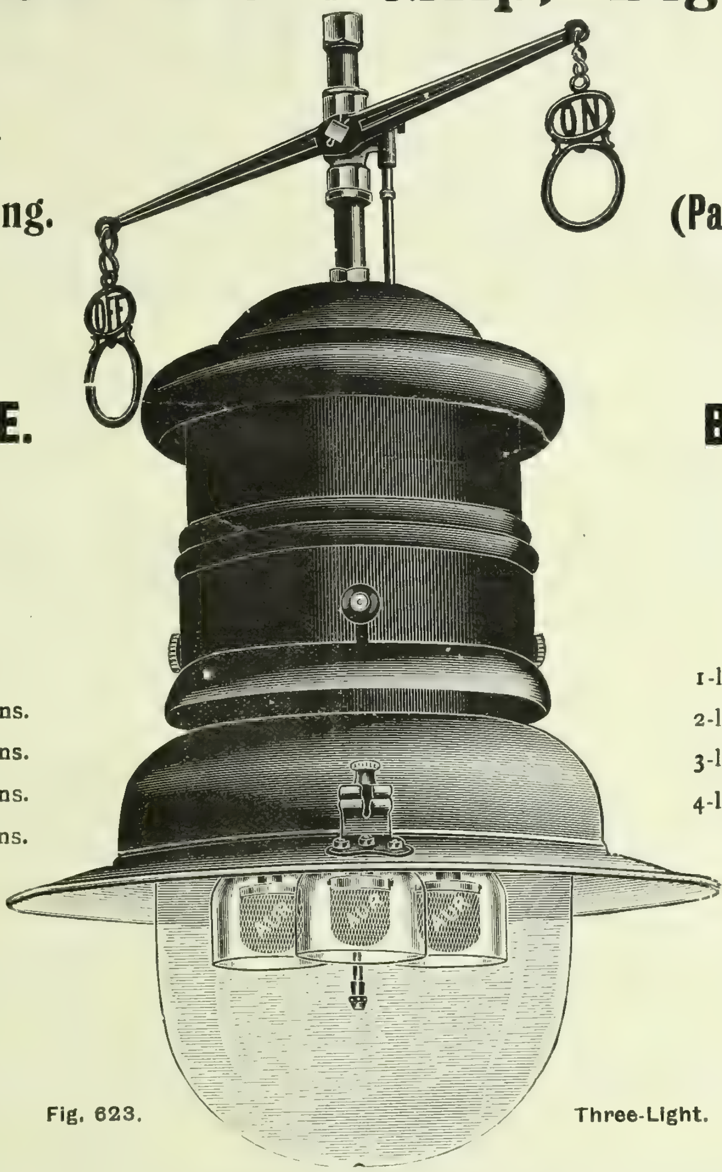


Fig. 623. Three-Light.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, **4½d.** each, or **4s. 3d.** per dozen, subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.
Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*

Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Oct. 11, 1910.

JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

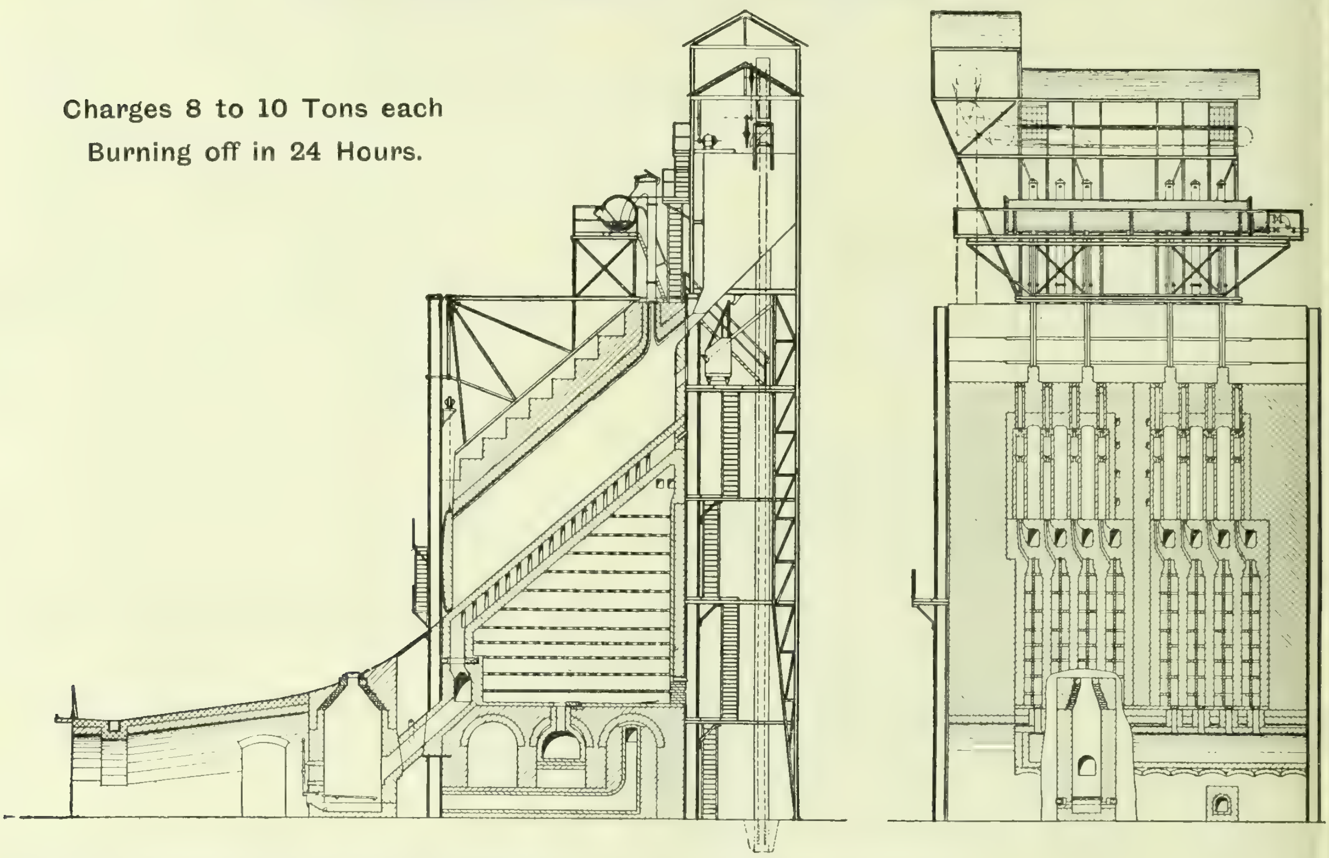
VOL. CXII. No. 2475.] LONDON, OCTOBER 18, 1910. [62ND YEAR. PRICE 6d.

THE KOPPERS' PATENT

CHAMBER OVEN

Results have been obtained which have never been equalled by any other System of Carbonization.

Charges 8 to 10 Tons each
Burning off in 24 Hours.



Plants in Operation and under Construction at the following Gas-Works—

		OVENS.	Cub. Ft. per Day.
The Bochum Corporation Gas-Works, Westphalia		7	670,000
The Vienna Corporation Gas-Works, Austria		15	1,400,000
,, ,, ,, ,,	(1st Repeat Order)	19	1,750,000
,, ,, ,, ,,	(2nd Repeat Order)	46	5,250,000
,, ,, ,, ,,	(3rd Repeat Order)	72	7,400,000
The Innsbruck Gas-Works, Austria		12	600,000
,, ,, ,,	(Repeat Order)	6	300,000
The Halberstadt Gas-Works, Germany		9	420,000
		186	17,790,000

ADVANTAGES:

GREATER YIELD OF GAS OF HIGHER LIGHTING AND HEATING POWER.
COKE PRODUCED CAN BE EMPLOYED FOR METALLURGICAL PURPOSES.
INCREASED YIELD OF SULPHATE OF AMMONIA.
TAR PRODUCED IS OF A LIGHT FLUID CHARACTER.
LESS COST OF LABOUR.
LESS CAPITAL COST.

Full Particulars on application to the

KOPPERS' COKE OVEN & BYE-PRODUCT CO.

301, Glossop Road, SHEFFIELD.

Telephone No. 1935. Telegraphic Address: "KOCHS, SHEFFIELD."

CONTENTS.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2475.——TUESDAY, OCTOBER 18, 1910.

EDITORIAL NOTES—GAS, &c.

Gas Publicity.

OUR electrical friends do not appreciate the adoption by the gas industry of their own methods in the matter of the systematic advertising of electricity. They were not, however, the first in the advertising field. Gas undertakings were making announcements direct to the public, through the aid of the daily and weekly newspapers and weekly and monthly magazines, long before the Electricity Publicity Committee was conceived. But where electricity has led has been in the collective support of electricity supply undertakings to this means of bringing the virtues—more or less correctly described—of their commodity before the public. Collective support for gas publicity, as was seen in our issue for Sept. 27 (p. 825), is now being organized; but meanwhile private gas undertakings are advertising on a larger scale than ever. This fact, however, must not have any adverse influence on collective effort in this direction. There is in the gas industry too much of the tendency to let others do all the pioneering and other work; too much of the mean spirit that holds in allowing other people to do all the voluntary pulling of the chestnuts out of the fire, and then participating in the feed. There are gas company administrators who, within our own knowledge, will not agree to expend the amount of the subscription to the Gas Companies' Protection Association or to the Sulphate of Ammonia Committee, on the ground that, while other people are willing to spend the money to keep matters active in the fields of the operations of these organizations, there is no call upon them to lay out money in any such way. It would be a bad thing for the gas industry if all gas administrators were actuated by like miserable shortsightedness and parsimony. Men of those characteristics, men with minds so concentrated that they cannot appreciate the needs of the times, are unworthy their positions in a progressive industry. However, we hope to see a united gas industry in this matter of the general advertising of the merits of gas; and the sooner now the Committee who have the formulation of the joint advertising scheme make a pronounced move, the better. Opportunity is being allowed to slip past. The lighting and heating season is upon us; and there ought already to have been seen such an advertising of the inverted gas-burner and gas-fires as has never been witnessed before.

Meanwhile, certain gas companies are pursuing an independent advertising campaign. Advertisements have appeared in certain London newspapers, in the Woman's Supplement of "The Times," and in provincial papers. The Gaslight and Coke Company have spent generously in this direction; and the South Metropolitan Company have done a part. Various provincial companies are engaging in local advertising with greater enthusiasm than was at one time the case. An excellent example is seen in an advertisement occupying nearly half a page in the "Reading "Standard;" this being inserted by the local Gas Company. It is headed "Facts! not Fiction;" and in it there is worked out a comparison of the cost of the electricity consumption of a 50-candle metallic filament lamp at 6d. per unit, as compared with the gas consumption of a 60-candle power inverted incandescent burner, with gas at 2s. 6d. per 1000 cubic feet. Per 1000 hours, the cost of current is £1 11s. 3d., as against 7s. 6d. for gas. The Reading Electric Supply Company have a similar advertisement; but, duly cautious, they do not commit themselves to comparative figures, being content with a few generalizations. But local and spasmodic advertising is not sufficient for the gas industry. Something more is required to-day. It is requisite that we should keep pace with, and even ahead of, the electricity industry in this matter of publicity. The gas industry has, since electricity came into the field for lighting, heating, and cooking, always led in the magnitude of business in those branches; and the lead can easily be maintained by a liberal recognition of the nature of the activity with which we have to contend. It is always wise to give one's competitor the credit of possessing greater strength than is actually the case.

Electricity Evicted by the Society of Medical Officers.

WHEN the Society of Medical Officers have decided to evict electricity from the meeting and exhibition rooms on their premises, it may be taken that they have some good and sufficient reason for doing so. For some years, they have tried electric lighting (this having superseded the old method of gas illumination), even to the metallic filament lamp; and they have found it sadly wanting. This fact, and the one that the Committee and members of the Society are all members of the medical profession, may be counted by the gas industry as of importance, which is accentuated by the further facts that the modern system of inverted gas lighting has been adopted, and gas has also been chosen as the fuel for heating.

All too long, with hardly superficial consideration, many members of the medical profession favoured the use of electricity and the abandonment of gas; but when asked for reasons, it was invariably found that they had not got farther with the study of the matter than the elementary stage that in the combustion of all gases there must be products of combustion, while with electric incandescent lamps there are none. Beyond that point, few ever ventured. Those who did found that with gas, the products were harmless, and that the use of gas assisted in producing the circulation of the air of rooms; while, on the other hand, where electric light was employed, and a number of people were gathered together, the lamps did not assist in the circulation of the air, that there was stagnation, and, consequently, in a short time, the exhalations of respiration charging the air caused it to be unwholesome for those who had occasion to remain in such an atmosphere. That is just what the Committee of the Society of Medical Officers of Health have found; and they have further found that the light distribution of electric lamps is not at all satisfactory. And these two findings have induced them—it is not a matter of economy with them, so much as a sanitary atmosphere, and a good light—to return to gas. This will be a sad blow for the electricians, who, beaten on the score of economy, have made much in the pursuit of new custom of the old "baseless fabric" of the "vision" of our medical friends.

Here, however, the return to gas on the premises of the Society of Medical Officers of Health is made on the strength of an experience with electricity extending over some years, and of considerations as to the relative effects of the two forms of lighting to which attention had not been formerly given. Not only in respect of lighting, but of heating, gas is the elected fuel; and the system by which it is applied supplies the greater part of the interesting subject-matter of an article elsewhere. The position and influence of the members of the Society make their example all the more valuable. Example—satisfaction is already expressed with the experience—such as this goes a very long way; just as the Gaslight and Coke Company have found that a properly fixed gas-fire in a medical practitioner's house has a remarkably rapid effect in removing misconception in that household, and in spreading the truth of the matter in relation to gas heating. Within their own knowledge, the Company can name something like 1000 medical men in their area of supply with gas-fires in regular use. And those who are not medical practitioners, but are interested in electricity, talk of rooms in which gas-fires are used as something akin to lethal chambers. It must be a strange case that is served better by ignorance and misrepresentation than by knowledge and truth.

Expansion of Work among the Juniors.

The Junior Gas Associations have commenced their new session's work with an ardour that is eloquent testimony to unabated vigour. This is one of the most satisfactory signs of our times; for in it we have a clear endorsement of the guarantee that, with the exercise of a wise policy on the part of our gas administrators, the executive posts of the gas industry will still be filled with men well equipped for the conduct of business. The organization of the juniors, the enthusiasm displayed at their meetings, and the range of subjects dealt with in the Presidential Addresses and in the papers that are produced, are all the material presentments of an earnest desire to gain something, and that something is knowledge, and knowledge of a high-class order. The juniors of the day realize that knowledge makes the strong man in any walk of life; they realize that knowledge eases the labour of life whatever be the vocation; they realize that knowledge can command (through the better service that can be rendered) respect, and serve as the road to advancement; and they realize that knowledge will enable them to hold their positions the better in the keen struggle of life. The broader and the deeper the knowledge, too, the greater the personal enjoyment and recreation derived from its possession. It is recognized that the age does not become less competitive. Competition grows day by day. In it there is an unceasing restlessness; and the truth of this is found not only in industry and trade, but in the increasing activities for supremacy of the countless units that make the mass that we describe by the general term of mankind. When, therefore, our particular juniors put forward such a vast amount of voluntary effort in the acquisition of special knowledge to help to qualify them the better for the vocation of their choice, there is ground for satisfaction at the appreciation they thus evince regarding the needs of the times in respect both of personal efficiency and of industrial well-being.

The really efficient gas engineer of to-day has to be the possessor of knowledge that can be used in construction and direction which would qualify him for position in almost any branch of engineering; his commercial knowledge and instinct must be of a high order in connection with the purchase of materials; as a manager, he must have a broad knowledge of human nature, and be himself humane; and as a manager, too, on the competitive side of trading he must be keen and ever alert. The gas engineer of the day indeed requires to know many things; his work becomes daily more imperious in its demands and more crucial. Then all the more honour to those who take up the gas industry as the field for their professional life-work, and by their individual effort increase their personal accomplishments for the better negotiation of the task that lies before them. Already this session the range of subject-matter brought before the various Junior Gas Associations indicates the numerous lines in which knowledge has to be pursued. Look to the addresses of Mr. W. Dunlop, of Kirkcaldy, of Mr. J. Fraser, of Provan, and of Mr. R. S. Ramsden, of Burton-upon-Trent, to the lecture of Professor Cohen on "Smoke" last Saturday, and to the papers that have appeared in our columns on "Coal Tar Distillation" by Mr. A. R. Warnes, and by Mr. J. Berry on "Retort-House Governors," and there alone there is a variety of knowledge represented that might well make those who do not like work for its own sake stand aghast at the very idea of engaging themselves to a progressive industry demanding so much of those in the positions of technical and commercial responsibility. We do not want these in the gas industry; and the industry will be all the better for freedom from their attentions. And they may as well learn first as last that there is no industry to-day that requires greater application of science, nor demands more from its technical and commercial officers, than that of gas manufacture and supply. It will be an absolute waste of time for those to hope to retain position in the gas industry who think that a little labour expended in acquiring an amount of superficial knowledge will enable them to enjoy an age of ease.

It augurs well, then, that there should be this voluntary activity in acquiring knowledge on the part of those who have planted their feet in the gas industry. There are many of them who want to do more than is possible by internal means, and to take advantage, in addition to the teachings obtained from their own collective experience, of the instruction that is available, by proper arrangement, from scientific specialists and teachers. It is a desire that should be encouraged; and the seniors of the industry should see what can be done to assist in bringing to tangible form the aspirations and ambitions of the juniors in this respect. The Leeds University provides a special course of university training for those who are in a position to take advantage of it, and are making the gas industry the scene of their life's work. In connection with the University, too, special courses of lectures have been arranged for those who cannot avail themselves of the long course of systematic study (see *ante*, p. 49). These lectures will appeal more particularly to those who are within a reasonable railway journey to Leeds. On their own initiative, or on that of their President (Mr. F. Thorp), the Manchester Junior Gas Association, with the assistance of Dr. Harold B. Dixon, Professor of Chemistry at the University of Manchester, and of the Council of the Manchester District Institution of Gas Engineers, have succeeded in bringing about arrangements for courses of gas lectures in connection with the University.

The thing that we have admired even as much as the success that has all along attended their efforts has been the resolute manner in which the Junior Association "stuck to "their guns" until their object was attained. The syllabus (*ante*, p. 37) shows a course of lectures by masters in their subjects; and when it is observed that three of the lecturers are from London, the question naturally arises: Why cannot the other Junior Associations nearer south also secure the services of these gentlemen in similar manner? There are the Midland and the Southern Associations. What of these? Cannot the Senior Gas Associations do something to assist them in obtaining what the Manchester District Institution have realized? It is quite certain that, at such a distance from Leeds, a course of lectures of this kind could not possibly affect those at the industry's recognized centre at Leeds. The Welsh seniors are very anxious to assist the juniors in their area, who, through the scattered character of the gas undertakings in Wales, are not as yet organized. The seniors have experienced difficulty in formulating their plans; but they are getting to the point at which they will shortly be taking tentative action to test the workableness of their schemes. On every hand there are the indications of fervour among the juniors which deserves the fullest encouragement. We wish them the utmost success in their endeavours.

The Development of Scientific Illumination.

A handy little instrument, novel and ingenious in its design, for the measurement of surface brightness, has been introduced in a paper read, before the Optical Society, by the inventors, Mr. J. S. Dow and Mr. V. H. Mackinney. Full details concerning the device are given in other columns this week. There are unquestionably fields of utility and fields for interesting and practical research for such a portable instrument as this, if not used in any arbitrary manner. This is a development, on original lines, from illumination photometers, and in many respects for purposes for which they are not applicable; but in the use of the latter, under the diverse conditions of their employment, the results have been so eccentric and disuniform, although the photometrical values of the sources of light may have been approximately the same, that one has become distrustful of them. This instrument of Messrs. Dow and Mackinney may form a supplement to the illumination photometers, and be used to show the considerable influence surrounding surface brightness and surface reflection have on the readings of illumination photometers.

The new instrument also emphasizes the fact that the art of illumination measurement is being carried to a refined point that appears to be somewhat unnecessary if people would only intelligently use their eyes. But many people—we are afraid they are of the majority—will not intelligently apply the law of the eye to a determination of illumination; and so the illuminating engineer, in the exercise of his art, wants to prescribe, accurately measure what is prescribed, and see that there is adherence to the prescription that he thinks the most suitable for purpose and conditions. In our opinion, the practical usefulness of an invention such as that now before us will be found in the ability it confers of judging as to the relative brightness and reflective power of surfaces of all kinds. That is a matter which has been largely left to purely visual observation, so that oftentimes there has been erroneous conclusion; and there is, in the result, but sparse knowledge of this subject at the present time. The new instrument is already proving that some of our beliefs

formed from observation will have to be considerably revised when subjected to the more exact disclosures of Messrs. Dow and Mackinney's invention.

The main question that will be asked is as to the constancy of the instrument. We have only yet the attestations of the inventors on this point; but an instrument so comparatively inexpensive, and demanding so little labour in use, will not be long before it has application by many hands and eyes, and so be put to critical trial. Examining the instrument solely from a structural point of view, it may be said that it has been cleverly designed; and providing there is perfect uniformity in manufacture, we fail to see, on limited acquaintance, where there is any chance of inconstancy save in the electric incandescent light that is used as the standard. But this, as is explained, can be frequently and readily verified. The instrument, according to curves exhibited before the Optical Society, has been brought up to such a pitch of perfection that error comes well within ± 5 per cent. For all practical purposes in illumination, nothing better is wanted. If, as is intended, the instruments are tested by the inventors themselves before being sent out, to see that this range of error is not exceeded, then they should not hear much in the nature of complaint. This is, however, an instance in which the fate of the instrument will be decided by the experience derived from its use by observers other than the inventors, from whom meanwhile congratulation cannot be withheld.

The Development of an Idea.

Another over-capitalized Company. Expert gas men had no difficulty in forming this conclusion by the merest glance at the first copy of the prospectus of the East Hants Gas Company, Limited, that they received last week, or at the first peep at the abridgment of the prospectus as freely advertised in the daily papers during the week. But the thing that at once struck us was that the East Hants Company appeared to be the consummation in the development of a bright idea. It was not difficult to find some justification for the belief. In February last, a prospectus was issued of a new gas venture under the title of the Liphook Gas Company, Limited, with a share capital of £5000; in June, the prospectus of the Liss Gas Company was issued, with a capital of £10,000; in October, the prospectus of the East Hants Gas Company, Limited, is issued with a capital of £30,000, of which there are now offered 1300 "A" shares of £10 each, ranking for a cumulative preferential dividend of 8 per cent., and 950 "B" shares of £10 each, entitled to the surplus profits of the Company, and unrestricted as to dividend. The proposed issue of the East Hants Company therefore amounts to £22,500. There is a pretty little association between all these three ventures; and there is the indication of all three being, as it were, part and parcel of one scheme. Some of the Directors certainly have a strong nominal likeness.

LIPHOOK DIRECTORS: E. H. Jellett, J.P., Andover, Arthur Gibson, Reginald Victor Steed (Gas Engineer).

LISS DIRECTORS: E. H. Jellett, J.P., Reginald Victor Steed (Gas Engineer), Thomas Webb, J.P., Mayor of Andover.

EAST HANTS DIRECTORS: E. H. Jellett, J.P., Thomas Webb, Alexander Ritchie, F. W. Talbot.

There is a connection between the three concerns established in the Boards, all concerns having their birthdays in 1910; and there is a progressive idea as to the capital requirements of the three Companies. Dipping into our large knowledge of the gas engineering profession, we do not recognize Reginald Victor Steed as coming within its range; but as we should be extremely sorry to do him an injustice, we should be pleased to learn from him something as to the qualifications that entitle him to describe himself as a "gas engineer" on any prospectus or elsewhere, as a matter of fact.

Repudiation.

The prospectuses are so framed (the Liphook and Liss prospectuses are almost identical) on the models of those of the Eaton group, that people may very well have been pardoned for labouring under the impression that their origin had some association with that notorious pile of wreckage. But the Boards have held up their hands in pious horror at such a thought; and so in each case a denial has been issued, signed by different Secretaries; and the denials bear the marks of a common origin.

Important Notice to Intending Applicants.

The Directors consider it their duty to inform intending applicants that the Liphook Gas Company, Limited, is not connected with the group of companies known as the "Eaton" group. It has been formed to meet a great local demand for a gas supply, and offers to persons interested in gas company investment an opportunity of joining, at par, what promises to become and has every prospect of providing a safe and secure 10 per cent. gas investment, and substantial increase in capital value.

By order of the Directors,

Feb. 19, 1910. WALTER HUGHES, *Secretary.*

Important Notice to Intending Applicants.

The Directors beg to inform intending applicants that the Liss Gas Company, Limited, is not connected with the group of companies known as the "Eaton" group. It has been formed to meet a great local demand for a gas supply, and offers to persons interested in gas company investment an opportunity of joining, at par, what promises to become and has every prospect of providing a safe and secure 10 per cent. gas investment, and substantial increase in capital value.

By order of the Directors,

June 11, 1910. REGINALD DALLEY, *Secretary.*

Important Notice to Intending Applicants.

The Directors consider it their duty to inform intending applicants that the East Hants Gas Company, Limited, is not connected with the group of companies known as the "Eaton" group. It has been formed to meet a greatly increased local demand for gas, and offers to those interested in gas company investment an opportunity of joining, at par, what promises to become, and has every prospect of providing, a safe and remunerative gas investment, and substantial increase in capital value.

By order of the Directors,

Oct. 10, 1910. F. P. ADAMS, *Secretary.*

Mr. F. W. Talbot, as vendor in the case of the East Hants Gas Company, joins the Board after allotment. It would be interesting to know whether Mr. F. W. Talbot was ever associated with the Board of the Laindon Company, which has proved so disastrous to those who invested money in it.

Financial Considerations.

In the East Hants prospectus, Mr. C. Chambers Smith is the Consulting Engineer. He is described as a member of the Institution of Municipal and County Engineers. His qualifications for forming estimates as to gas-works property and prospects are not known to us. This gentleman has drawn up a truly interesting estimate as to the revenue and expenses of the East Hants Company, the former of which shows an annual sale of 20 million cubic feet of gas. Here we come to the consummation of the triangular featured scheme. No less than 12 million cubic feet of this consumption is to be provided by the estimated business of the Liphook and Liss Companies—5 millions by Liphook, and 7 millions by Liss; the East Hants Company selling them the gas they require in bulk. Now this business of 20 millions on the proposed issue of £22,500 capital represents the extravagant capital of £1125 per million cubic feet; and yet outside manufacture the East Hants Company have only to find capital in the distribution department for 8 million cubic feet—the distribution capital associated with 12 millions of business being the obligation of the Liphook and Liss Companies. The poor little Liphook and Liss Companies are to pay the fearful price for gas in bulk of 3s. 10d. per 1000 feet; and as it is proposed they shall charge 5s. to ordinary consumers, it is stated, in one or other of the prospectuses, that there will be 1s. 2d. profit remaining for them. But the 1s. 2d. has to bear not only the capital charges, but all the administration and working expenses. Mr. Chambers Smith kindly makes out that the net profit of the East Hants Company will amount to very nearly as much as the working expenses—£2281 10s. compared with £2981. Estimates in connection with new gas flotations have been constantly falsified. However, this is company promoting *in excelsis.* It is all so delightfully simple. Find two small districts in which to supply gas; and then in a third small district form another company for its supply, and for the supply of the other two companies in bulk. That is high-class scheming. One company, with a few—a very few—thousands of capital could by itself have supplied the three areas.

Oil Prices.

The question was put to us the other day as to why it was the price of gas oil was on the decline while the price of coal was hardening. There is no objection to oil at low prices in the gas industry; and any interest in the cause only arises from curiosity. It seems, however, that the Standard Oil Company are concerned in the matter. It would be surprising if they were not. They have had their eyes upon their newly-born rivals in Europe; and according to the "New York Times," there is to be war upon them. In making war, the *modus operandi* of the Standard Oil Company consists in using their huge resources to break-down rates to such a level that those who cannot offer resistance to their might must go. The statement published by our American contemporary says—putting the matter shortly—that notwithstanding the enormous over-production of crude oil, seventy new oil companies have been promoted during the last six months on the English and Continental markets. In view of this condition of affairs, the Standard Oil Company have inaugurated a campaign to increase the world's consumption of refined oil by a reduction of the price abroad, and especially in the Far East, where, with the enormous population, there is an unusual opportunity. To accomplish this, considerable reductions in prices have already been made, not only in the East, but in Europe. Looking in another direction for information, we find it stated that "there are not wanting experienced observers who argue that there is really no 'rate war' at all, and that the cut in prices has merely been rendered necessary by the enormous accumulation of oil stocks, especially in America. It is known that, during the past five years, the production in America has more than doubled, and there are in the States at the present time over 100 million barrels of crude oil in storage." It is also argued that developments in the production of oil will cause such an expansion in its use that what is now regarded as an undesirable position will eventually turn out to be a good thing for the oil industry. At such a time as the present, the spreading abroad of optimistic views will possibly help to buoy-up the spirits of investors in oil.

Expansion at Exmouth.

Among the progressive undertakings in the smaller towns, the Exmouth Gas Company are well entitled to a place. The Company have been steadily advancing for many years, and may be expected to make even more rapid strides as they come to exercise the powers of development in the surrounding district which Parliament has recently conferred upon them. There is still in Exmouth itself room for the profitable expansion of the Company's business; and there is every reason to anticipate for the undertaking a prosperous future. If it has suffered at all in the past, it has been from the exercise of over-caution. As the Chairman had occasion to point out last week, those who were associated with the Company in the early days did not look far enough ahead. It was a common failing with the pioneers of the gas industry. They did not foresee the expansion of which it was capable. Their horizon was circumscribed by the doubts and difficulties surrounding a new business, every essential feature of which was a departure from custom. Launching thus upon an unknown sea, it is little wonder that they thought more of the needs of the immediate present than of those of the future. If they could have seen how the demand for gas was to grow, they might have made provision for the expansion. Works might have been laid out differently; and certainly sites could, in hundreds of instances, have been better chosen, if those who were in at the beginning had had the gift of prescience. The same may, of course, be said of the pioneers of railways, and of many other industrial concerns. In many ways we have to pay for the shortsightedness of our predecessors, as those who come after us may have to pay for our want of appreciation of the trend of events. All that can be done is to make the best of the circumstances, rectify the mistakes of the past as we may, and guard as far as possible against repeating them. The Exmouth Gas Company are doing this. They have obtained able guidance in Mr. P. S. Hoyte, the capable Chief of the Plymouth and Stonehouse Gas Company, who, being acquainted with the local circumstances and conditions, is well fitted to render Exmouth good service as Consulting Engineer. Messrs. Willey and Co., who have carried out the latest addition to the works, have been associated with the Exmouth undertaking from the beginning, and have been responsible for all improvements and alterations since effected. Association of this character is as remarkable as it is honourable.

The Duties of Auditors.

An address to which a considerable amount of attention has been drawn was delivered some days ago by Mr. Charles Duguid (whose name is well known in the City as that of a writer on financial topics) at the London Institution, on the position and duties of auditors in connection with the certification of accounts of public companies. At the outset he dealt strongly with the need for plain speaking on the part of auditors, whose certificate, he urged, "ought to say what it means," and not merely give hints. This would certainly seem to be the case, if it is intended to convey information to the general body of shareholders. Then the lecturer found fault with the reading of an auditor's report at a meeting, instead of printing it in full in the balance-sheet, as "a way towards hushing it up." As was rightly pointed out, when a report is read at a meeting, its technical terms cannot be grasped without difficulty, even by the shareholders present: while the great majority of shareholders who did not happen to attend the meeting would never see the report, unless they went to the trouble of applying and paying for it. "You must never forget," said Mr. Duguid to his audience, "that as auditors you exist in the interests of the shareholders against the directors." Auditors, he went on, existed in a great measure to see that the directors rendered to the shareholders a faithful account of their stewardship—to see that the shareholders were aware of the true position of the business which belonged to them. The shareholders themselves were by no means allowed to escape criticism in connection with the question of auditing. After admitting that it was much easier for the auditors of a company to act with the directors than with the shareholders, Mr. Duguid remarked that "the directors are a small organized body, with whom the auditors may be in frequent contact; the shareholders are an unorganized mob, apathetic, and with no sense of gratitude. If shareholders procured the auditors who, by their stupid apathy, they deserve, they would be represented by a class of auditors falling far short of the class which they fortunately possess. I say this deliberately, in spite of all my criticisms. I believe that at the root of any shortcomings there may be in our system of audit, lies the apathy of the shareholder." As to remedies, one mentioned (though it was admitted there are objections to it) was that company auditors should be rendered more independent of both directors and shareholders—that they should be appointed as at present, nominally by the shareholders, but that they should not be removable by directors, shareholders, or themselves without application to (say) the Board of Trade. Finally, Mr. Duguid urged that auditors should receive higher fees, and that these could be raised, in cases where there happened to be a "useless" director on the board, by clearing away this director, and handing his fees over to the auditor! A novel idea—but one which would not be easy to put into practice. The points of the lecture were not, of course, based on experience gained in connection with sound gas company accounts.

Personal.

Mr. Jacques Abady has been instructed by the Oriental Gas Company to proceed to Calcutta in connection with the public lighting contract recently entered into with the Corporation of Calcutta. Mr. Abady anticipates being back early in the New Year. He leaves next Friday by the P. and O. steamer *Morea*.

Alderman Phillips has consented to accept the Mayoralty of Salford for the ensuing municipal year. He has been a member of the Town Council for 25 years, and is Chairman of the Gas Committee. In presenting the requisition to Alderman Phillips at last Wednesday's meeting of the Town Council, the Mayor (Alderman Snape) said his work as Chairman of the Gas Committee was deserving of the highest praise; adding that if the undertaking had been a private company, Alderman Phillips would have been entitled to a very substantial salary.

After his sojourn at home since the end of May last, Mr. James C. Watson, the Engineer of the Oriental Gas Company, commences his return journey to Calcutta on Friday. He will travel *via* Marseilles, by the *City of London*. The time at home has been partly spent in rest and holiday, and, naturally, partly in the consideration of matters relating to the welfare of the concern of which he has charge. One result of this will be that, on Mr. Watson's arrival in Calcutta, the finishing touches will be given as rapidly as possible to the work of modernizing the plant which has been proceeding as opportunity favoured for some time past. *Bon voyage*, health, and an abundant success on again actively taking up the duties of his office, are the wishes that will accompany Mr. Watson from a great number of friends on his once more leaving home.

THE VISIT OF THE GERMAN ENGINEERS.

An Interchange of Courtesies.

We have received from Mr. Walter T. Dunn, the Secretary of the Institution of Gas Engineers, copies of a telegram sent by Herr Prenger, the President of the German Association of Gas and Water Engineers, to Mr. Alexander Wilson, the President of the Institution, on the departure of the members of the Association from Great Britain on the 9th inst., at the close of their visit, and of Mr. Wilson's reply. They were sent, at the suggestion of Mr. Wilson, with a view to publication.

[Copy of Telegram.]

Dover Pier, 9th October, 1910.

Wilson, President of the Institution of Gas Engineers.

Leaving Great Britain after the instructive and enjoyable days with our colleagues and friends, we once more thank you most heartily for the great hospitality shown to us and send best greetings. Hoping to meet our friends again before long.

Prenger.

[Copy of Letter.]

11th October, 1910.

Herr Direktor Prenger,
Gas, Water, and Electric Works, Koln.

My dear Mr. Prenger,

I beg to acknowledge with thanks the very kind telegram you sent me from Dover Pier.

We are all very pleased indeed to know that you enjoyed your short visit to this country, and we all trust that you have arrived safely at your various homes, and have found everything right both there and at your works.

We would ask you to accept our thanks for giving us the opportunity of enjoying such a very pleasant week in the company of our German friends.

We have all come to the conclusion that it would not only be for the benefit of our industry, but for the peace and goodwill of the various nations, if such visits could be arranged more often.

Kindly accept my best wishes and kind regards, and believe me to be,

Yours very truly,
(Signed) Alex. Wilson,
President of the Institution of Gas Engineers.

Obituary.

We regret to record the death, in his 61st year, after a short illness, of Mr. Henry Graham Harris, a partner of the late Sir Frederick Bramwell, on whose decease he became head of the firm of Messrs. Bramwell and Harris. He was a member of the Institutions of Civil and Mechanical Engineers, was Vice-President of the latter body, and was on the Council of the Society of Arts.

By the death of Mr. John Birch Paddon, which took place at his residence, Drymma, Neath, on Friday, the 7th inst., the gas engineering profession loses one who for a long period held an honoured and a prominent position in it. Though closely identified with several successful gas undertakings, Mr. Paddon will be best remembered by his work in connection with the amalgamation in 1881 of the Brighton and Hove General Gas Company and the Brighton Gaslight and Coke Company, and also with the designing and erection of the well-known works of the Company at Portslade, which were visited by the Société Technique du Gaz en France in 1901, and by the Institution of Gas Engineers on the occasion of their meeting in London two years ago. The works were brought into use in 1872; and under Mr. Paddon's supervision considerable improvements were made in them. A novel feature in the construction of the gasholders was the arrangement which he introduced, and which came to be named after him, for the purpose of strengthening the guide-framing to enable it to withstand the force of the Channel gales. He filled the position of Engineer and General Manager of the Company for some twenty-six years, relinquishing it in 1886, and being succeeded by his Assistant, Mr. Joseph Cash. He was then elected to a seat at the Board, and subsequently became Chairman of the Company—a post now held by his son, Mr. A. Matthews Paddon, M.Inst.C.E. At the time of his retirement from active business in 1902, besides being Chairman of the Brighton Company, the late Mr. Paddon occupied a similar position in the Lea Bridge, Colney Hatch (now Southgate and District), East Cowes, and Malta and Mediterranean Gas Companies; and he was a Director of the Gaslight and Coke Company. For many years he was a prominent and well-known figure in the Parliamentary Committee-rooms, where he appeared in support of numerous Bills promoted on behalf of gas undertakings. He was elected an associate member of the Institution of Civil Engineers in 1861, and was transferred to full membership in 1871. He was a Justice of the Peace. Mr. Paddon, who was in his 86th year, enjoyed good health until comparatively recently. He leaves a family of two sons and a daughter.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 217.)

In spite of one or two adverse factors, the Stock Exchange did not have at all a bad time last week, and most markets closed higher. The French strike was at first a disturbing element; but its handling by a courageous Government very quickly restored the position. The storm centre was the Rubber Market. The opening day was quiet and rather uneven. Government issues were steady, and Railways strong and rising on labour prospects. Americans began to improve. But the Foreign Market was rather heavy, and South Africans weak. Tuesday showed weakness. Consols fell $\frac{1}{8}$, and Americans were almost the only firm spot. Wednesday was a little brighter. Consols were unchanged, and Railways were watching Paris. But there was a recovery in other markets; the settlement promising to produce no difficulties. Thursday's business was on a much reduced scale; the Hebrew fast-day keeping many away. The tone was mostly good, though Consols lost $\frac{1}{8}$. The Foregn Market recovered confidence. On Friday, the tendency was quite fair in almost every department, excepting the afflicted Rubber Market. There was good buying of gilt-edged securities; Rails were firm; Americans strong; and foreign affairs brightening. This state of things, with some degree of activity, continued on Saturday; and, with the death of the French strike, the general close was cheerful. In the Money Market, there was an ample supply; and rates ruled easy; but shortly before the close the terms for discount were inclined to harden a little. Business in the Gas Market showed no falling off in the aggregate; but it was almost monopolized by three or four of the larger undertakings. Several issues, however, which were not dealt in, advanced their quotations; and the general tendency all round was good. In Gaslight and Coke, the ordinary was steady at from $106\frac{1}{2}$ to 107 for the greater part of the week; but towards the close it touched 106, and the quotation was pulled down half-a-point. The secured issues were firm and rather active. The maximum realized from $87\frac{1}{2}$ to $88\frac{1}{2}$, the preference from $104\frac{1}{2}$ to $105\frac{1}{2}$, and the debenture $80\frac{1}{4}$ and $81\frac{1}{2}$. South Metropolitan was unchanged at from $121\frac{1}{2}$ to $122\frac{3}{4}$. Commercials were again untouched, as in the week before. Among the Suburban and Provincial group, Alliance and Dublin was done at 89, British at $44\frac{3}{4}$, Brighton ordinary at 160 (a rise of 2), South Suburban at $121\frac{1}{2}$, and Tottenham debenture at $98\frac{3}{4}$. On the local Exchange, Liverpool "A" was marked at 221. In the Continental companies, Imperial was steady and unchanged at from 187 to $188\frac{1}{2}$, ditto debenture realized $95\frac{1}{4}$ and $95\frac{5}{8}$, and European fully-paid $23\frac{3}{4}$. Among the undertakings of the remoter world, Monte Video changed hands at $12\frac{9}{16}$, Primitiva at from $7\frac{3}{8}$ to $7\frac{9}{16}$ (a rise of $\frac{1}{8}$), and ditto preference at from $5\frac{3}{16}$ to $5\frac{5}{16}$—a rise of $\frac{1}{8}$.

ELECTRICITY SUPPLY MEMORANDA.

The Ease of Assertion—Public Lighting and Disturbance of the Peace of Mind of Electricians—Fire Alarms in the Electrical Press—Rival Departments and Rate Aid—A Hard Nut at Kingston.

One of the interesting features of the controversy that continues to rage—through the mortification of our electrical friends at the success of the inverted gas-burner in tendering competition, at the expiration of street-lighting contracts, with electric lighting—is the ease with which assertion is made by our electrical contemporaries, and generally without the support of concrete example. One can always plunge into the abstract very liberally, and then sit complacently through criticisms of the performance. But it is quite another thing to give support to the assertion that can be analyzed, and so enable the weaknesses of the assertion to be exposed. Only last week it was shown in the "Memoranda" that, if it is necessary to come down to a price for current of 0·5d. per unit to compete with the vertical incandescent gas-burner for street lighting, then the price must be "cut" still closer to compete with the inverted gas-burner; and that, if it is necessary to fall to such a price for current in public lighting, then what a farce it is for electrical people to tell private consumers that, with electricity at from 3d. to 6d. per unit, electric lighting is cheaper than lighting by the inverted gas-burner. We have the "Electrician" informing its readers that the Manchester Electricity Department "has laid mains specially for street lighting, and is in a position to give the inhabitants of Cottonopolis a cheaper and better form of lighting for their streets than they have at present." In effect, this is saying that the department can give cheaper and better lighting than the Gas Department, with all the improvements in incandescent gas-lighting that they have at hand. Now is this true? We should like to see the nature of the support on which the assertion is founded. There is a contributor of the "Electrical Review," too, in an article on "High-Power Electric Incandescent Fittings," saying that "the electrical contractor is now in a position to offer lamps and fittings which easily compete with gas lanterns in point of first cost and maintenance." The ease of assertion, without going any farther, is a well-developed characteristic of our electrical friends; but we do wish they would push out a little more into the open. When they have in the past ventured a short way out, they have relied entirely on the prices charged to lighting authorities by their own Electricity

Departments. There is Marylebone, for instance. The prices at Marylebone were examined by us recently [Sept. 13, p. 706] in the light of the tender for inverted lamps for the streets of Holborn. And last week, again, examination was made of other published prices. It is easy enough to assert; but in business, people want something a little more substantial.

The Holborn lighting contract is not yet settled. Electrical interests are trying to move heaven and earth to save this contract from going the way of Westminster, Hackney, Bethnal Green, Finsbury, and Stoke Newington. They have even moved some of the shopkeepers in Holborn to sign a petition against gas lighting retaining the field. "Meteor," of the "Electrical Times," is in the seventh heaven of delight. "The supporters of gas on the Borough Council," he says, "are being presented with a nasty pill in the shape of a petition from their constituents against acceptance of the Gaslight and Coke Company's proposals for street lighting." It is not such a nasty pill after all. The capital statement in the petition is "that the gas lighting in the borough is inadequate, and therefore detrimental to our business." The electricians and shopkeepers have overlooked the fact that it is not the present gas lighting that the Gaslight and Coke Company are proposing to retain, but they are offering, through the inverted gas-burner, a largely increased illuminating power in the streets at a lower cost than the existing gas lighting. The statement in the petition is a cunning device of the electrical spirits at the back of the petition; but the Council will see through it. And as to the declaration that the present gas lighting is detrimental to the business of the shopkeepers of Holborn, there are no visible signs of any languishing of their businesses. On the contrary, there have been indications in recent years of an increasing opulence on the part of the shopkeepers of Holborn. The petition also states that "the neighbouring boroughs of St. Marylebone and St. Pancras have adopted more modern methods, with complete success and economy." The Marylebone "economy" was, as stated above, compared, in our issue of Sept. 13, with the economy offered by the Gaslight and Coke Company to Holborn; so that what was then written comes in opportunely with the presentation of this petition. It is also submitted that competitive tenders should be invited. This is being done; but the Gas Company are put to unfair disadvantage by the publication of the terms of their offer. "Meteor" remarks: "We thought the time had gone by when local authorities dared to place contracts of such magnitude without first inviting tenders publicly." He must have been asleep lately, or he would have remarked the number of local authorities who have been placing contracts for electric lighting with their electricity departments without first publicly inviting tenders. It is one of the things of which private enterprise in gas supply is constantly complaining; and it is one of the abuses of local government that has grown up with the development of municipal trading in electricity. After all, the thoroughfare known as Holborn does not constitute the administrative area of the Borough Council; and the Borough Council have to consider the interests of the borough as a whole, and not those of a single thoroughfare. At the same time, the interests of the thoroughfare will be amply considered and safeguarded by the adoption of modern methods of gas lighting, instead of electric lighting.

The electrical papers have been striking out right and left at us recently for calling attention to the disastrous fires that are known to have occurred, with fatal results, through the premises being lighted electrically, and to the increasing number of fires that occur, and which are labelled "cause unknown." We are not in the least degree injured by the repeated assaults of our perturbed friends; nor is there any intention on our part to refrain from comment on these matters by the transparent cover the electrical press chooses to employ in the vain desire to hide its own uncomfortable feelings. Several of the editors of our contemporaries have joined hands and formed a ring, and danced with glee, round a paragraph that appeared in the "Globe" the other day announcing that a few window curtains had been destroyed by coming into contact with gas-jets. This is the exciting piece of news:

> The severe storm had the remarkable effect in London of causing, in rapid succession, no fewer than six outbreaks of fire, occurring north, south, east, and west, within a period covered by three hours. In each case they were caused by curtains at open windows being blown into the gaslight.

It will be noticed that the paragraph points to the occurrence as being "remarkable." Also it only mentions the destruction of curtains. Nothing is said of a loss of life, or thousands of pounds waste of property. Remember Clapham and Accrington! However, the "Electrician" considers the intelligence as to these curtain fires "very significant at the present time when fires of unknown origin are of only too frequent occurrence." These fires were not of unknown origin. Then it goes on to unconsciously pay gas one of the best tributes to its safety that has ever escaped electrically wielded pen. "When one considers the *multitude* of gas-jets which are in close proximity to inflammable materials, and that a draught may be sufficient to bring such materials into a position where they are liable to catch fire, *one can only marvel that serious conflagrations are not more numerous.*" Thanks. The fires at Clapham, Accrington, and certainly one of those at Brixton were caused by contact of inflammable goods with electric lamps or wires; and the public, the authorities, and drapery assistants recognize the danger. We read in the evidence at an inquest in connection with one of the Brixton fires that the girls had become so unnerved at the happenings in large drapery premises, the main parts (if not all) of which are electrically lighted, that, before going to sleep, they placed their clothes in readiness for escape should fire break out. Last week, in a paragraph we referred to a statement in Messrs. Jones and Higgins' newly-issued drapery catalogue that the "premises are lighted throughout with electric light." But, in a companion and facing statement, the public were desired to be assured of safety, inasmuch as the premises are "protected against fire by Grinnell Sprinklers." In the original "electric light" and "fire" are in black capital letters. Messrs. Jones and Higgins know the public; and they are aware of the alarm that has been created lately. It is indeed a mighty obstruction that has been erected against the progress of public credence in the still advertised electrical fiction as to the superior safety of electricity. The force of habit is undeniably great with our electrical competitors. Or "perhaps it is a form of humour with them."

The paper just referred to has been commenting on the report that the chief officials of the Gas and Electricity Departments of the Manchester Corporation have recently made regarding the result of their conferences to see what could be done to smooth away differences of opinion, and to enable them to work together in greater amity. The point upon which our contemporary largely expanded was the agreement between the chief officials as to the propriety of a uniform basis of profit contribution in relief of the rates, which, in view of the position of the respective standing capital debts of the two departments, would mean that the Electricity Department would hand over rather more than the Gas Department. The "Electrician" thinks that "it is a defect of the basis that it introduces this anomaly." We do not think the Electricity Department is likely to sing much of a song about this anomaly; for it would be very glad if an arrangement were come to by the City Fathers whereby the department would be let off so lightly. It remembers the years upon years that the Gas Department has been dropping into the municipal maw some £50,000 annually. It also fully remembers that from the gas consumers, since the gas undertaking has been municipally controlled, there has been extracted in aid of the rates an aggregate amount greater than the sum of the loans raised for the concern. The Electricity Department is more concerned over history not repeating itself in its case than it is that it should now be called upon to pay rather more annually than the Gas Department. But no good can come of saying much about this matter at present. The City Council have yet to pass a resolution confirming the principle that the chief officials say ought to be adopted. And we doubt the passing.

Here is a little riddle for solution at Kingston-on-Thames: Why is it that six years ago the electricity undertaking made a profit, and has not done so since? We are not going to attempt to answer it, beyond saying that what is wrong must be looked for at the base of the business, the character of which has been entirely altered by the fact that, under the conditions created by development, the average return per consumer has fallen, while the average standing charges per consumer has not showed a *pari passu* recession. But the weary councillors of Kingston would be glad if someone would tell them how best to assure themselves against annually recurring deficits. They have the unpleasant duty before them this year of putting on to the rates another ½d. in the pound through the loss incurred by the electricity undertaking; and really they do not know quite where they are. The Electricity Committee are badgered all round over their capacity for managing a concern at a loss. They have in recent years made coal, cables, and metallic filament lamps the successive scapegoats; and now they will soon be at a loss for something fresh that will enable them to make their peace with the public. But Mr. Councillor Wyeth, who describes himself as "unfortunately a member of the Committee" of three years' standing (so he ought to know something), avers that the Committee have no policy, they work in the dark, they vote large sums of money not knowing whether it is going to be remunerative, and they make estimates, but they have not the ghost of an idea as to whether there will be a profit or a loss. This is a sad reflection on municipal trading in electricity. What would be thought of any member of the Council who, year after year, estimated losses in his private business, and did not do something to turn the loss into a profit? What would the shareholders of an Electricity Company think of a similar proceeding on the part of the Directors? It is an immoral proceeding for a municipal authority to persistently look to those who are non-consumers of electricity to subsidize the electricity undertaking. But triumphantly cry the councillors, when a suggestion is made to raise the price of current to a figure that would make the concern pay, "then the ratepayers generally would have to pay more for the public lighting;" and already the Council cannot justify the change from gas to electricity. How different things would be if the supply were in the hands of a company! Why there should be such fright over raising the price of current to private consumers, we cannot understand, when electricity is stated by electrical station managers to be the cheapest and safest illuminant, and possess so many other advantages that the days of those who use it should be prolonged to those of Methuselah. But there the fact remains that electrical people are frightened over advancing the price. And there is the further fact that, whereas when there were fewer consumers on the books at Kingston, a profit was made, with an extension of the capital expenditure and a greater number of consumers, there is a loss. Obviously there is something wrong. What is it?

GAS ACTS FOR 1910.

[Fourth Article.]

Resuming the review of the Local Authority Acts which contain powers relating to gas supply, there has first to be noticed the measure of the Little Hulton Urban District Council. This is invested with more than ordinary interest, as it incorporates a scheme for the supply of coke-oven gas from the coke-ovens of the Earl of Ellesmere. The Council are empowered to purchase the portion within their district of the gas distribution system of the Salford Corporation; the purchase price being by agreement £7500. The proposal, however, to acquire a part of the canalization of the Farnworth and Kearsley Gas Company has dropped out. The purchase money is to be applied by the Salford Corporation to gas-works purposes to which capital is properly applicable, or to the repayment of any outstanding money borrowed for gas-works. The limits of the supply of gas by the District Council are to embrace the portion of their district not included within the limits of supply of the Farnworth and Kearsley Gas Company. The Council have been clothed with all the ordinary authority of gas suppliers; and confirmation is given to the agreement with the Earl of Ellesmere, the terms of which were fully stated in the "Journal" for Feb. 1 last. The maximum price of gas is placed at 3s. 6d. per 1000 cubic feet of gas of a standard power of 14 candles tested by the "Metropolitan" No. 2 burner. The Council are granted power to borrow such sums as may be necessary for the purchase of the portion in question of the gas undertaking of the Salford Corporation, £300 for laying a new main, £1400 for working capital, and, for the extension and improvement of the works, such sum as may be necessary as approved by the Local Government Board. The amounts required for purchase and for the new main are to be repaid in thirty years; and the working capital within ten years. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Mallow District Council have obtained the powers sought in respect of the purchase of the property of the New Mallow Gas Company, Limited, and the supply of gas within specified limits. The Council are to give notice within three months after the passing of the Act of their intention to acquire the undertaking. The lands are specified upon which manufacture may be carried on. Most of the powers sought are in the ordinary form; but with regard to the price to be charged for gas supplied through meter, it "shall not at any time exceed such price as may be determined by the Board of Trade within one month after the price or consideration for the purchase of the undertaking of the Company has been determined." The illuminating power of the gas is to be not less than 14 candles tested by the "Metropolitan" No. 2 burner. The Council are to be empowered to borrow the sum requisite for the purchase of the works. This is to be repaid in 35 years from the dates of borrowing, instead of the 40 years mentioned in the Bill. The money required for the extension and improvement of the undertaking, is left to the sanction of the Local Government Board. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Matlock Bath and Scarthin Nick District Council have in their Act obtained relief from the provision imposed upon them in 1896 as to the removal of the gas-works from the present site. The provision referred to seven years from Jan. 1, 1897; but the period was extended to a further seven years. There has, in the present Act, been repeal of these clauses; and the Council are authorized to maintain and extend the works on the old site. Succeeding clauses in the Act alluding to gas supply are of the usual form, save that we see the 10 and 15 per cent. discounts clause has been adopted. The Council for the purpose of the gas undertaking are authorized to borrow £3000, to be repaid in 30 years—not 40 years as suggested in the Bill. Further sums may be borrowed with the sanction of the Local Government Board. [*Parliamentary Agents: Messrs. Roberts and Co.*]

The Middlesbrough Corporation are in their Act empowered to supply gas-fittings, &c.; and they have conferred upon them several modern gas powers. The standard illuminating power of the gas is prescribed at 12 candles, tested by the "Metropolitan" No. 2 burner. The proposal as to a limit discount of 15 per cent. on gas supplied to large consumers for power purposes has been erased. In the financial section of the Act, it is decreed that "all expenditure made by the Corporation before the passing of this Act for the purpose of providing and laying down gas-mains, not exceeding the sum of £8500, and for the purpose of providing and fixing gas-meters, not exceeding the sum of £5500 in excess of the amounts authorized to be borrowed for such purposes, is hereby ratified and confirmed; and the Corporation shall repay to the account or fund out of which such expenditure was respectively made the whole of such expenditure out of the moneys by this Act authorized to be borrowed by them for those purposes respectively." The new borrowing powers for the gas undertaking now stand as follows in the Act: In respect of gas-mains, £8500; and of meters, £5500 [These are the two sums referred to in the foregoing provision]; for gas-mains on the security of the district fund and general district rate, any sums not exceeding £26,000; and meters and fittings on the security of the district fund and general district rate, not exceeding £20,000. Additional money may be borrowed with the consent of the Local Government Board. The period for the repayment of the money for meters and fittings has been altered to ten years; and in regard to that for mains, to 30 years. A reserve or renewals fund is provided for, to be built up from the difference between receipts and expenditure. The clauses regulating the sale of coke in the streets have been altered; and now read as follows:

(1) Every person who shall sell or offer for sale coke from any vehicle in any street, shall sell the same or offer the same for sale in sacks with a metal label affixed to the top of every such sack indicating the correct legal weight or measure of coke therein.

(2) Any purchaser of coke from any vehicle in any street and any inspector of weights and measures or other officer appointed by the Corporation may require that any coke sold or offered for sale as aforesaid be weighed or re-weighed, or measured or re-measured, by any instrument or measure stamped by an inspector of weights and measures. Provided

(*a*) No seller of coke or person in charge of a vehicle in which coke is carried shall be required under this section to carry coke beyond such distance not exceeding half a mile as may be prescribed in that behalf by the Corporation;

(*b*) Where any such coke has at the instance of the purchaser been weighed or re-weighed, or measured or re-measured, in pursuance of this section, and found to be of the weight or measure stated in that behalf by the seller of the coke or the person in charge of the vehicle, the purchaser shall be liable to the payment of all reasonable costs actually incurred of, and incidental to, the weighing or re-weighing or measuring or re-measuring.

(3) If the owner or any person in charge of any vehicle from which coke is being sold or offered for sale in any street wilfully makes any false statement as to the weight or measure of the coke in any sack, or wilfully increases such weight by damping such coke, or wilfully does any other act by which the purchaser of the coke shall be defrauded, or fails to comply with the other provisions of this section, or obstructs any weighing or re-weighing, or measuring or re-measuring, authorized by this section, he shall be liable for every such offence to a penalty not exceeding £5.

(4) Public notice of the provisions of this section shall be given forthwith after the passing of this Act by advertisement in two newspapers published or circulating in the borough, and by a notice affixed outside the Town Hall, and by the distribution of hand bills amongst persons affected or likely to be affected, as far as such persons can reasonably be ascertained. A printed copy of the notice affixed outside the Town Hall, sealed with the corporate seal, shall be sufficient evidence that the provisions of this section have been complied with.

The Corporation are allowed to form a fund to be called "The Accident Fund," to provide for meeting claims upon them under the common law, the Employers' Liability Acts, or the Workmen's Compensation Acts. The fund is to be limited to £12,000. [*Parliamentary Agents: Messrs. Durnford and Co.*]

In the section of the Omnibus Act of the Middleton Corporation dealing with gas, the prescribed illuminating power is placed at 14 candles, using the "Metropolitan" No. 2 burner for testing. The other clauses are of common form. Protective provisions for the Lancashire and Yorkshire Railway Company have been inserted. In the financial section, a clause appears empowering the Corporation at any time, after Jan. 1, 1940, to require the persons entitled to any annuities provided for under section 56 ("Lighting Rates, &c., to be Charged with Annuities") of the Act of 1861, and for the time being outstanding, to accept redemption of any such annuities on payment of the then fair value of the annuity or annuities redeemed, and the amount of such value is, if not agreed, to be settled by arbitration, in accordance with the provisions of the Arbitration Act, 1889, except that the arbitrator shall be nominated by the Local Government Board on the application of either the Corporation or the annuitant. And the Corporation may, with the sanction of the Local Government Board, borrow at interest, on the security of the consolidated fund and consolidated rate, and of the revenues of their gas undertaking, the amounts payable according to the award to be made by the arbitrator, or such part or parts thereof as the sinking fund then applicable for the purpose shall be insufficient to meet, together with all costs, charges, and expenses payable by the Corporation in respect, or arising out, of the arbitration, or the redemption of the annuities. [*Parliamentary Agents: Messrs. Baker and Co.*]

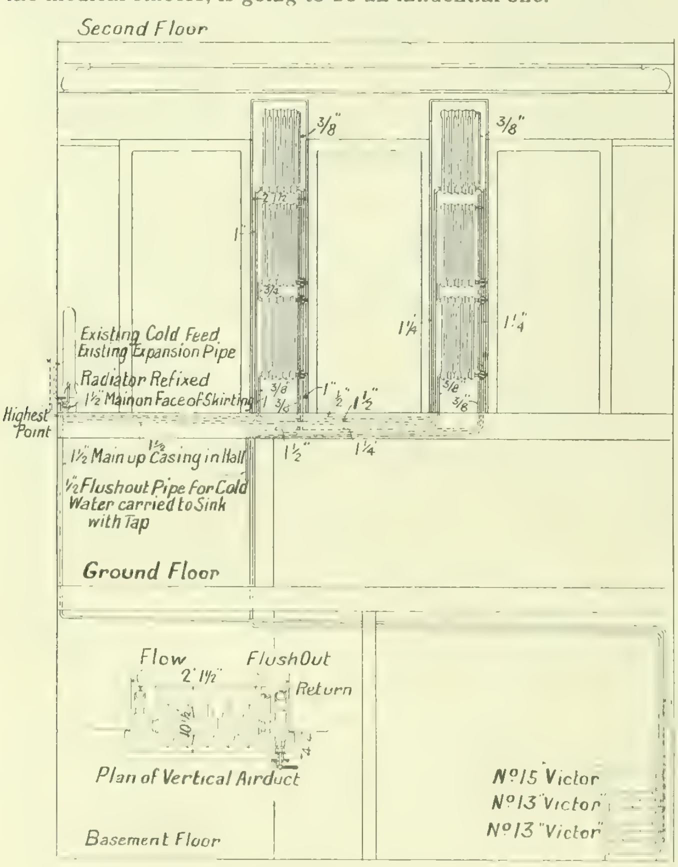
In the Rhondda District Council Act, a stand-by clause appears for the protection of the Gas Department. The terms, following those of the Mountain Ash clause granted in 1909, are as follows: "Notwithstanding anything contained in the Gas-Works Clauses Act, 1871, or any other Act, a person shall not be entitled to demand from the Council a supply, or the continuance of a supply, of gas for premises having a supply of gas from an installation other than that of the Council, unless he shall have previously agreed to pay the Council such minimum annual sum as will give to them a reasonable return on the capital expenditure and standing charges incurred by them to meet the possible maximum demand for those premises; and the minimum annual sum to be so paid shall be determined, in default of agreement, by arbitration in manner provided by the Arbitration Act, 1889." [*Parliamentary Agents: Messrs. Torr and Co.*]

Opening of Gas-Works at Maltby.—Works erected at Hellaby Bridge for the Maltby and Bramley Gas Company, Limited, were formally opened last Wednesday by Lady Mabel Smith; and that night 500 houses in the district were illuminated with gas. Some particulars of the undertaking (to which Mr. John H. Brearley, of Longwood, is acting as Consulting Engineer), and of the opening ceremony, will be given in next week's "Journal."

FROM ELECTRICITY TO GAS

At the Premises of the Society of Medical Officers of Health.

If there is a scientific and professional Society that in its collective capacity ought to know what, from the health standpoint, is best in the way of lighting and heating, that Society is surely the one composed of medical officers of health. Their offices, demonstration, and exhibition rooms are situated at No. 1, Upper Montague Street, Russell Square, W.C.; and there (we have the authority of Mr. W. A. Lawton, the Secretary of the Society, for saying) they have for some years been using the electric light, with the result that, on meeting nights, the rooms became stuffy and unbearable, and though, in the demonstration room, eight metallic filament lamps were used, the members used to complain that they could not see to read in the parts of the room farthest from the lights. The offices, demonstration room, and exhibition rooms have been lately redecorated; and it was decided that simultaneously hygienic conditions should be established in the meeting room by means of gas lighting and heating. Members of the Society prefer in winter time to avoid, whenever possible, breathing London air in an unpurified state; and they then like to have it delivered warmed into their meeting room. They have a fancy, too, for having their rooms well lighted and ventilated; and, in short, they desire to be an example to others. There we have the proposition they set the Gaslight and Coke Company. Well lighted and ventilated rooms—a plentiful supply of fresh air, filtered and warmed, and the warming to be subject to rapid regulation. The Company have carried out the work; and last Thursday there was a demonstration to show how efficiently the whole installation answers requirements. It proves how gas can, in places where people gather together at night time, be employed to ensure the maintenance of the hygienic conditions; and the example, endorsed by the professional position and weight of the medical officers, is going to be an influential one.



Details of Heating Apparatus for the Glover-Lyon Ventilating System at the Premises of the Society of Medical Officers of Health.

In the first place, as being the chief part of the new installation, reference may be made to the warming and ventilating arrangements for the meeting and demonstration room of the Society. Description should be prefaced by the information that the room is superficially 24 feet square, and 13 feet high; and its cubical capacity is therefore about 7500 feet. In this room on meeting nights, there are at times as many as 150 members assembled. Now for the heating of the apartments, the Society asked for something that approached an ideal system. The electricians said "Put in electric radiators and fans." The medical officers shivered at the notion of the thing; and the result was that the Gaslight and Coke Company submitted a scheme which has been carried into effect—the work, so far as the air warming is concerned, having been carried out for the Company by Mr. Thomas Potterton, of Balham. In the basement of the premises, there has been fixed a battery of three gas-heated boilers—two No. 13 pattern, and one No. 15 pattern—all connected to a water flow and return; so that three or two boilers, or one, can be used at will, and according to the passing need. These boilers consume 240 cubic feet of gas per hour when all three are engaged at full capacity, or 80 cubic feet each. The system of flow-and-return in the building will be best seen by the drawing accompanying this article. Hot water is first supplied to a radiator fixed just inside the door of the meeting room; and the position of this is such that, when it is in use, any air passing in by the door cannot fail to be warmed, and thus draughts are prevented. But this radiator can be cut out of the circuit, as can the others to which allusion has to be made; so that regulation and control are found from beginning to end of the system. Now in this room there are three large windows facing Russell Square; and between these windows, there is a space which looks like part of the solid wall, but which in reality is hollow. These hollow spaces (or enclosures we will call them) came in very handily in designing the scheme. In each of the enclosures are mounted, one above the other, three radiators, with the hot-water flow connected so that it feeds into the top one, and then passes downwards through the battery of three. Here we have what may be looked upon as a closed circuit—the only water that is really used up being the small quantity that is evaporated; and to compensate for this, there is a little cold feed into the foot of each radiator.

Now as each radiator possesses 25 square feet of heating surface, and there are three radiators in each enclosure, and two enclosures, there is in all 150 square feet of heating surface supplied by them. These enclosures in effect form shafts, at the foot of each of which there is a 12-inch electric fan, capable of passing 2500 cubic feet of air per minute, or 5000 cubic feet the two. But owing to friction in passing over the radiators and through the diffusing arrangement (to be presently referred to), it is calculated that 3400 cubic feet of air are passed per minute. In being drawn in from the outside by the fans, the air is first filtered; and passing over the radiators is warmed—regulation being effected by externally-operated valves which put the radiators in or out of circuit as required. We have got the warm air into this shaft; and the distributing arrangement of Dr. Glover-Lyon, who is a member of the Society of Medical Officers of Health, comes into play. This is in the form of a duct running across the room at ceiling-level, and containing closely-cut narrow slits on the front of the casing, through which slits warmed fresh air is driven, and so is diffused through the room. On the opposite side of the room, also near ceiling-level, there is a 2-feet fan (with an exhausting capacity of 4000 cubic feet per minute) which extracts the air vitiated by respiration, and sends it through an adjoining room into the open.

We have spoken of the regulation and control that are afforded by cutting out of circuit as many of the radiators as is thought requisite. But supposing the room were allowed to become too hot, the mere cutting out of the radiators would not immediately produce any appreciable diminution of temperature, seeing that the radiators would retain their heat for a considerable time. To provide, therefore, for a more rapid cooling than is to be obtained by cutting radiators out of circuit, arrangements are made for drawing off the hot water, and passing it into a sink in the basement. In this way, the radiators cut out would be almost immediately cooled. In addition to this system of supplying fresh, warmed, purified air, there is an alternative or supplementary means of heating in a Wright 21-inch "Salon" gas-fire.

The fans described are not the only means of ventilating. Personal experience goes farther than all the bare assertion that one finds in electrical advertising literature. The Society of Medical Officers can attest, from experience in their meeting room, that the electric light is of no use whatever for aiding ventilation. They have therefore had introduced a five-light inverted ventilating-lamp connected with an outlet duct. The lamp consumes 18 to 20 cubic feet of gas per hour; and therefore the cost for gas is less than ¾d. per hour. It is fitted with a figured, frosted globe and screen; and by it there is diffused throughout the meeting room a soft light. The control of the lamp is by a tap near the door, at the side of which tap there is provided a bye-pass supply for a pilot light in the lamp. This answers splendidly. The Committee of the Society, their Secretary informs us, are gratified with the pleasant conditions that now exist, and which did not obtain before; and though nothing can yet be said about cost (Mr. Lawton has already had inquiries from other Societies as to expenses), the experience so far satisfies that the system adopted will be an economical and healthy means of lighting and heating the place.

Above the meeting room are two rooms for exhibition purposes; and these are also now lighted by inverted gas-lamps, though electricity was used before—lighting and extinguishing being by the Telephos switch. The electric fittings have been left up, so that a contrast of the efficiencies of the two forms of lighting can be made. Comparisons are said to be odious; and certainly to electricians a demonstration of the contrast here might be regarded as very offensive.

Passing through the exhibition rooms, it was observed by our representative that the "Normandy" distiller is on view, by which pure water is obtained by generating steam by the burning of gas. Allusion was made to this contrivance in dealing with the Gas Companies' joint exhibit at the Japan-British Exhibition. Another exhibit is a surgical gas-bracket by Messrs. Best and Lloyd. In connection with this, an incandescent gas-burner is employed; the light being magnified, and capable of being directed on to an object at any angle.

The lecture list of the London Institution for the session 1910-11 includes one by Professor Vivian B. Lewes on "Smoke and its Prevention."

NEW GAS-WORKS FOR PADIHAM TO BE INAUGURATED TO-MORROW.

General View of the New Gas-Works of the Padiham Urban District Council.

[Showing from the left Boiler-House and Chimney, Retort-House, Coke Elevator and Hopper, and Offices, Stores, Meter-House, and Gasholder.]

The first gas-works in Padiham were erected in 1846, by the Padiham Gaslight and Coke Company; the capital value being £4000. At a parish meeting the same year, the Lighting and Watching Act was adopted. Inspectors were appointed for part of the parish; and sanction was given for £170 to be spent by the inspectors in fitting up the lamps for lighting the town with gas.

In 1876, the Padiham and Hapton Local Board obtained an Act of Parliament to acquire the undertaking of the Padiham Gaslight and Coke Company. At that time, the capital value stood at £12,928, divided into 2400 fully paid-up £5 shares and 464 shares on which £2 each only had been paid. The consideration was the granting to the shareholders of perpetual annuities, called the Padiham and Hapton Local Board Gas Annuities, commencing on the 31st of December, 1874, calculated in the aggregate at £1118 17s. 7d. per annum; to the holders of any one or more shares in the Company, a perpetual annuity of 8s. 6d. in respect of each £5 share and 3s. 5d. in respect of each £2 share; the remaining £18 17s. 7d. was to be paid over to the Directors of the old Company and sold, and the proceeds divided between the shareholders. The consumption of gas during 1876 was about 17 million cubic feet.

In 1879, a contract was entered into with Messrs. James Kemp and Brother, of Read, for a supply of gas to their mill at Read; Messrs. Kemp agreeing to pay a portion of the cost of the work. In 1880, the consumption of gas having then increased to about 19 million cubic feet per annum, additional land was secured for the erection of new plant and buildings to meet the growing demands. With this acquisition, the land available for gas-making purposes was about 3157 square yards—2056 square yards being freehold. The site was situate right in the centre of the town.

Matters appear to have progressed much in the usual way until 1884, when an expert called in by the Council recommended that a new site be procured for gas-works purposes. Negotiations took up some considerable time, as it was not until 1887 that the site upon which the new works have been erected was secured. During the same year, the first lift of the existing gasholder with tank was erected to the design of Mr. Thomas Newbigging.

In 1896, the consumption of gas having increased to 41 million cubic feet per annum, the then Manager recommended to the Council the desirability of erecting new works on the land already provided. An engineer was appointed, and a scheme submitted to the Council at an estimated cost of £26,000. Differences of opinion as to the wisdom of spending so much money existed among members of the Council; and with other public works necessitating urgent attention, the question was deferred.

Considerable extensions were made to the old plant between then and the year 1907. At this time, the consumption of gas having risen to nearly 70 million cubic feet per annum, the Council again took into consideration the question of constructing the new works, and decided to add an additional lift to the gasholder situate on the new site. The contract for this work was let to Messrs. Newton, Chambers, and Co., in May, 1908; the work being completed by the end of August the same year.

In the meantime, the present Engineer received instructions to prepare a scheme, which was accepted by the Council, and a Bill, which ultimately became the Padiham Urban District Council Act, 1908, was promoted in Parliament in the session of 1908.

The following is a summary of the principal provisions contained in the Act relative to gas:

Extends the limits of supply by including the townships of Sabden, Read, and Simonstone.

Authorizes the purchase of the mains and services of the Read Parish Council.

Enables the Council to differentiate the charge for gas supplied inside and outside the urban district.

Grants the Council power to redeem by compulsory purchase the gas annuities not redeemed by Jan. 1, 1938.

Makes provision for the erection of the new works and for distribution purposes.

The Site.

The extent of the land available for gas-works purposes is some 16,560 square yards adjoining the Lancashire and Yorkshire Railway, and no doubt will meet the requirements for some considerable time. From a gas engineer's point of view, the site is an exceptionally good one, though the difficulties which had to be faced, and which will be dealt with later, made the site, from a constructional point of view, an expensive one.

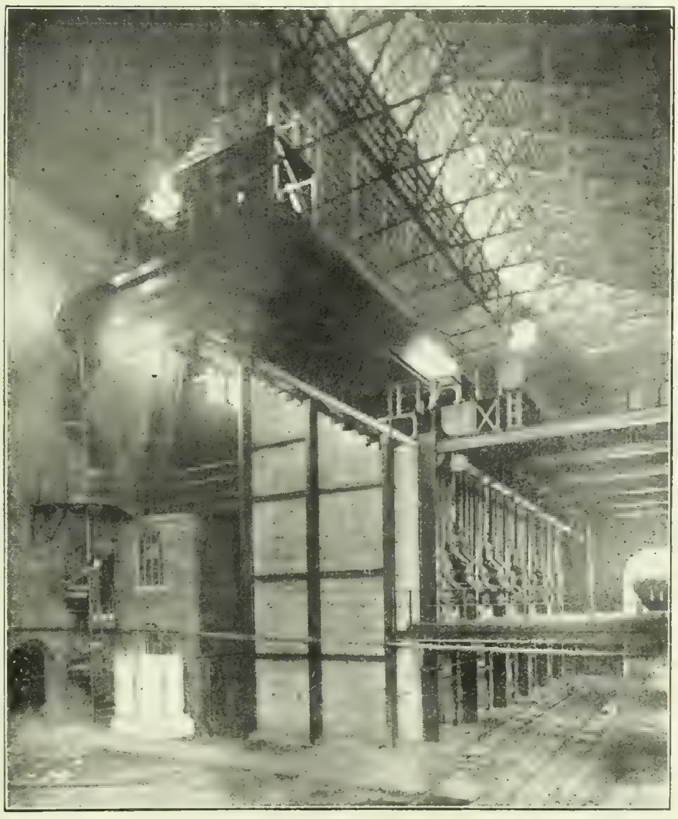
To take full advantage of the railway, it was decided to construct the works on two levels; the lower level being 15 feet below the higher or railway level. Some 20,000 cubic yards of earth has been excavated and removed; ample room being found for the excavated material in the levelling up of the Council's land adjoining the works. A strong retaining wall, constructed with local stone, supports the higher level, and forms the lower part of the coal-store.

Several important points had to be kept in view when designing the works; the principal ones being: Coal had been taken from beneath part of the site; the possibility of property being erected in the future on the land abutting on two sides of the site; and the existence of the gasholder already on the site. It was only after many months of careful consideration and work that the present scheme was submitted to the Council for their approval.

The carrying out to the full extent of the scheme will ultimately result in enabling the production of a million cubic feet of gas per diem, though the present provision is only for half-a-million cubic feet per diem.

General Arrangement.

In arranging the buildings and plant, the primary object was that, as far as possible, advantage should be taken of the higher



A General View of the Carbonizing Installation.

level for dealing with the coal, coke, oxide, tar, sulphate, and other matters requiring railway facilities. In short, it was decided that all material requiring handling should be handled downwards, and not upwards, as was the case on the old works. The higher level contains the purifiers, sulphate plant, and weigh office for coal, along with overhead tar-tank placed high enough for the tar to gravitate into the railway-waggons—the tar being pumped into this tank from the storage tank situate on the lower level. The lower level contains the retort-house and coal-store, the condensing, washing, and scrubbing plants, boilers, exhauster and compressor houses, offices, stores, workshops, and meter and governor house, &c.

The buildings have been arranged in as open a manner as possible without isolating any building in out-of-the-way places. The plant is well grouped together, without being congested; the whole being constructed with economy, but still at the same time with due regard to appearance and efficiency. The buildings are all constructed with Accrington brick, relieved with Yorkshire stone; and uniformity of design has been observed throughout the works.

A View on the Charging-Stage.

ENTRANCE, OFFICES, STORES, &c.

The entrance to the works is from Park Road, being situate between the offices, stores, and meter-house on one side, and the workshops, mess-rooms, &c., on the other side.

The main entrance is 12 feet wide, and the side entrance 4 feet wide. The gates are of wrought iron, of a plain, neat design, hung to massive pillars of Yorkshire stone.

The entrance to the offices is distinct from the works entrance. This block of buildings, upon which the general design has been relieved somewhat, comprise: The weigh office, inquiry office, manager's office, photometer-room, test-room, laboratory, and lavatories; the rooms being situate on the ground floor. The corridors which divide the rooms are of ample width and height; being tiled up to dado height, and plastered above to the ceiling. The entrance is formed with a suitable vestibule, inside of which is the inquiry window; the latter enabling complaints and other matters to be dealt with without necessitating access to the offices.

The laboratory and test-room are tiled and plastered, as previously mentioned, and face Park Road; and when completed they will be equipped with the most modern apparatus, and will no doubt prove a valuable acquisition to the plant. The other rooms which face the works are lofty and well-lighted, and are fitted with every conceivable convenience. Special attention has been paid to the ventilation of this block of buildings; and the heating will be by gas-radiators.

Adjoining the offices, and in direct communication therewith, are the stores. These comprise three lofty rooms, each 20 feet square, well furnished and equipped; and they have been designed with due regard to keeping a strict watch and account of stores. The blacksmiths' and fitting shops are each 20 feet square, being lofty and well-lighted; and adjoining these are the mess-room, bath-room, and lavatory. Special attention has been paid with a view to ensuring the comfort of the workmen; the rooms being lined with enamel brick and fitted up with suitable lockers, wash-basins, and bath. It is hoped that the men will show their appreciation of the efforts made to secure their comfort, by the frequent using of the bath, &c., provided.

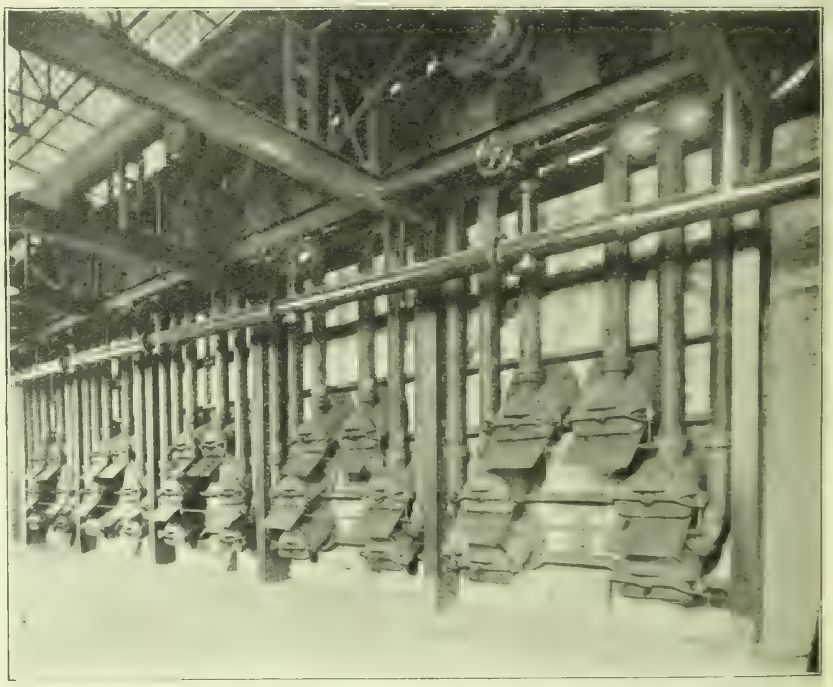
RETORT-HOUSE, COAL-STORE, AND CARBONIZING PLANT.

Naturally, it was an anxious time when the type of retort which should be adopted was under consideration. No undue haste occurred in this matter. In fact, months were spent observing results of different types of retorts and inspecting recently constructed installations before it was decided to adopt the present system. It is not the intention here to discuss the relative merits of any particular system. Suffice it to say that what has been installed, having regard to all the conditions, is, it is ventured to state, the most suited to the requirements.

The retort-house, which occupies the centre of the site fronting the main entrance, is 115 feet in length, 60 feet in width, and 52 feet in height up to the eaves; the house having been taken up sufficiently high to contain any type of setting should it, on future consideration, be desired. The lighting and ventilation of the house have received full consideration.

The house is constructed with Accrington engineering bricks; the plinths, oversailing, and base courses to the panels, key-stones, springers, corbel, &c., being in Yorkshire stone. The roof is of substantial design and contains fourteen principals, with ventilator running the full length of the roof; the slates being secured to the angle purlins with lead nails.

It will be remembered that mention was made of the site being an expensive one from a constructional point of view. This chiefly applies to the retort-house, coal-store, and carbonizing plant. The spot selected for these structures turned out to be a huge pocket of what might be best termed as "Jelly Sand." After careful consideration, having regard to the importance of good foundation work for this part of the plant, it was decided to entirely remove the sand. This necessitated excavating to a depth of from 5 feet at one end of the house to 15 feet at the other end; and at that depth a good bottom was secured on blue clay. The method of constructing the foundations was as follows: First of all, a 12-inch bed of concrete was laid; then the space was filled up to within 2 feet of the ground line in the case of the retort-bench, and 1 foot in the case of the house walls, with local rock quarried as large as could be conveniently conveyed to the site; then another layer of concrete to within 6 inches of the ground line, to receive the brick footings. Concrete has not been spared throughout the construction of the works; and this branch of the building work forms one of its chief features.



The Discharging Side of the Bench.

The retort-house has been designed to contain nine settings of six retorts on the inclined principle; but only five settings have been erected. The retorts are 20 feet long, and taper from 20 in. by 15 in. ◯ at the charging end to 24 in. by 15 in. ◯ at the discharging end.

The main arches of the bench are built with specially constructed bricks, so that the joints of the arches are vertical, to

ensure the weight of the arch and backing going evenly over the division walls and preventing any undue thrust on the front of the bench.

The gas is taken off from the bottom end of the retort and the hydraulic. Foul and tar mains are erected between the front of the bench and the house wall—thus being quite clear of the bench itself. An 18-inch foul-main is carried to one end of the retort-house and connected to two of Braddock's retort-house governors fitted with suitable bye-pass and gantry round the governors. The foul-main is then conducted along the side and end walls of the house to the condensers. An 8-inch tar-main is carried underneath the hydraulic main, and connected to the steel tar-tower at the end of the bench.

The drawing and charging floors are formed with steel girders and concrete arches covered with "Nori" Accrington paving bricks, making a firm, substantial floor.

The coal-handling plant is arranged to receive coal from the store and deliver into a battery of storage hoppers erected over the charging end of the bench, and capable of holding 100 tons, or 20 tons per bed. Underneath the hoppers are fixed the combined measuring chambers and shoots—one to charge each tier of retorts.

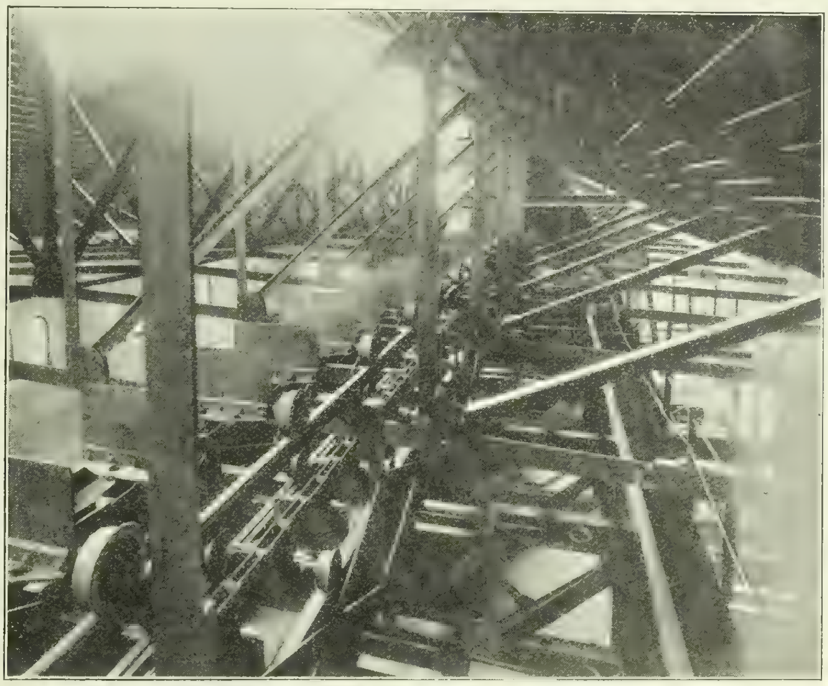
The coal-handling machinery consists of the coal-breaker, erected in a cast-iron tank, which forms the breaker-pit; the coal being fed into the breaker by a jigging feed arrangement. After passing through the breaker, the coal is fed into an elevator, which in turn delivers to a push-plate conveyor fixed over the hoppers. This plant, along with the coal-handling plant, is driven by a gas-engine, situate in the engine-house between the back of the retort-bench and coal-stores.

The coke plant is fixed outside the retort-house, and consists of an elevator delivering into a storage hopper erected on the higher level. A large gantry has been formed outside the end of the retort-house; so that the coke can be tipped from the gantry in the store-yard to a depth of 10 feet without cost of stacking, or can be tipped from this platform into the elevator when required to feed the storage hopper. On the ground level, a line of rails has been fixed for receiving the coke whan discharged from the shoots fixed in the drawing floor. These rails are connected up to the elevator on this level also, so that the coke can be elevated from either level. The storage hopper is fitted with shoots and operating gear for delivering the coke as it is required into the carts or waggons.

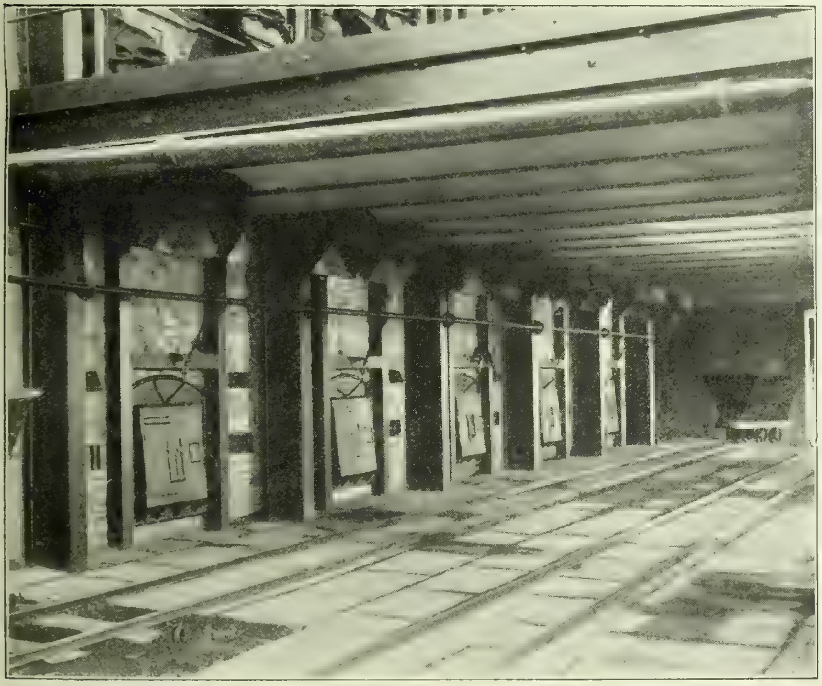
Suitable clutch gear is arranged for putting in or out of action any part of the plant previously referred to. The special features of the installation are the strong manner in which the bench is braced, and the arrangement of staircases and platforms which makes the whole of the plant easily accessible.

Coal-Stores.

Running parallel the full length of the retort-house is the coal-store, which is 25 feet wide and 32 feet in height from the lower level to the eaves; the store having a tipping capacity of about 2000 tons. After about two years' negotiations with the Railway Company, fairly satisfactory provision has been made for dealing with the coal. Owing to local conditions, the cost of constructing a railway siding into the works made this means of bringing in the coal prohibitive, so that it was decided to put down a light railway. The Railway Company having set aside in their goods yard about twelve waggons' length of siding accommodation for the department's use, a 2-feet gauge railway was laid alongside, and continued into the coal-store. The method of bringing in the coal is with light tipping-waggons built to contain about 12 cwt.; and the rails being laid down with a suitable fall into the store, little difficulty is experienced in pushing the waggons into the store. The railway is also continued through the store to the coke-hopper, so that coke can be taken back on the return journey to the railway waggons in the same waggons that bring the coal. This method, it is thought, will prove to be very economical in use, and certainly has been economical in construction.



The Coal Conveyor and Elevator Head.



A View in the Subway.

The whole of the carbonizing installation, coal and coke handling plant, retort-house and coal-store roofs, with the light railway accommodation, was placed in the hands of Messrs. Drakes Limited, of Halifax. The completed scheme is in entire keeping with the firm's reputation for work of this class, and has, it is ventured to state, given the greatest satisfaction to all concerned.

Retort-Chimney.

This is situate at the southern gable of the retort-house, and goes up to a height of 90 feet from the ground-line. It has an internal diameter at the base of 4 ft. 3 in., tapering to 2 ft. 9 in. at top. The shell is circular, with a batter of $2\frac{1}{2}$ inches in 10 feet; the base of the chimney being square and relieved with Yorkshire stone. A $4\frac{1}{2}$-inch fire-brick lining is carried to the top of the chimney, with a 2-inch cavity between this and the outer wall; the lining being arranged so that every 20 feet of the height is supported on the outer wall. The cap is formed with moulded terra-cotta blocks surmounted with a cast-iron plate secured with copper dowels.

Condensers.

The condensers, which have been removed from the old works, comprise eight columns, 22 ft. 6 in. high; the outer tubes being 2 ft. 8 in. in diameter and the inner ones 1 ft. 10 in. in diameter. Four of the columns were erected in 1887 by Messrs. R. & J. Dempster, Limited, and the others at a later date. Being of the annular type and in satisfactory condition, they are eminently suitable for the new works, and have the advantage of having suitable connections, which have been refixed as far as possible.

Boiler and Exhauster Houses.

The boiler, exhauster, and compressor houses form one complete block of buildings situate on the lower level between the northern gable of the retort-house and the railway; a passage 10 feet wide being left between the back of the buildings and the railway wall for the purpose of connecting up the two levels at this end of the works.

The boiler-house walls are carried up to a height of 26 feet to support the overhead water-tank, erected by Messrs. R. & J. Dempster, which has a capacity of about 25,000 gallons; the tank being sufficiently high to ensure a good supply of water on the higher level. The water is pumped from the River Calder by an Evans pump situate in the compressor-house.

The exhauster and compressor houses are lofty, well-ventilated buildings; the walls being covered with ivory white tile relieved at the skirting dado and frieze in light brown and yellow. The ceilings are panelled, and formed with Pensacola pitch-pine. The floors are suitably tiled; and ample provision has been made for ready access to the connections.

Boilers.

The boiler-house contains two Lancashire boilers, 18 feet by 6 feet, constructed by Messrs. Yates and Thom, Limited, of Blackburn, and fitted with Wilton's patent furnaces. Situate in the corner between the boiler-house and retaining wall is the boiler chimney, which is constructed in a similar manner to the retort chimney, with the exception that it has not the square base.

Exhausters and Compressors.

The exhauster-house contains a 30,000 cubic feet per hour exhauster, supplied by Messrs. George Waller and Sons, Limited, and one 20,000 cubic feet per hour exhauster supplied by the Bryan Donkin Company, Limited. The last-mentioned exhauster has been transferred from the old works, where it was erected in 1898. In this house is fixed the marble tablet commemorating the opening of the new gas-works.

The compressor-house contains the high-pressure plant for supplying Sabden, the township previously referred to. The compressors, which are in duplicate, were supplied by the Bryan Donkin Company, Limited. They are capable of delivering 10,000 cubic feet of gas per hour into Sabden, through about 5000 yards of 3-inch Mannesmann tubing, under a pressure of 10 lbs. to the square inch. The gas is governed at the entrance to the township with Reynolds governors in duplicate. This plant, which has been in operation since February last, is giving the greatest satisfaction, and certainly accomplishes all that the makers claim for it.

Washing and Scrubbing Plant.

This plant is situate between the northern gable of the retort-house and the front of the boiler-house; being well protected from the weather on three sides. The Livesey washer, supplied by Messrs. R. & J. Dempster, Limited, is capable of dealing with 500,000 cubic feet per diem, and was erected on the old works in 1906. The first portion of the tower-scrubber, 30 feet high and 8 feet in diameter, was erected on the old works the same year. This has now been extended to a height of 50 feet, making it ample for present use, and leaving a satisfactory margin for future requirements.

The scrubber is fitted with a liquor turbine at the top, with the usual distributing-pipes, and is provided with 5 inch by ⅜ inch boards having ⅜-inch space. The boards are supported every 5 feet with strong framing, which prevents buckling; sufficient room being left between the layers opposite the manholes for cleaning-out purposes. The effectiveness of this system is shown by the fact that practically every board was removed and refixed without breakage. The scrubber, which is of Messrs. Dempster's usual ornamental type, and has planed joints throughout, offered

Purifier Installation.

no difficulties in its removal and re-erection. The rotary scrubber, supplied by Messrs. W. C. Holmes and Co., is capable of dealing with 500,000 cubic feet per diem. Erected on the old works in 1898, it is still in excellent condition, and will form a useful adjunct to the new works.

Purifiers.

The first section of the new plant to be erected was the purifiers. These were completed in November, 1908, and have been in use since that date; the gas being brought over from the old works by means of a 12-inch main, which will eventually be used as a distributing main. The purifiers are of the Green type, 22 ft. by 18 ft. by 5 ft., fixed in one continuous length; each purifier having two covers over openings 15 ft. by 8 ft. The boxes are erected upon a substantial iron structure; the wall around the back and ends being carried up to the top of the purifiers, the back wall answering the purpose of a boundary wall. The iron roof is carried on stanchions which extend from the ground level at the front of the structure, and from the walls along the back and ends. Considerable time and thought were expended in deciding as to the best method of operating the purifiers; and many installations were inspected before the present system was adopted.

The oxide is raised by means of friction hoists. These are driven by a gas-engine situate in the engine-house at the end of the structure. The covers are raised by means of a Hovey crane. This permits of the two covers being raised at one time, and carried perfectly level; and it can easily be operated by one man.

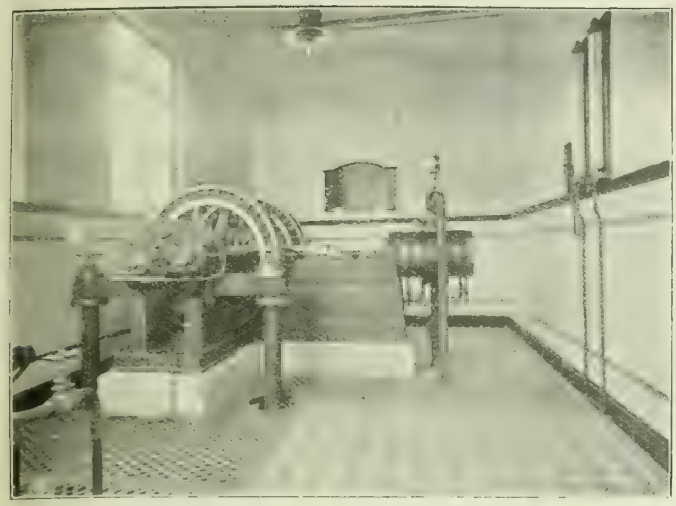
The rubber jointing material around the covers is stiffened by means of a continuous sunk iron bar, which is embedded in the rubber frame. This is secured to the kerb of the cover, which makes an exceedingly effective joint without any solution. Not the slightest trouble has been experienced with it, after nearly two years of actual work. The foul oxide is discharged from the purifiers on to the revivifying floor beneath, and is raised by means of iron skips, which are moved on the revivifying floor as required by means of flat-wheeled bogey-carriages. The purifiers are fitted with Spencer's hurdle-grids. At each end of the structure, openings are left for raising the skips by friction hoists; and they are rapidly lifted and run to the required position.

We are able to give the following figures relating to the purifying costs and the working of the plant. During the year ending March, 1910, seven changes took place; and the average quantity of gas passed each change was 10,043,000 cubic feet. The total cost of purification, including all labour in emptying, re-filling, and revivifying, gas, oil—in fact, everything carefully allotted to the plant—was £25 6s. This works out at an average of 0·08d. per 1000 cubic feet of gas made.

The oxide is loaned gratis from the Gas Purification Company. Four men will empty, clean out, and refill one of the purifiers during an ordinary working day of nine hours. This means handling in and out about 60 tons of oxide. The complete installation was carried out under a strict time penalty well within the specified time, and undoubtedly reflects the highest credit on the Contractors, Messrs. R. & J. Dempster, Limited.

Sulphate Plant.

Adjoining the purifiers is the sulphate-house, which is 30 feet long, 19 feet wide, and 17 feet in height from the ground line to the eaves; the plant being capable of dealing with 30 tons of liquor per day. The apparatus consists of rectangular shaped primary and secondary stills; the upper part of the former



Corner of Engine-Room, Showing High-Pressure Plant.

liberating the ammonia, while the lower part comprises the liming chamber. This is fitted with a patent injector which continually mixes the lime with the liquor, after which it flows through a lime interceptor into the secondary still. These are designed so that the entire side may be removed for cleaning without disturbing the fittings.

The lime-mixer has a lift and force pump with steam-driven agitator; the superheater being 2 feet in diameter and 6 feet in height, while the ammonia and foul gas pipes are 4 inches in diameter. The plant is fitted with the usual lime settling tanks, acid-supply tank, purifier, and condenser; the plant being arranged so that the devil liquor is released at such a temperature that it is deprived as far as possible of objectionable features.

The order for the plant was placed with Messrs. Dempster; but Taylor's saturator was embodied in the contract, and this, together with the whole of the lead work, was carried out by this firm.

Weigh Office.

This is situate alongside the entrance to the railway yard. The roof is formed by means of an overhead tank of 3500 gallons capacity, supplied by Messrs. Dempster. This will be used for loading up the tar into the railway-waggons or for local sales. Outside the office there is a 5-ton weighbridge.

Meter and Governor House.

This is situate on the lower level adjoining the stores and close to the gasholder, and contains a 30,000 cubic feet per hour station meter, transferred from the old works. When the scheme is completed, the two 14-inch governors (by Messrs. Parkinson and W. & B. Cowan, Limited), erected on the old works in 1906 and 1907, will be removed into this house.

A feature of this structure is the cellar, which will contain the whole of the connections and valves belonging to the meter and governors, arranged so that they can be operated from either the meter-house or the cellar floor levels.

Tar and Liquor Storage.

This is an underground brick tank situate on the lower level, divided into two compartments; the capacity being about 360 tons. The bricks for this work were specially selected. The whole are laid in cement, having the joints raked out to a depth of ½ inch; the surface then being covered with two coats of cement. The roof is formed with 12 inch by 6 inch steel joists and concrete arches.

Works Connections.

As far as possible, the connections have been placed above the ground level; and in no case is there a valve throughout the works situate underneath the ground. Another satisfactory feature is that, from retort to meter, there is not a single syphon to pump; past experience on the old works having ensured that this sometimes neglected part of the plant should receive more than average consideration. The whole of the condensed products are conducted into an inspection chamber, from which they overflow into the storage well.

Storage.

The storage comprises one gasholder on the new works, 100 feet in diameter by two 24-feet lifts, with a capacity of 360,000 cubic feet, and one holder at the old works, 60 feet in diameter, by two 20-feet lifts having a capacity of 120,000 cubic feet—making a total storage of 480,000 cubic feet. Provision has been made for increasing the storage on the new works when required.

We trust that the future has in store for the enterprise shown by the Council and their Engineer (Mr. A. J. Harrison) a good measure of reward.

A SHOW-ROOM AT PUTNEY.

How attractive a gas show-room can be made is effectively demonstrated by the Wandsworth and Putney Gas Company in connection with premises of this character which have lately been opened by them for the mutual benefit of their consumers and themselves. But attractiveness, of course, is not everything. To fully serve its useful purpose, a show-room must be in a central position, where the greatest possible proportion of the residents of the locality will be bound to see without seeking it, and where those who are seeking will find it with the minimum of trouble and inconvenience to themselves. This point was naturally fully recognized by the Company, who for some time kept a sharp look-out for a suitable available spot in the most desirable business thoroughfare. The result was that at length they secured exactly what they wanted—a large corner building in the middle of Putney High Street, a famous shopping centre, with every facility of access. In the day time the extensive window space, and at night the big installation of outside lighting, persistently claim the attention of the passer-by. The least observant person could hardly pass by the place without noticing that it had been dedicated to gas. The Company rent the whole of the building; but at present they themselves occupy only the ground floor. Thus there is plenty of room for extension should it at any time be deemed advisable.

Calling on Mr. H. O. Carr, the Company's Engineer, a few days ago, a representative of the "Journal" was ushered into what at first glance appeared to more resemble a handsomely appointed drawing-room than a place designed for the exhibition of gas appliances. This, however, is merely a first impression. A second glance shows that, though in no respect overcrowded, there is a most representative assortment of gas-fires on the floor, and a number of beautifully selected fittings suspended from the ceiling and otherwise fixed. A visitor may enter to admire the interior; but the chances most certainly are that he (or she) will remain to select a gas-fire or some fittings. The room which is referred to here is the first (and the largest) of the series of three that are occupied by the Company. The decoration generally is carried out in the Adam style; and everything is in perfect harmony. Heavy green curtains at the back of the window match the carpet, while the ceiling is an exceptionally fine piece of work. The walls are panelled in a shade of Wedgwood blue, white, and gold (making the place look extremely light and cleanly); and palms and ferns are dotted about the room to add to its pleasing appearance. Messrs. Maple and Co. have done the furnishing well; and, in fact, everywhere the best of taste is displayed. The fire-place, with its rich overmantel and massive brass fender-seat, has in it an armour-bright dog-grate, fitted with a "Blenheim" fire. It might be thought that amid such luxurious surroundings the unfixed gas-fires, marked with both hiring-rates and net purchase prices, would seem out of place; but, on the contrary, they add to the attractiveness owing to many being of delicately coloured porcelain as well as black, and are certainly presented in the most pleasing of aspects. Even the figured tickets are made as attractive as possible; and, above all, as mentioned, there is no overcrowding. Of course, all the latest novelties are to be seen; and various fittings are provided with switches, so that they can be lighted-up for inspection by prospective purchasers. With regard to these fittings, it is unnecessary to say more than that the assortment is thoroughly representative of the latest and best designs; while the silk and beaded shades and glass globes and cylinders cover a wide range.

Stepping from the first room into the second, there are seen illustrations of the uses of gas in the bathroom and kitchen. A bath and wash-basin are fitted with hot and cold water; the means by which the former can be provided being demonstrated by various forms of water-heaters. Here there are to be found more gas-pendants—this time of a less expensive style, so that the wants of all classes of consumers may be adequately catered for; and there are also specimens of gas-irons, gas boiling-rings, coffee-roasters, &c. Leading out of this is the third room, in which are displayed gas-cookers of all sorts and sizes, in exactly the condition in which they are sent out to the consumers. Stores are arranged in bins round two sides of this room, from which they are entirely curtained off. In the centre there is an Edgar ceiling-light, which ventilates out into the open, by means of a flue running to the outer wall of the building.

In the extensive window space an effort has been made to show every useful gas appliance—a remark which is sufficient to enable one to understand the variety of the display. Mention may be particularly made of two beautiful oxidized silver standard gas-lamps, with silk beaded shades. There are also set out fires and cookers, muffle furnaces for art enamelling, a gas fire-lighter, a singeing burner, a painter's burning-off tool, and other things too numerous to name. In fact, a careful study of the window would form a liberal education in the multifarious uses to which gas can now be usefully applied.

The outside lighting is on such a generous scale that the premises are, without doubt, the finest lighted in Putney. At the

An Exterior View of the Wandsworth and Putney Gas Company's New Show-Room during Lighting Hours.

corner of the building there is a Keith high-pressure three-burner cluster inverted lamp, credited with a light of 4500-candle power, and round the sides there are eight single-burner lamps on the same system, each of a capacity of 1500-candle power. The lamps are believed to be fully up to their stated power, if not to even exceed it. The gas is supplied at 80 inches pressure by means of a compressor in the basement of the building; and so successful is the installation, that a neighbour has already applied to have two lamps run off the same supply. A pipe from the high-pressure main also runs through the two rear show-rooms, and to it are connected lamps of various types, which can thus be seen in operation when desired by visitors. In connection with this matter, it may be mentioned that the Company are supplying a line of shops at Earlsfield on the high-pressure system; and the demand for the light has so grown, that it is in a fair way to outstrip the capacity of the machinery so far put down.

Sufficient has been said here to justify us in congratulating, a[s] we do, the Directors of the Wandsworth and Putney Gas Company on the excellent step which they have thus taken to assis[t] the distribution side of their progressive undertaking—a ste[p] which can hardly fail to still further popularize the remarkabl[y] cheap gas supply which they offer to consumers. As a matte[r] of fact, the first week's business has proved to be four times tha[t] of the old show-room within a minute's walk—but in a less im[-]portant thoroughfare, and smaller premises.

An Interior View of the Wandsworth and Putney Gas Company's New Show-Room.

EXTENSIONS AT THE ILKESTON GAS-WORKS.

In the spring of 1907, the Ilkeston Corporation decided to adopt a scheme submitted to them by the Gas Committee for enlarging and modernizing their works, in accordance with plans prepared by the Gas Engineer, Mr. F. C. Humphrys. It included the acquisition of 9611 square yards of land (separated from the existing works by a public road), to be utilized for coal sidings and storage, and also for screening and loading coke and for general stores. The legal proceedings were somewhat complicated, and caused delay. Certain objections were raised by the Local Government Board; and two inquiries had to be held—the second on the 9th of March last year. The following July, however, the Corporation obtained a Provisional Order granting them power to use the new lands for the manufacture or storage of gas or residual products. Meanwhile, the engineering works were being pushed on as rapidly as possible; the following contracts having been arranged: Gasholder and tank, Messrs. C. & W. Walker, Donnington; retort-house and boundary wall, Mr. J. G. Short, Nottingham; compressor and pressure raiser, the Bryan Donkin Company, Chesterfield; governor and connections, the Gas-Meter Company, Oldham; stoking machinery, Messrs. Aldridge and Ranken, Bath; coal-conveying plant, standards, and generating plant, Messrs. Robert Dempster and Sons, Limited, Elland; power-house and coal-store, Mr. J. G. Short; siding, Mr. T. W. Ward, Sheffield; coke plant, Messrs. Robert Dempster and Sons, Limited; and weighing-machine, Messrs. Hodgson and Steale, Salford. Other contracts were entered into with the Midland Railway Company, for a connection between their line and the gas-works siding; with the Stanton Iron-Works Company, for cast-iron pipes; with the British Mannesmann Tube Company, for high-pressure steel tubes; with the Lead Wool Company, for jointing material.

With these preliminary observations, we proceed to give a description of the works.

Gasholder and Tank.

The gasholder is built on the spiral-guided system, on the most modern and improved lines. It has two lifts; but provision is made for a further lift to be added when additional storage is required. This would be the outer lift, and the present outer would then become the middle lift. The two lifts are 108 feet, and 110 ft. 6 in. diameter respectively, each being 25 ft. 6 in. deep; and when fully inflated they contain 453,000 cubic feet of gas. To guide the lifts in rising and falling, bulb-headed T-rails are fixed to the sides. They pass between rollers which are secured in strong carriages; these in turn being strongly bolted down to the top of the tank and to the top of the outer lift. The tank is of steel throughout, and is 115 feet in diameter and 26 feet deep. It has a capacity of 1,673,330 gallons of water, the weight of which is 7600 tons. In constructing it and the holder, 330 tons of steel were used; so that the total weight bearing on the concrete foundations is equal to 7930 tons. In joining the various parts of the structure together, upwards of 220,000 rivets were used, varying

View Showing the Feeding Platform and Inclined Track for the Travelling Hopper, also the Bridge over the Roadway and the Storage Hoppers.

from $\frac{7}{8}$ to $\frac{1}{4}$ inch in diameter. At the top of the tank a walk-around, formed of steel chequered plates, is fixed; access to it being gained from the ground by a steel ladder. From here the carriages at the top of the tank, and also those on the dip of the outer lift, can be attended to; the latter being accessible when the outer lift is landed in the tank. Ladders are carried up the sides of the holder, giving access to the crown.

Coal and Coke Handling Plant.

The coal-handling installation, supplied by Messrs. Robert Dempster and Sons, Limited, consists of an electrically-operated capstan for hauling full trucks over the receiving hopper and taking the empty waggons away. The coal, when discharged from the waggons, falls into the steel receiving hopper, and from this is delivered automatically by means of a sure-feed arrangement in regular quantities to the elevator. The elevator delivers the coal into an overhead push-plate conveyor, running the full length of the new coal-store, and arranged with outlets, so that the coal may be dropped into the store or be delivered through the end of the store on to the first band conveyor crossing over the public road already referred to, and delivering on to the second band conveyor skirting the private property alongside the gas-works, and delivering on to the end of the push-plate conveyor fixed over the coal-hoppers extending over the whole of the nine arches. These overhead hoppers are all fitted with Messrs. Aldridge and Ranken's patent automatic outlet-doors, working in conjunction with a Fiddes-Aldridge patent combined stoking-machine. The coal-handling plant is capable of delivering 20 tons per hour from the siding, either into the coal-store or into the overhead bunkers in the retort-house. All these conveyors, &c., are driven from an electric generating installation described later on.

In the new retort-house have been built nine arches, each 9 ft. 5 in. span and 20 feet through, each capable of receiving eight retorts 23 inches wide and 16 inches deep, of special ◠ section, to suit the Fiddes-Aldridge stoking-machine. Six of these arches are fitted up complete with furnaces, mouthpieces, ascension-pipes, hydraulic mains, &c. Coal-hoppers are fitted up over the whole of the nine beds; the floor on the charging side being made for the full length of the house, and on the discharging side for five beds only—*i.e.*, one past the settings. This floor is laid 2 feet lower than the charging-floor, and is fitted with rails to enable ordinary coke-trucks to take coke from the bottom retorts. The settings are on Brooke's patent tubular regenerator system.

The whole of the gas is taken off from the discharging end of the retorts through 7-inch ascension-pipes into hydraulic mains 2 ft. 6 in. wide in the gas space, and with a 6-inch space which can be opened for cleaning purposes while gas making is in progress. The foul main and tar mains are laid over the whole of the nine arches; the former being fitted with an 8-inch retort-house governor, and the latter delivering into a tar-tower at the end of the bench. The coke is pushed from the retorts direct into coke-trucks running on the rails previously described. These rails are continued outside the house round to the coke-pit. The trucks are of Messrs. Dempster's patent side-door type, fitted with ball-bearing wheels, and running so lightly that one man can easily handle a truck when charged with the coke from two 20-feet retorts.

After leaving the retort-house, the trucks are run under coke-quenching sprays, and afterwards discharged on the ground or

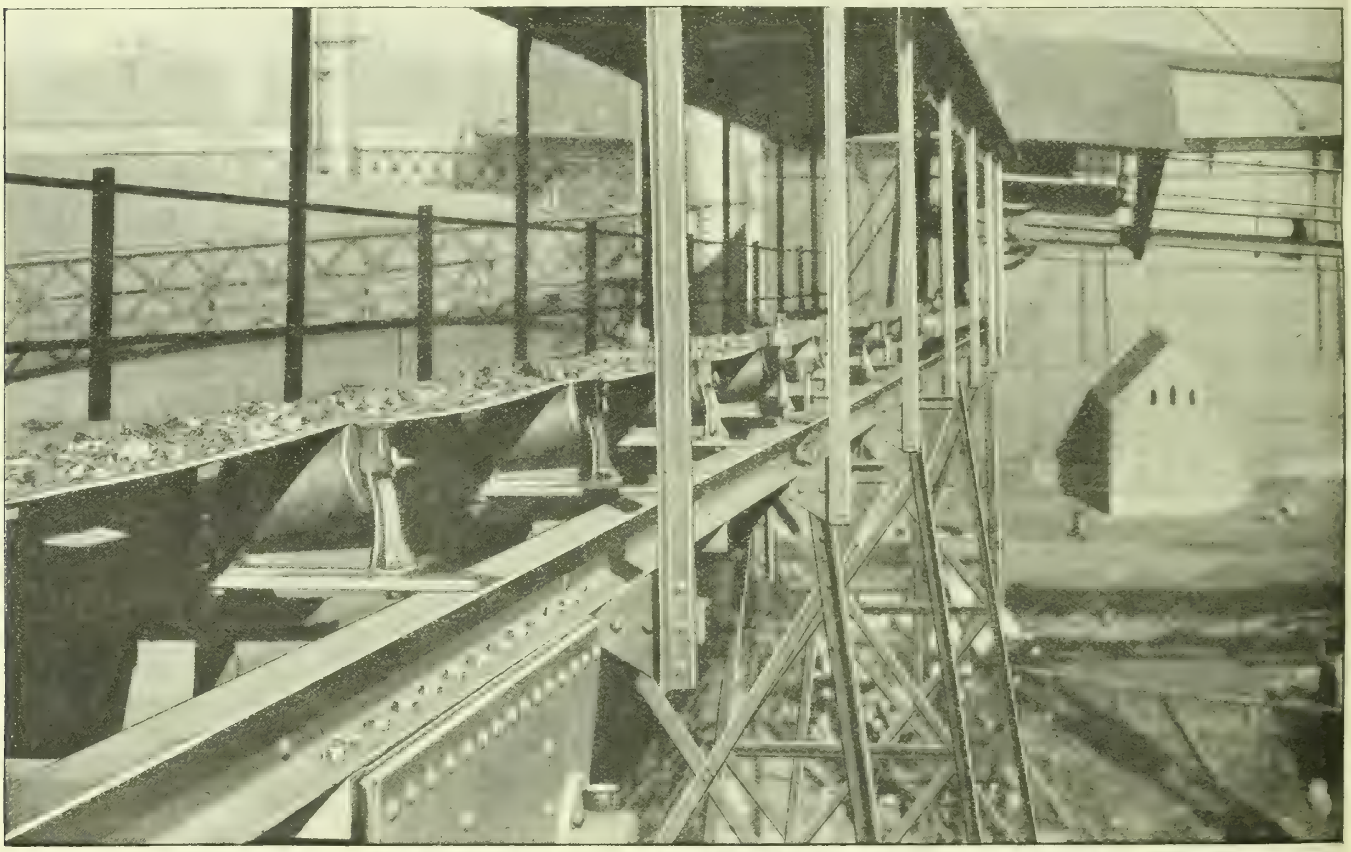
run over the coke-receiving pit, and emptied into a travelling hopper running on a track to the top of the screening plant. The bottom of this hopper is fitted with a quadrant outlet-door, with catches for engaging with striking gear, so that the discharge will be automatic at any required point on the track. The whole of the operations in connection with this hopper are controlled by a lever; the gear being so arranged that it is impossible for the attendant to start the winding gear in the wrong direction. In addition to this, there is an automatic shut-off both at the top and bottom of the track. The capacity of the hopper is about two tons, so that 10 to 15 tons per hour can easily be handled and delivered to the screening plant or to the stack in the coke yard. Over the screening plant is fixed a hopper, which receives coke direct from the travelling hopper. From this hopper coke is delivered in regular quantities by means of a feed device on to an impulse conveyor, which screens the coke and delivers it into hoppers below.

The motive power for the whole of the plant is obtained from two 22-kilowatt dynamos, compound wound, directly belt-driven from two "National" gas-engines of 42 H.P., with two switchboards complete with voltmeters and ammeters, &c., and each being specially fitted with a reverse current breaker, so that both dynamos can be run separately or in parallel. From these dynamos separate circuits are laid to each motor as follows: (1) Motor for driving the capstan for hauling trucks in the siding; (2) motor for driving the elevator and push-plate conveyor in the coal-store; (3) motor for driving the first band conveyor, taking coal from the push-plate conveyor; (4) motor for driving the second band conveyor and push-plate delivering to the retort-house hoppers; (5) motor for driving the travelling coke-hopper up the inclined track; (6) motor for driving the impulse conveyor screen; and (7) motor for driving the Fiddes-Aldridge stoking-machine. In each case a starter is fixed in the most convenient position, close to the motor it actuates.

The electric plant is housed at the gable end of the retort-house, close by one of the main entrances to the works. The whole of the contract for the above work, with the exception of the stoking machinery and the buildings, was carried out by Messrs. Robert Dempster and Sons, Limited.

Gas-Compressing Plant.

The portion of the town of Ilkeston which is situated on the side of the hill farthest from the gas-works is supplied from a holder of a capacity of 30,000 cubic feet. Up to a short time ago, this holder was kept filled by means of an exhauster, driven by a gas-engine which drew gas from the mains and pumped it into the holder. This arrangement had several disadvantages. It necessitated a man being in constant attendance on the plant at the holder, which it was only possible to fill at certain hours, as the draught on the main when the exhauster was at work interfered with the supply to the consumers; and it was also necessary to raise pressure at the works while the holder was being filled.



Details of One of the Band Conveyors; Showing the Structural Work Supporting it and the Gangways.

All these difficulties have now been overcome, and many advantages gained, by the installation of a gas-compressor at the works, which is connected to the holder by 2½ miles of 3-inch Mannesmann steel tube, the joints of which are made with lead wool.

The method of working is for the man, who still lives near the holder, but who is now engaged at the gas-works, to note every morning the quantity of gas needed to fill the holder. The compressor is then started, and the required quantity is sent out; being measured by a rotary meter on the compressor outlet. By this arrangement an adequate supply of gas is assured to the district, however it may increase, as the holder can be filled at any time without interfering with the consumers. All the machinery is now at the gas-works, and it is no longer necessary for a man to be in attendance at the holder. There is at present no automatic arrangement for shutting off the holder when full; but this could easily be fitted any time if found necessary. The house at the holder is, however, in telephonic communication with the gas-works.

The compressing plant, which, as already mentioned, was supplied by the Bryan Donkin Company, Limited, of Chesterfield, consists of a rotary compressor, capable of passing 3500 cubic feet of gas per hour, coupled direct to a horizontal steam-engine on a base-plate. The engine is fitted with a Pickering governor, and the compressor with an excess pressure valve, which can be set to give any desired outlet pressure. The compressor is capable of pumping up to 3 lbs. per square inch; but the pressure required when filling the holder is generally about 20 inches of water. A rotary meter is fitted in the outlet main, and registers the quantity sent out to the holder. The whole arrangement is found to work with the utmost smoothness, and it gives no trouble.

Station Governor and Connections.

The governor is of the most improved self-acting and compensating type; the valve being of the cylindrical pattern, with parabolic openings, so arranged as to give a constant outlet pressure whatever draught there may be. The pressure is regulated by a special water-loading arrangement on the top of the bell, and is so arranged that any desired pressure can be obtained, which can be increased or decreased so gradually that the change is not perceptible in the mains. The bye-pass consists of six 16-inch improved internal rack-and-pinion slide-valves, and all the necessary pipe connections, together with a special 24-inch distributing-main. The valves are fitted with columns or standards, with polished bright hand-wheels and brass indicators. The old governor has been thoroughly overhauled, and works in connection with the new one, each having a separate district to control. By means of a special system of connections, each is capable of doing the work of the entire district.

The Scottish Junior Gas Association (Western District) are to pay a visit next Saturday to the Atlas Locomotive Works, Springburn, Glasgow.

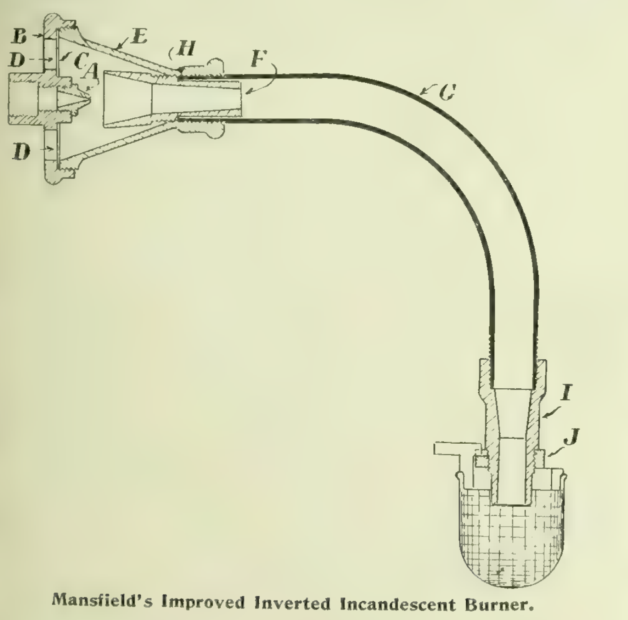
MANSFIELD'S IMPROVED INVERTED INCANDESCENT GAS-BURNER.

It will probably be remembered that early last year Mr. Alfred Mansfield, of the firm of Messrs. Mansfield and Sons, Limited, was appointed by the Corporation of Calcutta to confer with them on the subject of the public lighting of the city; and that shortly afterwards he made a report which appeared in the "JOURNAL" for the 9th of March. The result was the conclusion of a new contract with the Oriental Gas Company, and a reorganization of the public lighting service. Mr. Mansfield thereupon instituted inquiries with the view of obtaining burners suitable for the city of Calcutta; but he was unable to find one which would exactly meet the requirements of the authorities. These were that an inverted burner should be used, the gas pressure being 2 inches of water; that the consumption should range from 1 cubic foot to 4 cubic feet, according to the streets which had to be lighted; and that the burner should allow of incandescent lighting throughout the whole place, without having to resort to mixed flat-flame and incandescent lighting. Though the consumptions were in some cases to be very low, the efficiencies of the burners had to be high; and, after months of experiment, these have been arrived at, and at the same time great economies have also been effected.

Mr. Mansfield's new burners, which have been patented in all important countries, involve many new points, which consist essentially of the following: A nipple is used giving a definite supply of gas at any given pressure. There is a free air-way, which allows the force of gas to draw along with it whatever quantity of air is necessary for the burner. This is predetermined by a small tube or injector in the body of the burner. To avoid lighting-back, a mixing-tube of definite diameter and length is used; and at the end of this there is the usual nozzle orifice, together with the mantle holder. The positions of the mantles are decided in direct proportion to the diameter of the nozzle orifice. The length of the cone of the bunsen flame is arranged to be double that of the nozzle orifice, and the mantle three diameters of the outgoing nozzle from the end of it to the bottom of the mantle. A very large number of tests have been made with every available apparatus; and we are assured that the result is perfect, approaching 30 candles per cubic foot with a consumption as low as 2·2 cubic feet of gas per hour. Economy of gas is a great matter with lighting authorities; and when a burner can be obtained to give such high results as those mentioned, suppliers of gas have nothing to fear from Osram lamps, or anything else that can be put forward, especially when the same candle power can be repeated practically indefinitely—the only limitation being the quality of the mantles, the gas being always the same in calorific value.

Abstract of Patent Specification—No. 20,343; Aug. 31, 1910.

The invention has for its object "improvements in atmospheric burners for use with illuminating gas, and especially for mantles." The patentee remarks that a burner of definite dimensions will not work properly when used with different qualities and pressures of gas; to obtain the maximum of efficiency from any burner, it must be designed for the quality of gas as well as the pressure of the same with which it is used. A gas-burner of definite dimensions will not work properly when used with gas of a quality for which it was not originally designed; consequently, as the quality varies in nearly every town, it follows that any given burner varies in efficiency in each town.



Mansfield's Improved Inverted Incandescent Burner.

The burner consists essentially of a base plate, a nipple entering the base plate, a mixing-chamber at the back of the base plate, a gauze therein, an injector projecting from the chamber, a nozzle or burner proper, and a tube or connection connecting the nozzle with the conical orifice from the mixing-chamber.

As shown, the size of the nipple A governs the quantity of gas that has to be passed through the burner at the point of combustion, the diameter of the nozzle I regulates the required length of flame; and the height of the mantle support gives the amount of mantle surface to be exposed to the heating effect of the burning gas. By, therefore, screwing down the carrier J, the length of mantle exposed to the burning gas can be increased. Any consumption of gas can be arranged for—from ½ cubic foot an hour upwards to 5 cubic feet, with the same burner, by simply changing the nipple A, nozzle I, injector F, and mantle, the latter of which can be of the ordinary commercial type. By thus making the nipple, injector, and nozzle interchangeable (there being for each a considerable number of varieties), the "very highest efficiency for any kind of gas and any pressure can be secured." It is preferred to have the tube G arranged so that it can be screwed in and out a little by the adjusting connection H, so as to still further regulate it. But, as the patentee points out, "this is a comparatively small matter, as each tube is made of the right contour for best efficiency."

Attempts have, he continues, been previously made to obtain this result by providing regulating gas-nipples, and devices such as a hit-and-miss grid for controlling the primary air supply; but these methods have serious objections when used for such purposes as public lighting where the adjustment is frequently inadvertently altered by the lamp cleaners. "Consequently, in many places gas-burners are rapidly rendered useless by being choked with dust and insects which are drawn in with the primary air supply. They are also frequently of great annoyance owing to incomplete combustion, and consequent noisome smell."

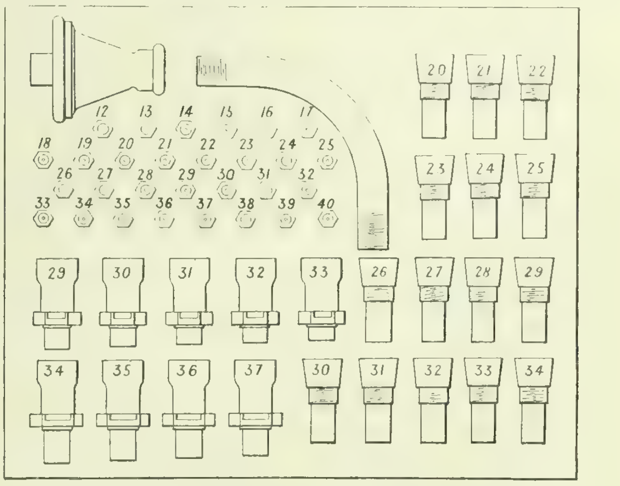
In order to prevent the gas from lighting back at the injector nipple, various forms of gauze and perforated cones have been introduced in the mixing-tubes of burners. These also rapidly become choked with insects and dust, and also by the corrosive action of impure gas. With gas-burners as at present constructed, the nozzle in which the gas burns is of definite diameter; and the consumption of gas by such a burner is always an unknown quantity. If the burner has been constructed to consume (say) 4 cubic feet per hour of one quality of gas, it will probably require 5 feet of a different quality of gas to work successfully.

By the present invention, it is possible to adapt the apparatus to any condition required for lighting and to any quality of gas. The inventor has found that the flame of the atmospheric burner when working at its best gives a clearly defined inner cone of unconsumed gas, which measures twice the diameter of the orifice from which the gaseous mixture is issued—that is to say, if a nozzle is fixed which has an issuing nozzle of 0·4 inch in diameter and after lighting the gas a measurement is taken from the end of the nozzle to the apex of the inner cone of the flame, this dimension should be 0·8 inch in length. Further, it is found that when used with an inverted mantle, the bottom of the mantle should be three diameters of the nozzle from the end of the latter to obtain the maximum efficiency. In the instance above mentioned, therefore, where the nozzle is 0·4 inch in internal diameter, the bottom of the mantle should be 1·2 inches from the end of the nozzle; and this can be regulated to a nicety by screwing up and down the carrier J.

When a nozzle of the desired aperture has been thus placed in position, the injector F is fitted into the chamber E; and the cone screwed up against the gauze C and the plate B. The gauze now prevents any insects and nearly all dust from entering the air-chamber at D. The connection H is screwed on to the air-chamber; and the requisite nozzle is adjusted in place. The mantle must be three times the internal diameter of the particular nozzle from the latter.

A little experience will show the operator exactly what alterations he should now make in the nipple, injector, and the nozzle—all these three being made of numerous sizes, each of which is interchangeable with the others. When, therefore, the operator comes to fix the burner, he first ascertains (from tables or otherwise) the size of injector F required for the particular purpose under consideration. A nipple which consumes the required quantity of gas at the regular pressure is selected; and experiments are tried with different sizes of nozzles until the proper size has been found to give a cone which has a length of twice the diameter of the nozzle. The burner so adjusted will give the maximum efficiency which can be obtained from the quality of gas available. It will also be found that as the burner is then correctly designed for the quality of gas, there is no danger of lighting-back, and no necessity for gauzes or other obstructions being placed in the mixing-tube or over the nipple.

We give below a diagram showing the box containing the necessary body, tube, nipples, and nozzles which Messrs. Mansfield use for the purpose of determining the correct burner for any kind of gas at any pressure.



Sample Case for Mansfield's Inverted Burner.

It will be noticed that the nipples are marked from 12 to 40. This represents the diameter of the hole in thousandths of an

inch. The injectors and nozzles are marked similarly; but in this case the measurements are in hundredths of an inch. This allows of each part having a definite relation to another. The consumption of gas is settled by the pressure and size of the nipple. The size of light and mantle is determined by the size of the nozzles; and the injectors settle the question of the quality of the mixture by the practical measuring of air in proportion to the quantity of gas sent forward by the nipple at whatever pressure is available. Messrs. Mansfield consider that the pressure should be 2 inches and upwards, as they find that no burner of the inverted type works well at less than this pressure.

POWER GAS AND ITS DEVELOPMENT.

A Lecture at the Sir John Cass Technical Institute.

In the well-equipped and commodious lecture-hall of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., there was delivered to a good audience on Monday evening of last week the inaugural lecture of a course of instruction in "Fuel." The lecturer was Mr. J. S. S. Brame (who is Lecturer on Fuel at the Institute); and he took for his subject on this occasion "Power Gas and its Development."

The chair was occupied by Professor F. Clowes, D.Sc., who, in his opening remarks, said that he had watched the progress of the Sir John Cass Institute with great interest. He felt sure, when he saw the manner in which the whole scheme was being supported, and the handsome resources which were at the command of the governing body, that the Institute would prove to be a highly successful one; and when his friend Dr. Charles A. Keane was appointed Principal, he was convinced that this success was still further guaranteed. The completeness of the equipment and the arrangements for scientific teaching were wonderful; but perhaps the most gratifying thing of all was the way in which students, who had been at work all day, would come to the Institute in the evening and devote themselves to the acquisition of knowledge—though when they looked at the names of the teachers, it could really cause no surprise that people should be willing to travel even long distances to hear such men and benefit by their instruction. The subject to be dealt with by the lecturer that evening was one of the greatest importance. One of the most uncomfortable thoughts that were forced upon them nowadays was that their fuel was not only being used in a reckless and random fashion, but in such a manner as to cause the very greatest nuisance. He need not speak to them of the inconvenience and loss which were occasioned by the smoke nuisance. It was a disgrace that such a nuisance still existed. The advance from the burning of raw, solid coal fuel to gaseous fuel, which was to be dealt with in the lecture, was a great step; and they must hope that some of the solid forms of fuel derived from coal would prove successful in assisting the development of the consumption of fuel economically and without causing nuisance. The use of fuel in an objectionable and an extravagant manner would be checked if they kept an account of the heat effect obtained by its consumption. This was done in many works, where the fuel was so burnt that the combustion was as perfect as possible, and the loss of heat was therefore minimized. They could only hope that progress on these lines would defer to a very considerable extent the time when they would find that the coal supplies were vanishing. An attempt was being made to do in England what was done elsewhere—pay for fuel at its heat-producing value. This, surely, was a step in the right direction. They bought other commodities on the basis of the value of the materials which they contained; and, of course, what they required in the fuel was its capacity for producing heat. They ought, under these circumstances, to know the heat value of the fuel they were using, and let its cost be assessed on this.

Mr. Brame then proceeded to deliver his lecture, which included descriptions (with the aid of lantern slides) of various forms of pressure and suction gas plants, and an outline of the general principles underlying the action of apparatus of this character. In opening, he remarked that the introduction of power gas would become a factor of great national importance in the very near future. Economy in coal consumption was one of the things they would be forced to face boldly before many years had elapsed. There could be no doubt that they had been extremely great spendthrifts in this matter. Of course, in some special industries it would be impracticable to economize in the use of coal for purposes for which it was required. For instance, in gas-works they must not expect any reduction in quantity, but rather the reverse. When, however, they came to blast-furnaces and coke-ovens, it would be seen that they had been absolutely lavish in the expenditure of the available heat units. By the introduction of big gas-engines, it was possible to utilize a large quantity of the heat units which formerly passed away in the waste gases. In coke-oven gas, also, there was a tremendous potential source of power. One English firm were saving £1000 per week on these lines; and there was an iron and steel works on the Continent where a fuel saving equal to £75,000 a year was effected.

Referring to the question of the present output of coal, the lecturer said the total coal production for 1909 was 263¾ million tons; and the annual home consumption some 180 million tons. It was difficult to estimate how this consumption was distributed; but it might be roughly computed that 45 million tons were utilized for power purposes, 20 millions for blast-furnaces, while some 17 millions were carbonized for the production of gas. Of course, it was to the demand for coal for power purposes that they must turn to realize the economies which were possible through the introduction of power gas.

He was not going to say that the steam-plant of this country would be entirely scrapped; but from the tendency of the times, and from the general economies which could be shown to arise from the introduction of gas power in many cases, it was not too much to hope that a very considerable reduction would be made in the quantity of coal consumed for steam raising. If out of the 45 million tons so used they could save only 9 million tons, this would be 5 per cent. of the home consumption of coal, and 20 per cent. of the total used for power purposes. Not only did they save coal in this way by the use of power gas. There was another factor of even greater importance which would arise from it. Power gas made possible the utilization of a vast quantity of fuel which would otherwise be quite unsuitable for employment as a power-raising agent. Several plants had been put down for the production of power from peat; and much colliery refuse which could not be otherwise used could be employed for power-gas making. Then, again, some wood-working factories were now using suction-gas plants fed only with waste wood or sawdust. In fact, a number of waste products in manufacturing operations could be utilized. A ton of dry peat yielded some 1000 B.H.P. per hour, together with from 70 to 200 lbs. of sulphate of ammonia worth £11 to £12 per ton. When it was remembered that in Europe there were 140 million acres of peat bog, often 14 to 16 feet in thickness, it would be seen that the utilization of but a small portion of the energy here stored up would effect a large saving of coal for other purposes.

Continuing, Mr. Brame said they must exercise discretion as to the way in which they purchased fuel. Until now, people had been in the habit of buying merely a ton of coal. But the quality of coal in relation to its calorific value would vary enormously, even in the same seam. It was no guarantee of the heat units contained in a coal to say that it came from a particular seam in a particular colliery. The only scientific plan was to say that one was buying for a penny so many heat units—making a deduction according to the amount of ash, &c., in the coal which would affect its value to the user. This system was becoming widely adopted in America, and was coming along in this country. He hoped the idea would spread more in the future.

As regarded fuel costs, the efficiency of power gas was approximately 20 per cent., while with steam 9 to 10 per cent. was a fair average. For small powers, suction gas was not a competitor with pressure gas from bituminous fuels, since gas plants using this class of fuel were unsuited for small powers by reason of their higher first costs and working charges. The pressure plants for non-bituminous fuels offered great advantages where gas was required for heating in addition to power. Pressure gas was usually somewhat richer than suction gas, and was more uniform in composition, since its production was continuous, while that of suction gas was intermittent. On the other hand, for small power plants a suction-gas apparatus offered so many advantages—such as compactness, low cost, and simplicity of working—that its rapid introduction was easily understood. Hitherto the choice of fuels had been limited to anthracite and good quality coke. The use of bituminous fuel, with its manifest advantages in the matter of supply and price, had until quite recently been impossible, owing to the difficulty of removing the tar from the gas; but practically all the leading makers now supplied suction plants which it was claimed worked well with such fuels.

As to the relative merits of coal gas and suction gas for small power plants, the lecturer showed that little advantage was obtained by the adoption of suction gas when cheap town gas was available—what little gain there was, he said, being quite counterbalanced by the conveniences arising from a town gas supply, and the total absence of stand-by charges. Above 30 H.P., however, the advantages of suction gas rapidly increased. The success of suction gas plant working on bituminous fuels (even of the most unpromising character) being now established, the extension of the use of this type of plant was likely to be very rapid. Systems of scrubbing the gas would be improved, when it was realized that such a process was essentially not a filtering one. The utilization of the exhaust from the engine instead of steam through the producer had given promising results; the poor quality of gas being more than counterbalanced by the higher compressions rendered possible in the cylinder. The abolition of the gasholder where pressure gas was needed for power purposes only, and the control of production according to demand by fans automatically working with the engine, was almost universal in German practice.

By the bequest of the late Mr. Frederick Tendron, the Deputy-Chairman of the Continental Union Gas Company, whose death was announced in the "Journal" for the 19th of April last, the Trustees of the British Museum have recently acquired a few choice mineral specimens. Conspicuous among them is a magnificent, and probably unique, crystal of pyrrhotite, measuring as much as 5½ inches across. The suite also includes smaller specimens of pyrrhotite, two specimens of the rare mineral chalmersite, some well crystallized gold, &c.

THE VALUATION OF THE ILLUMINATING VALUE OF GAS BY ITS CALORIFIC POWER.

By Dr. MAX MAYER, of Berlin.

A brief abstract was given in the "JOURNAL" for the 28th of June last (p. 960) of a paper read by Dr. Max Mayer, of the German Welsbach Company of Berlin, at the annual meeting of the German Association of Gas and Water Engineers at Königsberg, dealing with the subject of the valuation of gas for lighting purposes according to its calorific power. The paper is now published in full in the "Journal für Gasbeleuchtung," and some particulars may be added to those given in the abstract which appeared at the time the paper was read.

The author points out that whereas when gas was used for lighting by means of flat-flame and argand burners its quality was simply determined by photometric measurements, the introduction and general adoption of incandescent lighting have raised the question of how gas for lighting and heating purposes is to be valued. Gases which were formerly not applicable for lighting are now available, since the effect of lighting by incandescence depends upon (1) the temperature of the gases produced by the combustion, and (2) on the method in which combustion takes place, as conditioned by the burner and mantle used. M. Sainte-Claire Deville in 1903 first propounded, on the basis of the results of experiments he had carried out, that illuminating gas should be valued according to its calorific power. He and others have made further investigations to prove the tenability of the proposition that the illuminating power of a mantle is proportional to the heat expended upon it. But this question has not been satisfactorily disposed of, as appears from the lecture delivered last year by Professor Bunte, on "What Quality of Gas is Called For?"* and by the investigations made by Mr. A. Forshaw, who in his paper on the "Illuminating Efficiencies of Carbon Monoxide and Hydrogen Used in Conjunction with Incandescent Mantles"† denied that there was any relation between calorific value and illuminating power. Some reference must be made at first to earlier researches, with a view to filling up gaps and obtaining data for criticizing Mr. Forshaw's work.

It is clear that the conditions of combustion are of great importance so far as the utilization of the gas is concerned; and in this connection the effect of the burner takes precedence. In the ordinary bunsen burner, the air required for complete combustion of the gas is introduced in two ways. One portion—viz., the so-called primary air—is mixed with the gas before combustion; while the remaining portion, known as secondary air, finds access to the flame from the exterior. There is, therefore, first a combustion of the primary air in the gas, resulting in the production in the inner cone of the bunsen flame of a mixture of water gas diluted with nitrogen; the water gas thus produced being burnt in the outer cone by means of the secondary air.

The effect of the distribution of the air between the primary and secondary supplies on the illuminating power of the mantle was first precisely determined in the investigations made by Bunte, Mayer, and Teichel. The results of their work may be briefly summarized as follows: When the gas consumption is unaltered, and consequently the quantity of heat is constant, if but little primary air is mixed with the gas a flame of large volume is produced. If the primary air is increased, and the quantity of secondary air is correspondingly diminished, the volume of the flame is less. The smallest volume of flame is attained when the air requisite for complete combustion is introduced solely as primary air. A consequence of this condition is that the fall of heat from the flame to the mantle is lower than in any other case; and thus the mantle in these conditions attains its maximum temperature and its highest illuminating power. It follows, therefore, that with the same expenditure of heat or, in other words, the same consumption of gas, it is possible to obtain in the same burner quite different illuminating effects if the quantity of primary air, and consequently the volume of the flame, is altered. The author made experiments in this connection by comparing gases of different composition photometrically in the same burner with the admission of air under pressure, so that the gases produced by combustion gave a flame of the smallest volume and raised the mantle to the highest temperature. These investigations showed that in such conditions Deville's proposition, that a direct relation subsisted between illuminating power and calorific power, was maintained within 10-12 per cent. The shape of the flame becomes extremely important, because it affects the rate of flow of the gas on to the mantle. The greater this rate of flow, the more heat reaches the mantle in unit time, and the greater, therefore, is the increase in the temperature and in the illuminating power of the latter. With mixtures of coal gas and hydrogen, and coal gas and carbonic oxide, experiments showed that, within a range of 416 and 546 B.Th.U. net calorific power, practically the same illuminating result was obtained for the same expenditure of heat. Hence it was concluded that Deville's proposition was a law very generally applicable. These experiments, however, like Deville's, were carried out with air or gas under pressure; and they applied directly only to burners supplied with air or gas under pressure, and therefore working with a sufficiency of primary air for complete combustion. But quite another problem is presented by the question of the utilization of gases of high and low calorific power in low-pressure burners—that is to say, in ordinary upright and inverted incandescent burners.

The view has been repeatedly expressed that poor gases or gases of low calorific power show a better efficiency in low-pressure burners than rich gases. It has been emphasized that gases of low calorific power require less air, and consequently, in similar conditions of burner and pressure, can more easily draw in the amount of air necessary for complete combustion, with the result that a flame of smaller volume, and consequently a higher temperature of the mantle, are produced. In this way, an explanation of the reason why poorer gases in the ordinary bunsen burner give a better lighting efficiency than rich gases which require more air, is supposed to have been afforded. As a fact, however, the conditions are entirely different, as will be shown later. Deville's law would exactly apply for low-pressure burners, in which the combustion is completed in two stages, in the inner and outer cones of the flame, if, for the same quantity of heat employed, though different gases were used, the volume and shape of the flame and the distribution of the temperature in the interior of the flame were similar. Lamps working with air or gas under pressure are supplied with the theoretical quantity of primary air, and therefore the combustion gases reach their maximum temperature in the inner cone. On the other hand, in low-pressure lamps the combustion takes place in two stages, by the admission of primary and secondary air; and hence there is a rise of temperature between the inner and the outer cone which leads the author to speak of the temperature distribution in the interior of the flame.

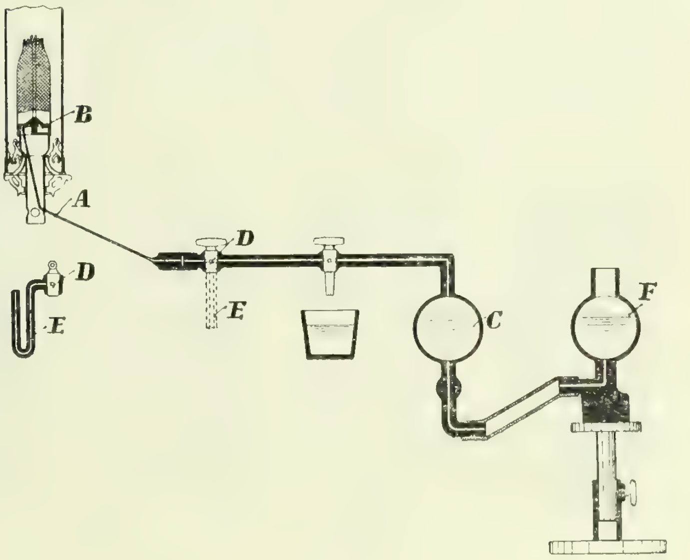


Fig. 1.

If gases of low or high calorific power are used in one and the same burner, and different proportions of primary air relatively to the total air required for the consumption of the gas are drawn in to the burner, the differences in light referred to would be expected to appear. In order to elucidate these conditions, the author carried out experiments on three upright burners—one being an ordinary Welsbach burner, and the other two burners, designated A and B, of lower consumption. The burners were first of all tried, with a well-fitting mantle which had been in use previously for 50 hours, with coal gas, and so adjusted as to afford the maximum illuminating power. The amount of heat employed was calculated from the gas consumption and the calorific power of the gas. The proportion of air required for the complete combustion of the gas was then determined on a sample. Another sample of gas was drawn from the mixing-tube of the burner immediately below the flame and analyzed for the purpose of ascertaining the quantity of primary air sucked in. The proportion of primary air per cent. of the air required for complete combustion of the gas was then calculated.

The samples of gas from the mixing-tube of the burner were taken by means of the apparatus shown in fig. 1, in which A is a finely-drawn glass capillary (of very small cross section relatively to that of the burner tube), which is carried through the wire gauze B of the burner into the inner cone of the flame. The capillary A is connected with a mercury pipette C having in the connection a three-way cock D, the third way of which communicates with a pressure-gauge E. The levelling vessel F can be moved up and down and set at any height with great precision. The pipette C is of about 150 c.c. capacity, and the filling of it with a sample occupies about one hour.

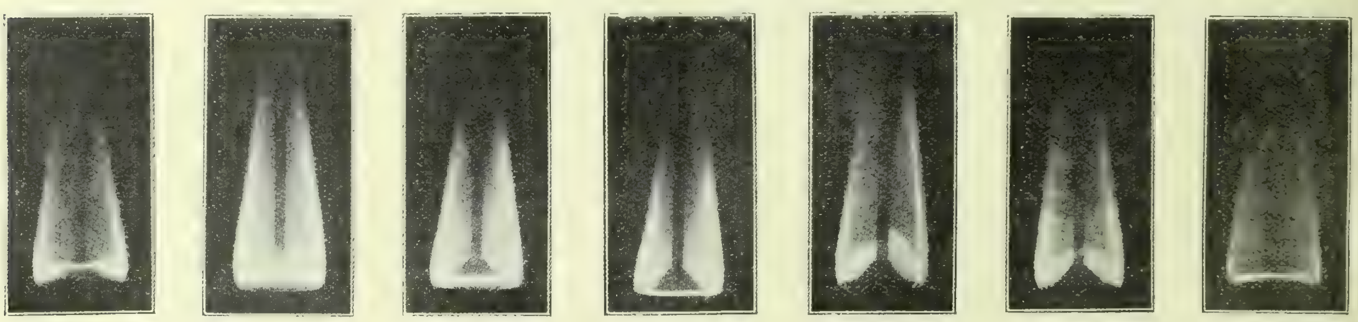
After the conditions for coal gas had been determined in the manner described, gases of varying composition and different calorific power were employed; the same amount of heat being expended as in the case of the coal gas. Gases of different calorific power were produced—some by carburetting coal gas with benzol, and in other cases by carburetting it with oil gas. Gas carburetted in these two different ways was purposely employed, with the object of observing just what effect different constituents exerted. Gas of low calorific power was produced by diluting the coal gas

* See "JOURNAL," Vol. CVII., p. 831. † *Ibid.*, Vol. CVI., p. 865.

or the two descriptions of carburetted coal gas with hydrogen. The specific gravity of the gases was determined and photographs were taken of the flames produced when the same amount of heat was being expended, in order that a record of the different shapes of the flames with the different gases might be obtained. After each trial of a new gas a check determination with coal gas was carried out, in order to ascertain that the lighting effect of the mantle had remained unaltered.

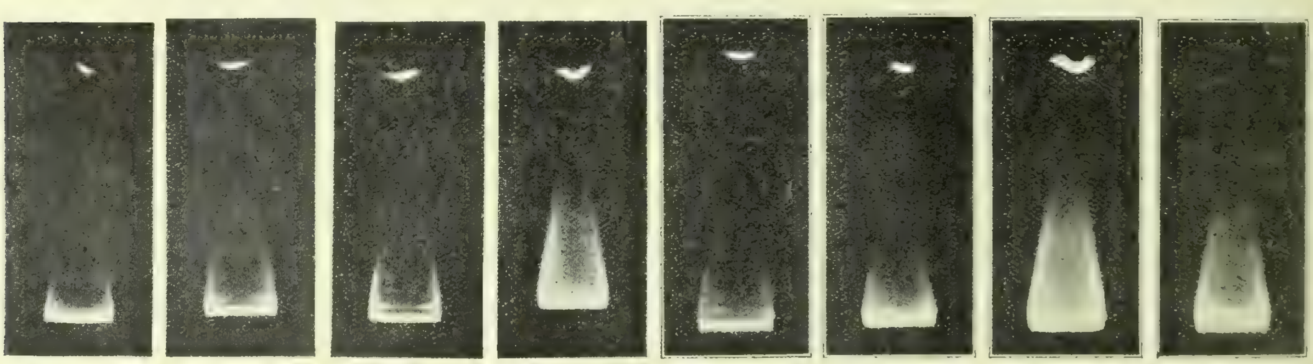
In the comparative trials with different descriptions of gas, the point of chief interest was to what extent the illuminating power varied when the heat expended remained the same. All the experiments were made with a gas pressure of 16-10ths. The composition of certain of the gases employed in the trials has already been given in Table I. on p. 960 of the "JOURNAL" for the 28th of June last. The first set of tests was made with the ordinary Welsbach burner, and the results obtained will be found on the same page, in Table II. In the first experiment, coal gas was used, and the maximum illuminating power obtainable from it was 77 English candles for an expenditure of heat of 2182 B.Th.U. per hour. The air required was 4·8 volumes per volume of the gas, and the primary air supply amounted to 54 per cent. of the total air required. The second and third experiments were made with coal gas carburetted with benzol and having a considerably higher calorific power than the uncarburetted coal gas. The consumption of gas was reduced till the expenditure of heat was the same as with the coal gas. These gases required 5·6 and 5·3 volumes of air for the consumption of one volume of gas, and 58 per cent. and 62 per cent. respectively of the total air required was drawn in as primary air. [The possible error in the determination of the proportion of primary air may be as much as 6 per cent. owing to the complexity of the methods of measurement and analysis.] The illuminating power obtained in the second and third experiments was 72 and 76 candles. The fourth and fifth experiments were with gases of low calorific power, and the consumption was increased in order to obtain the same expenditure of heat as with coal gas. The illuminating power was 79 and 82 candles respectively. The proportions of air required for complete combustion were 3·4 and 3 volumes per volume of gas, and 50 per cent. and 41 per cent. respectively represented the proportions drawn in as primary air. Hence the proportion of air drawn in was lower than with the gases of higher calorific power. It will be seen that the specific gravity of the different mixtures exerted no appreciable influence on the proportion of air drawn in. The fact that the quantity of air drawn in is smaller than with rich gases, is accounted for by the quantities of gas passing through the burner being much greater with the poor gases in order to secure the same expenditure of heat.

Looking at the results more closely, it is apparent that the poorer the gas the greater is its efficiency. But the superior effect of the poor gases used in the fourth and fifth experiments does not depend on the percentage of primary air drawn in being greater. That is an assumption which has hitherto been made because the poor gases require less air. The better efficiency of the poor gases must be traced to other conditions—*viz.*, to the difference in the composition of the gases. As the proportion of hydrogen in the gas becomes greater, the efficiency increases. Thus coal gas with 52 per cent. of hydrogen affords 77 candles; the poor gas used in the fourth experiment, containing 80 per cent. of hydrogen, affords 79 candles; and the still poorer gas used in the fifth experiment, containing 90 per cent. of hydrogen, affords 82 candles. It is obvious, therefore, that the chemical composition of the gas has a special influence on the conditions of combustion. It has been already shown that the poor gases draw in less air than do the rich gases for the same amount of heat expended in the same burner. A worse, rather than a better, efficiency might, therefore, have been expected from them. But it is known that one of the chief factors which determine the efficiency of the gas is the volume of the flame, which expresses its heat concentration. The greater the concentration of heat of the flame, the more heat reaches the mantle in a given time, and consequently the temperature of the latter is higher and the light it emits is increased. If the reproductions of the photographs of the flames obtained in the first, second, fourth, and fifth experiments (see fig. 2) are inspected, characteristic differences will be



Experiment I. Experiment II. Experiment IV. Experiment V. Experiment VI. Experiment VII. Experiment VIII.

Fig. 2.



Experiment IX. Experiment X. Experiment XI. Experiment XII. Experiment XIII. Experiment XIV. Experiment XV. Experiment XVI.

Fig. 3.

noticed in the inner cones of the flames. In the second experiment, the inner cone is very large, and the flame has a relatively big volume; whereas the inner cone is smaller in the first experiment. In the fourth and fifth experiments, the inner cone, with a bluer flame, comes right down to the wire gauze of the burner; but the quantities of air are smaller in the fourth and fifth than in the first and second experiments. Nevertheless the volumes of the flames are smaller and the lighting effects greater. The lighting effect cannot depend on the higher flame temperatures of the gases used in the fourth and fifth experiments, as has been held for a long time, because the flame temperatures of the different gases used are practically the same. The intensities of combustion of the separate gases in the mixtures are, however, not the same. The bunsen flame may be regarded as a stationary explosion; that is, the position of the inner cone depends on the velocity of issue of the mixture of gas and air being equal to the velocity of propagation backwards of ignition. In conditions similar in other respects, therefore, those gaseous mixtures have the higher concentration of heat in which the inner cone of the flame rests nearest to the top of the burner.

The highest rate of propagation of ignition in air has not hitherto been determined very exactly for separate gases. Ignition of mixtures of hydrogen and air proceeds at the rate of 4·2 metres (= 13·78 feet) per second; of methane and air mixtures, 0·6 metre (= 1·97 feet) per second; and of coal gas and air mixtures, 1·3 metres (= 4·26 feet) per second. These maximum rates of propagation are obtained when there is a small excess of combustible gas, and not with the theoretical mixtures of gas and air. These figures, which afford proof of the much higher intensity of combustion of hydrogen, are taken from results of experiments made by Professor H. Bunte in 1899. If the velocity of issue of a jet of gas is increased by raising the pressure, then with corresponding velocity of flow the flame can be raised and blown away from the mouth of the burner—*i.e.*, it can be extinguished. The pressure at which this happens has been called by Bunte the pressure of extinction. This figure for certain gases in

a rat-tail burner with a hole 0·75 mm. diameter and 0·449 mm. cross section is given in the following table :—

—	Carbonic Oxide.	Methane.	Ethylene.	Hydrogen.	Coal-Gas.	Water Gas (53·7 p.ct. CO) (36·1 p.ct. H_2).
Pressure of extinction in tenths of an inch . . .	1·73	2·20	45·3	1042	324	321
Velocity of the jet of gas in feet per second . .	22·30	34·50	115·0	1601	450	371

These figures cannot be applied directly to the Welsbach burner, as the conditions of combustion in it are totally different. But it may be accepted from them that the pressure of extinction of hydrogen is much higher than that of the other gases, and that the velocity of the jet of gas is much higher with hydrogen.

The foregoing experiments having established the fact that the composition of the gas has a considerable effect upon the economy of the burner, it was decided to make experiments with gases, of other composition and higher calorific power, produced by the addition of oil gas. The composition of the oil gas used was given in Table I. on p. 960 of the "JOURNAL" for June 28 last, which table also showed the composition of the mixtures of coal gas and oil gas, and coal gas and hydrogen which were used in the sixth, seventh, and eighth experiments. A new mantle was used for this set of experiments, the results of which have been shown in Table II. on the same page. Experiment No. 8A was made with coal gas having a net calorific power of 479 B.Th.U. per cubic foot, and with the consumption at such a rate that the heat expended per hour amounted to 2262 B.Th.U. With this expenditure of heat, the coal gas gave a light of 76½ candles. In the sixth experiment, a mixture of one volume of oil gas with eight volumes of coal gas was used at such a rate of consumption that the heat expended was the same as with the coal gas in experiment No. 8A. The light obtained was only 68 candles. In the seventh experiment, a mixture of one volume of oil gas and 17 volumes of coal gas was used, and the light obtained was 70 candles for the same expenditure of heat. In the eighth experiment, a mixture of one volume of oil gas with nine volumes of hydrogen was used, and a light of 88 candles was realized for the same expenditure of heat. The proportion of hydrogen in the mixtures used in the sixth and seventh experiments was practically the same as in coal gas; but in the eighth experiment it amounted to 92 per cent. The quantities of air drawn in to the burner decrease as the gas becomes poorer; nevertheless the lighting effect improves. A comparison of the composition of the mixtures of gas used in the sixth, seventh, and eighth experiments shows that there is considerable difference in the proportions of heavy hydrocarbons and of methane. The photographic views obtained in the sixth, seventh, and eighth experiments (see fig. 2) show that the mixture used in the sixth experiment gives the largest inner cone, while it contains the highest proportion of hydrocarbons. The flame in the eighth experiment has the smallest inner cone and gives the highest efficiency, though the gas used contained only 2·1 per cent. of heavy hydrocarbons and 4·6 per cent. of methane. No further proof is necessary of the proposition that the composition of the gas and the intensity of combustion of the constituent gases have a considerable influence on the effect obtained in the same burner from different gases for the same expenditure of heat. The composition of the gas and its velocity of efflux play almost a greater part than does the quantity of air drawn in. It follows generally, therefore, that as the calorific power of a gas falls, and the proportion of heavy hydrocarbons decreases, the calorific power of the gas is more fully utilized in the Welsbach burner.

The effect rises very greatly as the proportion of hydrogen in the mixture of gas is increased. The improvement in the utilization of the gas is to be traced back to the much higher intensity of combustion of the hydrogen. The extent of the influence of the somewhat higher flame temperature of the hydrogen must not be overlooked. As to the practical significance of the results obtained, it will be seen that the mixtures used in the first, second, third, sixth, and seventh experiments were such as might be produced in practice. Their net calorific power ranged from 479 to 584 B.Th.U. per cubic foot. The light obtained for the same expenditure of heat with these gases varied only between 68 and 77 candles. It may, therefore, be stated certainly, in so far as gases which come into question in the gas industry at the present day are concerned, that the calorific power can be regarded as a criterion of the efficiency for lighting. The greatest deviations amount to only 10 to 12 per cent.

It may be seen also from Table II. on p. 960 of the "JOURNAL" for the 28th of June how misleading it may be to judge mantles or burners according to their consumption of gas per candle-hour. The correct method of valuation undoubtedly is the determination of the heat units consumed per candle-hour, because the volume of gas burnt for the same quantity of light produced varies very greatly with the calorific power. So long as we are using gases of different calorific powers and of different compositions, fluctuations to an extent of from 10 to 15 per cent. in the results obtained with the same burner and mantle will be unavoidable. Those obtained with the ordinary Welsbach burner correspond also with the results obtained in the same manner with the burners designated "A" and "B" given in Tables III. and IV. on the page of the "JOURNAL" already mentioned. Experiments 12 and 16 referred to in those tables were made with mixtures of gas containing a high proportion of heavy hydrocarbons, and they showed the worst results. The pictures of the flames given in fig. 3 will show that the experimental gases behaved in the same manner as in the Welsbach burner. The quantities of air drawn in were, however, a trifle larger as compared with those of the Welsbach burner. The agreement between the forms of the flame shown in the pictures and the composition of the gases given in the tables in the previous number of the "JOURNAL" is apparent.

With reference to the investigations made by Mr. Forshaw on hydrogen and carbonic oxide, and his conclusion that there was no relation between illuminating power and the heat expended in the incandescent burner, his results become intelligible if regard is paid to the experimental gases and the arrangements which he selected. In the first place, hydrogen and carbonic oxide differ completely in their behaviour on combustion. The proportion of air required by the two gases is indeed the same; but with this all similarity between them disappears. The calculated flame temperature for hydrogen is about 2000° C., and for carbonic oxide about 2140° C. The velocity of propagation of ignition of the two gases is so different that it is impossible to test them in the same burner with the same mantle at the same expenditure of heat. Hence no proper comparison can be made between the two gases. The results moreover, being obtained with pure gases, have no practical importance. Deville's proposition is not directly a law; but for mixtures of gases within a certain range of calorific power it becomes a useful rule, which is shown by the author's experiments to be valid for low-pressure upright incandescent burners with the descriptions of illuminating gas now commonly employed.

SURFACE BRIGHTNESS, AND A NEW INSTRUMENT FOR ITS MEASUREMENT.

By J. S. Dow and V. H. Mackinney.

[Abstract of a Paper Submitted to the Optical Society last Friday.]

In the opening of the paper, the authors referred to the developments in photometry from the measurement of light sources to the illumination afforded. But even measurement of illumination does not exactly describe practical conditions. For, after all, what really concerns us is not only the illumination arriving on a surface but the actual "surface-brightness" which results. For example, it may happen that a good illumination is provided to show off the wall-papers in a room. But if these are of a very dark tint only a fraction of the light reaching them is reflected again. Measurement of surface-brightness would seem to be an important link in the chain of processes connected with the study of illumination, all of which have their sphere of usefulness.

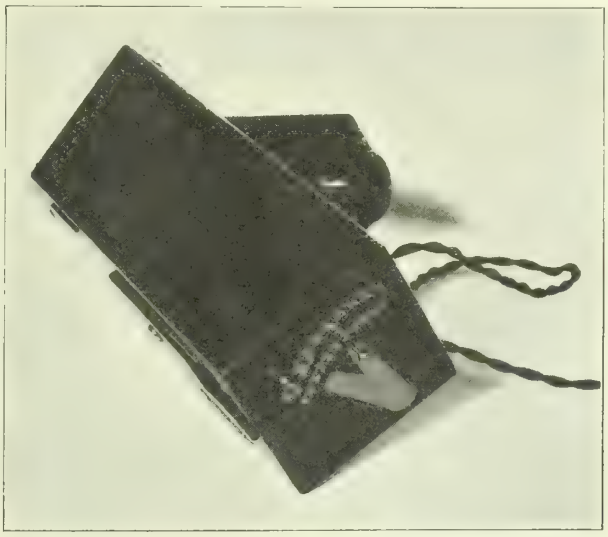


Fig. 1.

It therefore occurred to the authors that a description of a new form of instrument, primarily designed for the measurement of surface-brightness (though it can also be used for other purposes) might be of some interest. It is to be distinguished by the name of "Lumeter." The general appearance of the apparatus is shown in fig. 1. The idea of the instrument is to enable an observer to measure the surface-brightness of any surface by comparing it direct with a standard illuminated white one. The manner in which this is done will be understood from fig. 2. The observer looks direct at an illuminated screen, and sees, through an aperture therein, the illuminated surface to be studied. This screen

is illuminated by means of an opal glass plate. Behind it is a small metallic filament glow-lamp at a sufficient distance to render the screen of uniform brilliancy. In the illustration (fig. 2) the screen, with its circular aperture, has been taken out, and will be seen resting against the box. The sector-shaped opal surface can also be clearly noted.

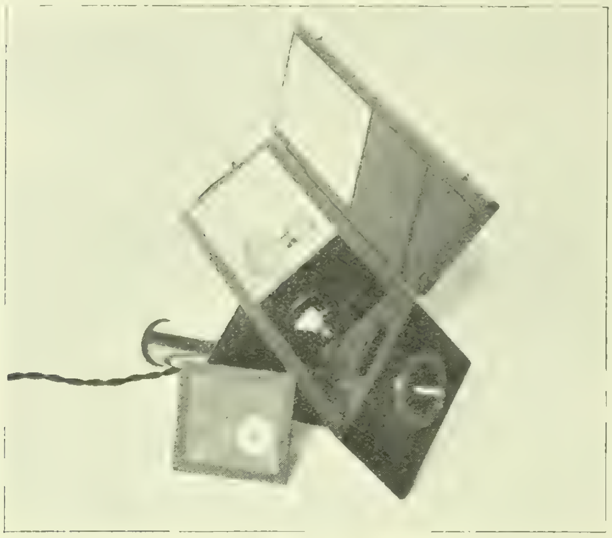


Fig. 2.

The screen has been made by depositing a matt-white precipitate on thin glass, and then scraping away a central disc. In this way a very fine line of division between the photometric surfaces can be secured. There were certain initial difficulties to be overcome in this method; but it is believed there seems to be now no difficulty in securing a satisfactory matt and permanent surface, provided the precipitate is suitably prepared. This device, like many others utilized in the instrument, is largely due to the ingenuity of Messrs. Conrad and William Beck. The screen is subsequently covered by a thin glass plate, which is bound in position. The actual white surface is thus preserved from air and moisture, and the glass cover can be handled with safety and easily cleaned. The position of the screen is such that no direct reflection from this surface into the eyepiece is possible.

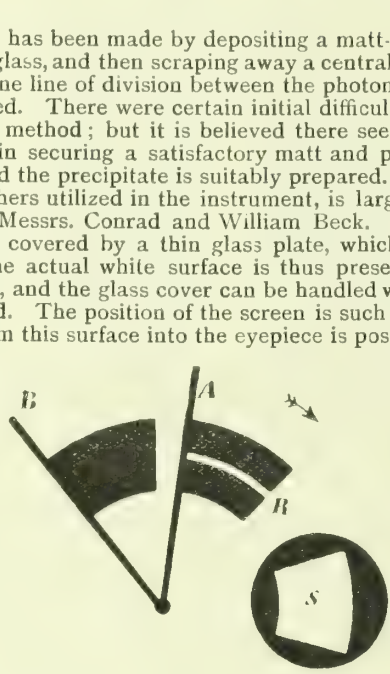


Fig. 3.

The method of altering the illumination is somewhat unusual. The screen S (see fig. 3) is covered by an opaque diaphragm D, which only allows a sector to be exposed. In front of this evenly-illuminated sector, two corresponding opaque screens, attached to levers A and B, can be made to pass. As the screen A is moved in front of the sector, its area, and therefore its intensity as a light-source, will be uniformly diminished from, say 1 to 0·1. The remaining intensity, 0·1, is derived from the part of the surface still visible through the ring R. The area of R is arranged to be exactly 1-10th of the total area of the bright sector. The lever attached to A therefore travels on an equally divided circular scale wit h nine divisions from 1 to 0·1. Having drawn across the lever A, we can gradually reduce the illumination still further by also bringing over the lever B. This exactly resembles A, with the exception that there is no ring cut out. In doing so, we gradually cut off the illuminated portion of the opal plate still left exposed, and reduce the illumination uniformly from 0·1 to 0. The lever B travels on a second scale immediately above that of A, graduated from 0·1 to zero.

A word or two may be said regarding the units in which the scale ought to be calibrated. Strictly speaking the instrument measures "surface brightness" or "intrinsic brilliancy," This may be expressed either in terms of "candles per square centimetre," or in terms of the illumination in "lux" or foot-candles which a truly white surface would have to receive in order to have equivalent brightness. The latter is the suitable method for most practical purposes, and has been adopted in this instrument.

Before using the apparatus one adjusts the position of the glow lamp illuminating the opal plate until the brightness of the white surface S—as compared with another similar white surface illuminated by means of a standard lamp at a specified distance—is (say) exactly 1 foot-candle. One then fixes the lamp in this position, and regards the scales as registering in foot-candles. It is of course, desirable to reset the lamp from time to time as the pressure of the accumulator gradually drops, and the candle power of the lamp eventually falls. In doing so, it is naturally preferable to utilize an incandescent lamp or flame standard mounted on a photometric bench; but probably an accuracy sufficient for many practical purposes can be attained by the use of a "standard candle" placed exactly 1 foot away. When using such an instrument as this, we are in many cases only concerned with relative values. For example, it may be desired to demonstrate that the illumination on a table is multiplied to a certain amount by using a certain reflector; or it may be desired only to study the distribution of illumination over a table, wall, or illuminated placard, &c. In such cases the extreme accuracy of the absolute value of the result does not greatly matter; all that is desired is that the instrument shall not vary during the measurement, and that the scale shall be strictly proportional.

By means of the device already described, one can measure values from under 1-100th to 1 foot-candle. It is also proposed to equip the instrument with two dark glasses, each absorbing 1-10th of the light passing through them, in order to increase the range of the instrument upwards. Either one or both of these glasses can be inserted in the path of the rays from the surface studied—thus enabling values as high as 100 foot-candles to be measured. Naturally, some care is necessary in selecting glasses which do not unduly absorb light of certain colours; but there seems to be little difficulty in securing that any error so caused will not be material from a practical standpoint. As an illustration of the wide range of brightness that can be measured by this means, it may be mentioned that the writers have measured values of over 50 foot-candles in shop windows; while it is also possible to estimate the brightness of the sky at night-time. This proved in one case about 0·008 foot-candle. In another case, owing to the diffusion of light from neighbouring arc lamps, a value of 0·015 foot-candle was registered.

There were a large number of special difficulties originally met with in securing a uniform scale; but the scale can now be regarded as correct within 5 per cent. over its length. The authors, however, would like to emphasize the importance of careful supervision in the case of instruments of this kind, as relatively small defects may lead to considerable errors if due care is not taken. They theretore propose to examine personally every instrument before it is sent out for use, in order to ensure that everything is satisfactory. It should, of course, be understood that the obstacles referred to above were difficulties in design only, and not in use. Once the instrument is correctly made, it should give anyone using it no trouble, as the parts are not easily deranged, and the whole construction is simple.

Although mainly intended for the measurement of surface-brightness, the instrument can be readily employed to measure illumination. In this case, a white surface is exposed to the illumination of the standardizing lamp, and the same surface is used for subsequent measurements. For this purpose, a screen that is diffusive and dead-white is desirable. Yet, as the same screen is used both in calibration and in experiment, any error caused by imperfect compliance with these conditions tends to "cancel out" as far as measurements of illumination are concerned. For practical purposes, good white cardboard or drawing paper, from which any glaze has been removed, answers. It is often convenient to pin into position in inconvenient corners; it is cheap; and it is readily replaced when soiled. The size of the surface employed naturally depends upon the distance from which it is likely to be observed. For near work a piece about the size of a half-crown is often ample; and the ability to use such a small surface enables one to penetrate into crannies where it would otherwise be impossible to obtain a measurement. One case in which white card or paper is convenient is in getting a rough idea of the reflecting power of wall-papers, curtains, &c. All that is necessary is to pin the card on the material in question, and take, first, a reading of the illumination on the white card, and then of the surface brightness of the adjacent material.

By a very simple addition, the instrument can also be utilized to measure the candle power of lamps in a room or street. A small tube terminating in an opal glass plate, ground on both sides, is inserted in front of the photometric screen. The observer then merely presents the instrument towards the lamp studied and balances the illumination of this opal plate. Then, knowing the distance of the source, he can readily calculate its intensity. It is, of course, necessary to determine once for all the constant of the instrument before use.

The compactness and the portability of the instrument, which enables it to be fixed, together with the accumulator, in a small case, and carried knapsack fashion on the back, or even in an overcoat pocket, is very convenient for practical measurements. Moreover, a measurement of the brightness of a surface by means of the instrument is unaffected, within wide limits, by the distance away of the observer.

The chief advantage of surface-brightness measurement is that it enables one to go right to the root of the matter—to study the illumination at the exact spot with which we are most concerned. With the instrument described, one can determine not only the illumination provided by the lighting engineer, but the resulting actual brightness of the objects illuminated. Again, in studying distribution of illumination, it is often very convenient to measure surface-brightness. For example, one can determine the distri-

bution of light over a large placard or the face of a building by merely pointing the instrument in the desired direction. In this way, one can reach parts from which it would otherwise be extremely difficult—almost impossible—to get a measurement.

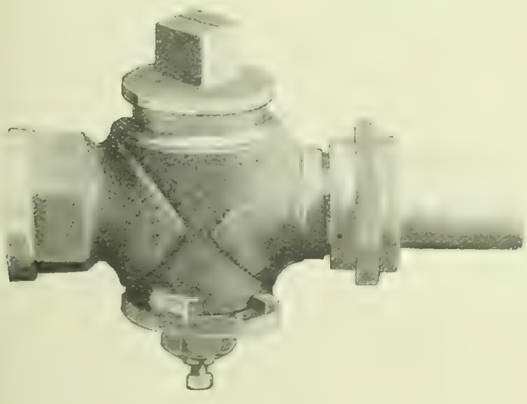
A few experiences of the use of the instrument in various interiors, &c., were mentioned by the authors. The study of wall papers was especially referred to, as was also the investigation of illumination in school rooms. Proceeding, they remarked that special care has been taken in the design of the instrument, in the hope that it might also be found useful for many laboratory purposes in which the very highest precision necessary for standard work is not demanded. It is somewhat curious that in photometrical laboratories, technical colleges, &c., there is often no mean between extremely elaborate experiments and the use of inconvenient and antiquated apparatus. An instrument such as this, in which a uniform scale is employed, saves a considerable amount of time, since the result can be read off at once; and the long calculations based on the inverse square laws, usually associated with work on a photometric bench, are avoided. Probably, therefore, an instrument based on this system, which can be used to measure either surface-brightness, illumination, or candle-power, would often be a valuable adjunct in the photometrical laboratory.

Discussion.

There was a short discussion on the paper; but there are not many points in the remarks which we need note, as forming any material supplement to the sketch given above of the contents of the communication. It was pointed out by Mr. Conrad Beck that the new invention would demonstrate the extraordinary differences of the lights through which one was accustomed to pass in the course of an hour or two in the evening without noticing any differences. An instrument of this kind, he also pointed out, would enable a great deal of useful scientific work to be done with reference to illumination which would allow a more thorough realization of the extraordinary differences under which the human eye could be comfortable, owing to its great adaptability. The new instrument should be useful in, among other directions, tabulating and forming scientific estimates for illuminating interiors and surfaces of buildings for producing pleasing architectural effects. Mr. Leon Gaster voiced the feelings of those present in saying Mr. Dow and Mr. Mackinney ought to be thanked for the instrument they had brought before the meeting. He thought that the appliance would be very useful to factory and school inspectors, who regarded the old photometrical apparatus and calculations as too much for them. It was light, portable, and sufficiently accurate for general purposes. Mr. John Darch was sure the instrument would soon be in the hands of a large number of people—anyway, it was a thing for which he had been looking out for many years. There were other speakers—Professor Chalmers (the President) among the number; but their remarks were nearly all directed to suggestions as to where there might, in their opinion, be improvement in some detail of the instrument, and to pointing out, from their own experience, useful applications for the instrument. Mr. Dow and Mr. Mackinney dealt with these in their replies; but it was quite evident that they are not convinced that the suggestions advanced will in any way conduce to betterment.

THE "SOLARI" PATENT COCK.

A patent main and sealing cock, which has met with a considerable share of approval, has just been introduced by Messrs. Willey and Co., Limited, of Exeter. Instead of the old method of stop, with cut-down barrel and pin in the plug, two stops are cast on the bottom barrel which engage with a stop in the bottom washer. These are made large enough for a screw hole to be drilled, so that the cock may be made secure either open or shut



The "Solari" Patent Main and Sealing Cock.

as desired; the screw for this purpose being found in the bottom of the plug, as shown in sketch. The advantages claimed by the firm for the "Solari" patent cock are that the positive stop arrangement dispenses with the old and undesirable form of stop-pin; all leak troubles due to the old form of stop-pins are entirely eliminated; it is an ordinary main-cock, and can also be sealed at will.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Eighth Annual Meeting.

Some two or three years back, the different Junior Gas Associations allotted out among themselves the various Saturdays in the month, so as avoid unnecessary clashing and crowding of the columns of the Technical Press. In accordance with this rule, the Yorkshire Junior Gas Association holds its annual meeting on the third Saturday in October; and the eighth such gathering was held last Saturday in the Leeds University, as on previous occasions.

Mr. S. W. Shepherd, the retiring President, took the chair. The Secretary's report, which had been circulated among the members, was taken as read, and the Treasurer's report was similarly adopted, with many complimentary remarks on its satisfactory character. In formally laying down his office, Mr. Shepherd referred to the prosperity that had attended the Association during the past year, and the happiness he had enjoyed in his work, for both of which he thanked his fellow-officers. Though the duties had been by no means onerous, he felt some little regret in resigning them, though it was a great pleasure to hand them over to so worthy a successor. Mr. Scholefield was an older man in the work of the Association, having been its first Secretary and largely concerned in its conception and successful launching. In many other respects, he would be able to fill the post better. He wished him every success and happiness, and a continuance under his guidance of the high position and usefulness of the Association.

Mr. Fred Scholefield, the Assistant Engineer and Manager of the Dewsbury Gas-Works, then took the chair and thanked his introducer and the members for their welcome. While appreciating the vote that placed him in this position, he should not have occupied it had he merely consulted his own feelings. He had, however, no desire to evade the responsibilities even of an unsought position; and he felt strongly the call to each and every member to take his part in the work of the Association. So far as his abilities allowed, he would endeavour to discharge his duties with some degree of credit to himself and satisfaction to the members, knowing the kindly consideration and co-operation upon which he could rely. He was proud of the good work done in the past directly and indirectly by the Association, and looked confidently to a development of this usefulness limited only by the degree to which the members at large loyally stood by and participated in the work done.

On behalf of the Council two alterations in the rules were proposed by Messrs. Shepherd and Cranfield, and sanctioned by the meeting—one opening membership in the Association to articled pupils in engineering establishments destined to pass into the gas industry, and in this way beginning their training; the other dealing with the question of participation in visits to works.

The President, on behalf of the Association, then presented the retiring Secretary, Mr. C. T. B. Roper, with a gold watch suitably inscribed, which had been subscribed for among the members. As being the one primarily responsible for Mr. Roper taking up the work six years before, he had admired his determination and courage in so long and honourably filling the position. As first Secretary of the Association, and a member of the Council ever since, he knew full well what a great amount of time and trouble Mr. Roper had devoted to the interests of the Association. He had won the admiration and confidence of all the members, and had brought into his work great business capacity, ungrudging devotion, and notable tact and courtesy. To him they owed not a little of the excellent position held by the Association, and its record of useful work.

Similar and very cordially expressed appreciations were offered by Messrs. Shepherd, Hill, Cranfield, and Fligg, who had been Presidents during his term of office.

Mr. Roper briefly replied, thanking the members for their all too generous words and gift and their kindly estimate of his past services. He begged a similar kindly forbearance to his yet unappointed successor, and promised him in advance all the help he could render.

The ballot for officers resulted in the following elections:—

President.—Mr. Fred Scholefield, of Dewsbury.
Senior Vice-President.—Mr. W. N. Booth, of Huddersfield.
Junior Vice-President.—Mr. W. W. Atley, of Whitwood.
Ex-President.—Mr. G. W. Shepherd, of Bradford.
Secretaries.—Mr. J. E. Sutton, of Bradford; Mr. W. Cranfield, of Halifax.
Treasurer.—Mr. E. Garsed, of Elland.
Council.—Messrs. J. Fell, of Halifax; G. W. Fligg, of Dewsbury; J. H. Hill, of York; R. Halkett, of Leeds; C. T. B. Roper, of Bradford.

Votes of thanks to the retiring officers and to the University authorities for the use of rooms for the meeting and lecture closed the business proceedings, after which an adjournment was made to the Chemical Lecture Theatre to hear the lecture by Professor J. B. Cohen, Professor of Organic Chemistry at Leeds University. His colleagues, Professors Smithells and Bone, were also present at the lecture.

The President, in introducing the lecturer, spoke of the pleasure they all had in welcoming him at this his first appearance among them, and of their sense of the high honour conferred upon

them in having been addressed at their annual meetings by no less than four of the University Professors. Professor Cohen's work in connection with organic chemistry was too well known to need more than passing mention, recognized as he was as one of the first authorities and finest teachers of the subject. The brilliant researches in organic chemistry that had been carried out in Leeds by Professor Cohen and his pupils had extended his fame far and wide. When the Yorkshire College was made the University of Leeds, a separate Professorship of Organic Chemistry was created; and Dr. Cohen became first occupant of the new chair. The subject of the afternoon's lecture was a singularly appropriate one, of present-day importance. Professor Cohen's interest and investigations in "Smoke"—its character, evil results, and avoidability—are of no recent awakening. He had pursued this study for nearly twenty years, and was recognized as one of the foremost authorities and most devoted reformers in this matter. They remembered also Professor Cohen's valued co-operation in the "Stoves" research still being carried out in the University on behalf of the Institution of Gas Engineers. One remembered these things and contrasted his scientific accuracy, self-restraint, and concentration on feasible reforms with the recent outbursts of Professor Armstrong in praise of the derelict coalite process, and his ill-timed attacks on the London and other gas companies for their non-complete removal of sulphur from their gas. With Professors Smithells, Cohen, and Bone so long and brilliantly working at problems in connection with gas—long before the new Department of Fuel and Lighting was thought of—the establishment of the Livesey Professorship at Leeds was thus clearly a case of natural selection, and left nothing to be desired in its appropriateness.

Professor COHEN then delivered the following lecture.

THE NATURE AND EXTENT OF AIR POLLUTION BY SMOKE.

When we consider the fact that something like a million tons of good fuel pass into the air as smoke every year, the utilization of this waste is obviously one of considerable economic importance. If the loss were restricted solely to the value of the unburnt fuel, a country as wealthy as Great Britain might perhaps afford to wait patiently till means had been discovered for removing it. But we know this emission of smoke brings in its train a host of attendant evils, the cost of which is many times the monetary value of a million tons of coal.

The smoke problem divides itself into three distinct parts—the cause, the effect, and the remedy. The cause is easily explained. It is mainly a chemical question, into which I do not propose to enter. The suggested remedies are various and manifold. These are partly chemical, such as the substitution for coal of combustible gas, coke, anthracite, or coalite; partly mechanical, as illustrated by the use of mechanical stokers, forced draught, and other appliances; and partly political, as exemplified by the more or less inadequate system of penalizing the smoke producer, which, however, does not touch the householder. Mr. de Morgan, the novelist, has suggested an ingenious device for inducing the householder to consume his smoke by taxing him at so much a pound on the soot extracted from his flues by a government chimney sweep—the tax being graduated according to the rateable value of the property.

It is, however, with the effects of smoke that I intend to deal this afternoon, and for this reason: being, as a nation, extremely conservative in our habits, unscientific in our attitude of mind, and dominated by our commercial interests, it is difficult to introduce a scientific system of burning fuel; it is more difficult to persuade people, manufacturers or householders, to apply it; it is most difficult of all to induce the authorities to enforce anything which may be thought to interfere, even remotely, with the commercial interests of the manufacturer or the liberty of the private citizen. So deeply rooted is our conservatism that not even the bait of pecuniary gain derived from the utilization of the unburnt coal is sufficient as a rule to overcome the prejudice in favour of older methods. There is no doubt that the use of gas for heating is gradually gaining ground among the more enterprising and enlightened manufacturing firms, because they find it more economical and efficient. But nothing but outside pressure, steadily and firmly applied, will induce the great bulk of coal users to make a change. In order to produce this pressure, we must find an answer to the question: what are the real evils of smoke?

It is no good appealing to the authorities on the ground that coal smoke is unsightly, and even that it shuts out some of the daylight. No Government is much affected by æsthetic considerations. The head of the Local Government Board may deplore the grime and ugliness of our big towns, and sympathize with the efforts which a few societies are making to improve matters. But he must have a stronger inducement than mere sentiment before he brings forward new forms of legislation; and no President of the Local Government Board has yet ventured to pledge himself to any definite policy in regard to meeting the evil of smoke more effectively than is done under our present system. But if it can be shown beyond any question that the effects of smoke are distinctly detrimental to the health of the community, or clearly pernicious in other ways, and that its removal can be effected without loss or discomfort to the manufacturer or householder, then the authorities have not only the right, but it is their positive duty, to interfere. What, then, are we waiting for? My own opinion is that we want more information. What is the quantity of smoke emitted? What is the quantity deposited? How far does it affect the health of the community? To what extent, if at all, does it corrode masonry or brickwork? Does it seriously interfere with vegetation? Do its effects extend beyond the immediate vicinity of the town? To what extent does it shut out sunlight, induce or aggravate fog? What is the increased cost of cleaning? These are some of the material facts about which we ought to have information before we can make an appeal upon which the Government authorities can be induced to act.

It is to some of these questions that my colleague, Mr. Ruston, and I have been trying to obtain definite answers. I attempted, in 1894, to estimate the amount of solid matter in Leeds air by aspirating a known volume of air through weighed plugs of cotton wool. The process was carried out near the centre of the town, where there was little traffic, for fifty days from the middle of April to the middle of June, about 20 cubic feet of air being aspirated daily. The average of two sets of experiments gave 1·2 and 1·16 mgrms. respectively in 100 cubic feet. If the smoke area covers 4 square miles, and rises, according to Angus Smith's estimate, to a height of 300 feet before being dispersed, this quantity will represent 8 cwt. of solid matter in suspension; and if the air is renewed fifty times, in twelve hours, it means 20 tons of solid matter delivered into the air at that rate. This solid matter, judged by the black colour of the plugs after filtration of the air, must be mainly soot. Now 20 tons would represent ½ per cent. on 4000 tons, which may be taken as the average daily coal consumption in Leeds. This is, of course, a rough calculation; but from the fact that more than 5 per cent. of coal burnt in domestic fire-places is emitted as soot, I am inclined to think the figure is much below the mark.

As to the quantity which falls—and there is a daily soot fall—we have two sources of information which substantially agree. In January, 1892, snow fell in Leeds and lay on the ground for several consecutive days during clear, frosty weather. Each day a fresh square yard of snow was collected from the centre of the town, melted and filtered, and the soot estimated. The weight of solid matter carried down in the first sample was equivalent to 16 cwt. to the square mile (= 240 tons per annum), and the additional weight each day was equivalent to 4 cwt. to the square mile; or, taking 4 square miles as the thickly-populated part of the city, and assuming the amount to diminish gradually towards the fringe of this area, the quantity may be roughly estimated at half-a-ton as the daily fall. This, again, is, I believe, under the mark. Mr. Ruston has estimated the amount of suspended matter by collecting and filtering the rain at various centres in and around Leeds from November, 1907, to October, 1908. Ten stations were selected at Leeds, and one at Garforth, 7½ miles due east of Leeds. The rain was collected by funnels, 12 inches in diameter, fitting into the neck of glass bottles, which were emptied and the contents analyzed once a month. These monthly samples include all atmospheric impurities, both soluble and insoluble, falling on a circular area 12 inches diameter. These impurities consist of those in suspension—viz., soot, tar, sand, and mineral matter—and those in solution, principally sulphurous and sulphuric acids and their salts, chlorides, in the form of common salt or free hydrochloric acid, and nitrogenous matter, in the form of nitrates, ammonia, and albuminoid substances. The final results in each case are worked out and expressed in pounds per acre per annum, and are given in the following table.

Analyses of Rain Water, Leeds and Garforth. Total for Year, Expressed in Pounds per Acre.

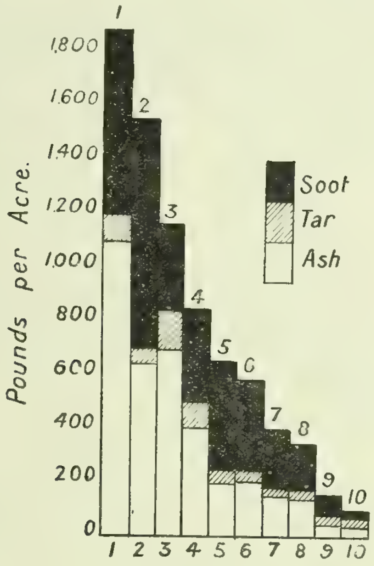
	Collecting Station.	Suspended Matter.	Tarry Matter.	Mineral Matter.	Free Acidity as H_2SO_4.	SO_3.	SO_2.	Chlorine.	Nitrogen as NH_3.	Nitrogen as N_2O_5.	Nitrogen as Albuminoid Ammonia.	Total Nitrogen.
Industrial.	1. Leeds Forge	1886	110	1113	35	123	34	164	13·0	0·0	4·7	17·7
	2. Hunslet.	1565	69	655	90	185	24	198	15 5	0·0	2·9	18·4
	3. Beeston Hill	1163	149	709	30	269	54	101	14·4	0·5	3·5	18·4
	4. Philosophical Hall (town).	849	78	423	45	149	38	75	14·4	0·3	2·2	16 9
Residential.	5. Headingley.	659	43	199	11	118	32	41	11·1	1 1	0·8	13·0
	6. Armley .	593	34	216	29	110	37	108	9·9	1·0	3·2	14 1
	7. Observatory	399	32	146	26	85	39	51	8·4	0·8	1 6	10·8
	8. Kirkstall .	352	28	141	8	77	56	57	7·7	0·2	2·3	10·2
	9. Weetwood Lane	147	26	54	11	82	13	34	8·3	1·1	2·1	11 5
	10. Roundhay.	90	14	49	0	53	16	38	5·8	0·7	1·3	7·8
	11. Garforth (country)	—	—	—	28	65	21	22	5·0	3·2	1·1	9·3

The solid impurities diminish rapidly as we pass northward from the centre of the town. Taking the centre as the unit, one mile out they fall to half, and two-and-a-half miles out, they fall to one-sixth; while in the chief industrial centres of Leeds these impurities are twenty times as great as in the purer atmosphere of Roundhay, about three miles north-east from the centre of the town. The waste of fuel in the form of unburnt coal passing into the atmosphere must be very large, for we get in Hunslet each year about 9 cwt. of soot per acre, or nearly 300 tons per square mile actually reaching the ground; while the average amount for the whole area included in the investigation, roughly 16 square miles, or 4 miles square, works out to 100 tons per square mile per annum. Taking the average of five stations included in this 4 square mile area, we have an average of 190 tons per annum,

or, roughly, ½ ton per square mile a day—a result approximately the same as that derived from the snow-fall experiments.

Soot is not pure carbon, but contains about 15 per cent. of a thick oil, by virtue of which it adheres tenaciously to everything, so that it cannot be removed by rain. It is, in fact, a kind of varnish. In order to ascertain the effects of this sticky material in the soot, I stationed, during the winter and spring of 1893 and 1894, three glass plates, a foot square—one in a garden at Pool (nine miles from Leeds), one on the University roof, and one on the roof of the Philosophical Hall (near the centre of the city). All were some distance from the neighbourhood of chimneys. The deposit on these plates after an exposure of a few weeks (loose matter having been washed away by rinsing with water) was analyzed and weighed. Fresh plates were then put in the places of those removed and the process repeated from month to month. The deposit consisted of 50 per cent. of carbon, or, roughly, three-quarters of it was soot; the proportion was as follows: for one part deposited at Pool, there were ten times the quantity at the University and twenty-four times the amount at the Philosophical Hall. The quantity of deposit varied at different times of the year; but the proportion remained practically constant.

This black, adhesive film represents a daily deposit weighing about 25 lbs., which covers the smoke-infected area with a permanent and ever-deepening coat of fast colour. The experiments are now being repeated at five stations in Leeds. Mr. Ruston has also estimated the tarry matter in the deposit at the different stations by extracting the soot with ether. At the Philosophical Hall, the amount of tar deposited in the year corresponded to 80 lbs. per acre; one mile to the North, the deposit was 32 lbs.; at 2½ miles to the North, it had fallen to 25 lbs.; and at Roundhay, 3½ miles to the north-east, to 14 lbs. It is this



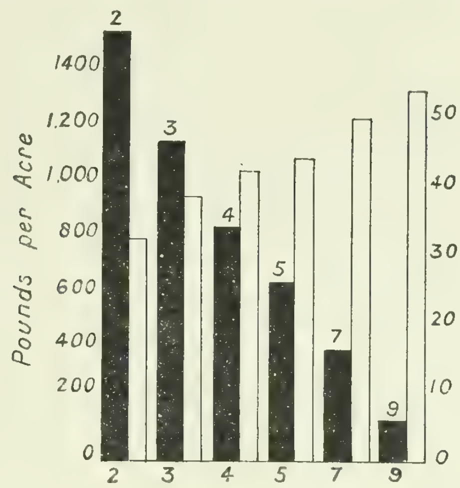
1, Leeds Forge 2, Hunslet. 3, Beeston Hill. 4, Philosophical Hall. 5, Headingley. 6, Armley. 7, Observatory. 8, Kirkstall. 9, Weetwood Lane. 10, Roundhay.

Fig. 1.—Suspended Matter.

adhesive deposit which discolours buildings and blackens vegetation. Unfortunately, it does more than blacken vegetation; it fills up the pores of the leaf, prevents the natural process of transpiration, and gradually destroys the plant. Experiments by Mr. Ruston are now in progress on the relative rate of assimilation of carbon dioxide by clean and blackened leaves; and the differences are most striking and instructive. The diminished vitality due to this cause, as well as to the action of acid to be presently discussed, is answerable for the destruction or stunted growth of evergreens near the centre of a town.

Both Mr. Ruston and I have determined, at different periods of the year and in different years, the amount of total daylight in various parts of the town. The method we used was to estimate the amount of iodine set free from a solution of an acid solution of potassium iodide. In 1895, daily tests were made, from the 1st of July to the end of the following February, at three centres—one in Kirkstall Road (an industrial centre), one at the Philosophical Hall (a town centre), and one on Woodhouse Moor (a high open space about a mile from the centre of the town). Without entering into details, it may be stated that, on the average, there is an absorption of one-quarter of the daylight in some parts of the city. Mr. Ruston's experiments were carried out during the month of June of last year at seven stations—six in or round the town and one at Garforth, 7½ miles distant. A comparison of Garforth with Hunslet (an industrial district) frequently showed an absorption of more than half the total daylight. This absorption of light will also affect vegetation.

It is instructive to compare the quantity of soot deposited at different centres with the amount of daylight. The relations, as indicated by the dark and light columns in the following table, show, as one might have anticipated, that the amount of daylight varies inversely as the amount of soot deposited. But the most injurious effects on vegetation are undoubtedly to be ascribed to the sulphurous and sulphuric acids emitted from the burning sulphur contained in the coal. The amount of these acids is given in the table above.



2, Hunslet. 3, Beeston Hill. 4, Philosophical Hall. 5, Headingley. 7, Observatory. 9, Weetwood Lane.

Fig. 2.—Influence of Suspended Matter on Intensity of Light.

In conclusion, Dr. Cohen referred to some experiments conducted by Mr. Ruston on the effects on vegetation of the acid carried down by rain; to its effect on health; and to the questions: "How far outside the town does smoke penetrate?" and "What is the increased cost entailed in the national washing bill?"

The lecture was fully illustrated with lantern slides, many of which were of arresting impressiveness; and Professor Cohen freely left his manuscript to deal with these in detail. Many of these represented work done in co-operation with colleagues in the Agricultural and Botanical Departments. Some of the recently exposed squares of glass were shown with their adhering coat of tarry soot, &c., which the rains of three months had not been able to remove; and the contrast between the squares exposed in the town and those farther afield were more eloquent than pages of numerical data. A slide was shown contrasting twelve months' deposit on such sheets of glass in the heart of Leeds and in the open country near. A telling series of slides showed leaves picked in various parts of Leeds, whose green colouring matter had then been removed and the translucent leaves with their coats of soot, photographed against the light. Even more striking were slides showing the boxes of grass raised under parallel conditions except for the water (equivalent to the local rainfall) given them. Some specimens were watered with varying proportions of sulphuric acid added to pure water, and others with the acid rain found even 7 miles out from Leeds and others with this same rain with its acidity neutralized. Even those of the audience who lived in view of some of the most striking instances of the effect on vegetation of acid rain that the country affords were struck with the effect shown. Most striking of all, perhaps, were some highly-enlarged sections of leaves showing stomata (or pores) blocked with soot, and then views of selected laurel leaves on bushes in various parts of Leeds originally of equal size and then photographed some months later, and showing most forcibly how the soot-choked stomata retarded growth and healthy development.

Mr. W. Cranfield, in proposing a hearty vote of thanks to the lecturer, said that, though they were proud of being "gas men," they were not only "gas men," or "gas men" all the time, and that afternoon had been one of the notable events in their Association meetings, as it had, for a time, lifted them a little out of the ordinary work and topics. He was proud to have the opportunity of bearing testimony to his personal indebtedness to Professor Cohen. He had had the privilege of working as a student under him in years past; and valuable as had been the direct results, the indirect were even more valuable, as Professor Cohen's work, example, and encouragement had been a constant inspiration to him. Leeds had been shown to have an unenviable distinction as regards its smoke-laden atmosphere. But there were even worse offenders in the West Riding; and he noticed that none of their Sheffield members had ventured to appear in the lecturer's presence that afternoon. They really could not over-estimate the magnitude and importance of the smoke evil; and although the ways out of the difficulty were not obvious and accepted, yet they did well to keep an ideal before their eyes and patiently to work on in the cause of reform—he would hardly say in order to awaken the public conscience, but, what was much more to the point, in order to awaken public dissatisfaction and so lead to some modified strong law vigorously and impartially administered. He would commend to their notice the truly scientific attitude Professor Cohen had adopted in his reluctance to use statistics and lines of argument that were not absolutely reliable and free from possible accessory causes. His reticence and guarded remarks were a valuable lesson to them, for the gas industry, in common with many others,

had suffered in the past from unreliable data, tables of results from experiments whose conditions were not closely studied and plainly set down, observations imperfectly taken, and large far-reaching conclusions drawn from scanty premisses. He was not sure that some of the recent calculations as to the amount of harm done by smoky domestic chimneys did not come into this category. Anyhow, it was quite in keeping with our English ways to attack the little offender and let the big sinner alone, to draw off attention from the offences of mill and factory chimneys by denouncing the cottage chimneys, or even by gibbetting as prime offenders the London gas companies, who leave a few grains more sulphur in 100 cubic feet of gas than they did formerly. Who should more insistently call public attention to the noble idea of clean, bright, and healthy towns than the men of the gas industry, who had at least the main key to the solution of the present difficulty in their possession?

Mr. J. H. Hill seconded the vote of thanks, and spoke of the ways in which even the smoke cloud had a silver lining for the gas industry. They had seen the results of experiments showing how strikingly smoke curtailed sunlight, so much smoke meant less natural light and more gas needed. His own town of York was hardly a typically smoky one; but they had far more smoke than they wished, and as a private householder his house suffered from neighbouring offenders—including an electric light works. Another way in which the smoke problem affected them was in blackened ceilings. These were popularly blamed on to gas. Of course, they all knew better, and he had greatly enjoyed calling attention to some appallingly black ceilings in some York public buildings where the thought of using gas could not be entertained—it was so dirty. Electricians claimed greater cleanliness for their commodity; but given clean air and comparatively smokeless towns, the cleanliness of gas would not continue to be libelled as at present.

The President, in putting the resolution to the vote, bore tribute to the interest and lucidity of the lecture, and emphasized the importance to all interested in gas of unremitting effort in "booming" their own unequalled fuel.

Professor Cohen, in acknowledging the vote of thanks (which was enthusiastically carried), expressed his gratitude for the patience with which he had been heard, for the personal references, and for their kind vote. His subject might at first have seemed somewhat remote from their industry, but was probably closer to it than many thought; and it would probably be through gas that the solution of the problem would be reached.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

The members of the Eastern District Division of the Scottish Junior Gas Association paid a visit last Saturday to the Durie Foundry, Leven, Fife, belonging to Messrs. Henry Balfour and Co., Limited, and to the works of the Leven and Methil Gas Company, Limited. About forty attended.

Visiting the foundry first, they were received by Provost Balfour, of Leven, who is Managing-Director of the Company, and who extended a hearty welcome to the party. A tour of the works was made, with Mr. J. Barker, the Manager, and Mr. J. Hunter, one of the staff, acting as guides. The pattern, moulding, and fitting shops were visited, in the last-named of which there was much to be seen in the interior fittings and methods of putting together gas apparatus. Although a great deal of the power in the machine-shops is derived from gas-engines, part of it is steam power, and in particular there is a venerable steam-engine of 48-H.P., which is about seventy years old, and is still going. A punching-machine, capable of making about forty holes at once in a number of gasholder plates, was shown at work; and in the yard, close by the workshops, the application of the plates was seen in the erection of the crown of a gasholder which is being fitted up, to the order of the Dunblane Gas Company. There was also seen a small coal-gas works, including a retort-bench of two ovens—a three and a two—condensing, washing, and scrubbing plant, and a holder, erected in 1824, and still in use.

When the foundry had been inspected, the party walked over to the gas-works, where they were welcomed by Mr. Andrew Hogg, the Chairman of the Company. Then they were shown a new two-lift gasholder, in steel tank altogether above ground, and spiral-guided upon a design of the builders, Messrs. Henry Balfour and Co., which is now nearing completion. The tank is 75 ft. 6 in. diameter, and 23 feet deep; and the lifts are respectively 69 feet and 67 feet diameter. The capacity of the holder is 158,000 cubic feet. It is proposed to telescope another holder, raising its capacity from 100,000 to 200,000 cubic feet; and when this is done, there will be storage capacity for upwards of 350,000 cubic feet. The maximum daily output of gas is at present 150,000 cubic feet; but it is expected to be nearly doubled in a short time. In the works there are two retort-benches—an old one, containing two ovens of sixes and two of threes; and a new one, containing three ovens of eights, fired on Hislop's regenerative system. For drawing off tar from the hydraulic main, there is a tar-column, which is a most effective piece of apparatus. The gas is condensed in four annular tubes, and then passes through a Livesey washer, a Waller steam-driven exhauster of 15,000 feet capacity per hour, a Creake annular brush scrubber, and the purifiers, which are four in number, 20 ft. by 16 ft. The works have been laid out with a view to the extension of any part.

The inspection over, the visitors were entertained at tea in the Central Café—Mr. J. Barker in the chair.

The President (Mr. W. Dunlop, of Kirkcaldy) said the members would agree with him that they had had a unique opportunity of gleaning knowledge on matters intimately connected with their every-day work. Messrs. Henry Balfour and Co. were a firm of long standing; and the work they turned out had always been excellent. He proposed a hearty vote of thanks to the Company and to Mr. Readdie for the arrangements he had made for their visit.

Mr. Alex. Wilson (Glasgow) said it gave him much pleasure to be with them, as he took a great interest in the doings of the Junior Associations, both in the East and in the West. One of the reasons for his presence was that it was in Leven that he started his life-work. He was born there, and served his apprenticeship in the Durie Foundry. He was pleased at going over it, and at seeing the great advances which had been made. The Company had always been noted for turning out a thoroughly sound article. The gas-works they had visited were very complete, and did credit to Mr. Readdie.

Mr. J. R. Moyes (Granton) proposed a vote of thanks to the Leven and Methil Gas Company for showing them their works.

Bailie Lawrence, a Director, said the Company started business in 1837, with a capital of £800. In 1846, the capital was increased to £1500; and in 1854 to £1800. Then there was a long halt of forty years. It was then raised to £3600. In 1908, it was brought up to £18,000; and it was now proposed to increase it to £30,000. In 1900, the make of gas was 13 million cubic feet; last year they made 42 millions.

Mr. P. L. Readdie, the Manager, said he began work in the Durie Foundry, where he was a journeyman when Mr. Wilson was an apprentice. He would impress upon young men who were about to enter gas-works to try to get a smattering of engineering work. Everything in their works, he might say, was new within the last ten years; and so they were likely to be able to keep pace with the times.

On the motion of Mr. W. Geddes (Granton), a vote of thanks was accorded to Mr. Barker, who briefly responded; and the proceedings closed.

Burkheiser's Process for the Recovery of Cyanogen.

The abstract translation of an article by Dr. Bertelsmann which was given under the title "The Burkheiser Purifying Process" in the "Journal" for the 4th inst. (*ante*, p. 23) contained the following statement: "An attempt to recover the cyanogen in the gas along with the ammonia, by converting it into ammonia through the intermediate formation of ammonium sulphocyanide, has not yet attained practical success." Messrs. Burkheiser and Co., of Hamburg, have written to point out that the conversion of cyanogen into ammonia is a perfectly established fact, and it is only the chemical explanation of the process of conversion that is not sufficiently cleared up and worked out. In view of this explanation, it may be well to give a full translation of the words of Dr. Bertelsmann in the "Chemiker Zeitung," the sense of which was intended to have been conveyed in the sentence already quoted from the "Journal." Dr. Bertelsmann wrote as follows: "In addition to the ammonia, Burkheiser will also recover the hydrogen cyanide contained in the gas by first converting it into ammonia. His purifying material changes the hydrogen cyanide into sulphocyanide, which remains in the material in the form of ammonium sulphocyanide. By oxidation the latter then becomes converted into ammonia and sulphur dioxide, thus:

$$NH_4CNS + 3O + H_2O = 2NH_3 + CO_2 + SO_2.$$

This part of the process, however, has not yet been sufficiently worked out (*durchgearbeitet*), and as the formation of ammonia by oxi dation will not be quite clear, the author would merely call attention to the oxidation of sulphocyanides with nitric acid according to the German patent No. 97,896, by which sulphuric acid and hydrogen cyanide are produced." Messrs. Burkheiser and Co. point out that, in thus writing, Dr. Bertelsmann meant only that the scientific explanation of the process is not yet sufficiently clear.

The East Greenwich Gasholders: A Correction.—We regret that the holder illustrated on p. 107 of the last number of the "Journal" was, by inadvertence, wrongly described. It was not the 12 million cubic feet holder erected by Messrs. Clayton, Son, and Co., Limited, but the four-lift one, of 8 million cubic feet capacity, put up by another firm in 1885.

Petrol Air Gas.—Last Wednesday, Mr. H. O'Connor, of Edinburgh, delivered a lecture on "Petrol Air Gas" to members of the Scottish Industrial Art Association. He described and showed in operation the plant for the working of the system known as "Solux," and dwelt upon the safety of the system, if used for the lighting of mansion houses, for which it was very suitable. The lecturer explained that the heat given off by the gas was only one-fourth or one-fifth of that derived from coal gas. He also described the method of supplying it already mixed with air, by which arrangement, when it was burning, it did not abstract oxygen from the air.

REGISTER OF PATENTS.

Mr. Cowan's Gas-Meter Specification: A Correction.—Towards the close of the abstract of Mr. William Cowan's specification for gas-meters which appeared in the "JOURNAL" last week, the following sentence occurred: "The diameter of the hole E must be so adjusted that it will discharge the quantity of water automatically fed by the spoon-feeding device G, so that when it has filled up to the syphon level, it cannot produce any further rise of level, and therefore brings the syphon A into operation." In the official provisional specification, the concluding words of the sentence were, "and therefore *cannot* bring the syphon into operation." Unfortunately, in the print of the complete specification, from which our abstract was prepared, the word put in italics above was omitted; while in the abstract an unnecessary "s" was added to the word "bring." The sentence should close as in the provisional specification.

Radiation Pyrometers.

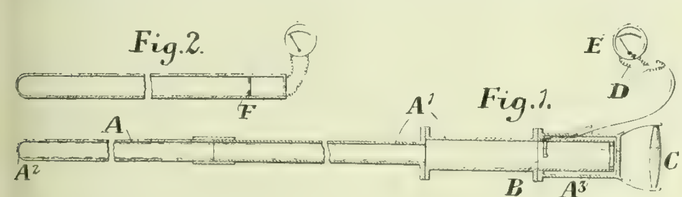
CAMBRIDGE SCIENTIFIC INSTRUMENT COMPANY, LIMITED, and WHIPPLE, R. S., of Cambridge.

No. 21,369; Sept. 18, 1909.

This invention relates to radiation pyrometers—that is, to pyrometers in which the sensitive element is not subjected to the actual temperature of the body whose temperature is required, but to a portion of the radiant heat therefrom, so that the sensitive element is only raised in temperature by a fraction of the true temperature of the body.

The great advantage of radiation pyrometers, the patentees point out, is that, owing to the fact just mentioned, the sensitive element does not wear out rapidly, even though it is used to measure extremely high temperatures. The chief disadvantage in radiation pyrometers hitherto used is that their readings depend not only upon the temperature of the body itself, but upon the nature of the surface of the body and on the temperature of surrounding objects. It is, therefore, in many cases necessary to apply corrections to the readings obtained in order to get true temperatures. Also most types of radiation pyrometers have the further disadvantage that they require focussing on the body whose temperature is being obtained before a reading is taken.

The objects of the present invention are, while retaining the advantage already mentioned of keeping the sensitive element outside the zone of intense heat, to secure the further advantage of avoiding the necessity of applying any corrections to the readings to obtain true temperatures, and also to avoid the necessity of focussing the instrument before a reading is taken.



Cambridge Scientific Instrument Company's Radiation Pyrometer.

As illustrated in fig. 1, a tube A A^1 is employed of definite length and closed at the end A^2, having mounted at the other end a pyrometer head A^3, containing the sensitive element B. A concave mirror C, of short focal length, is mounted in the pyrometer head in such a manner than an image of the inside of the closed end of the tube is formed a few inches in front of the mirror; and the sensitive element is so placed that this image coincides with it. To use the pyrometer, the closed end A^2 of the tube is inserted in the furnace or other body whose temperature is required; the other end of the tube, carrying the pyrometer head A^3, remaining at a comparatively low temperature. The sensitive element therefore has its temperature raised above the temperature of the surrounding pyrometer head by an amount dependent upon the intensity of the heat image formed by the mirror, and therefore by an amount dependent upon the temperature of the closed end of the pyrometer tube. Since for the same pyrometer the concave mirror is always at the same distance from the closed end of the tube, the instrument can be adjusted so that the image coincides with the sensitive element once for all, and will therefore not need focussing or otherwise adjusting each time it is used. Also, since the pyrometer tube will, in practice, be made of fairly small diameter, and will be subjected to the heat of the furnace for a length of several diameters measured from the closed end, the conditions necessary for true black-body radiation from the inside of the closed end of the tube are secured; and the readings will therefore be independent of the nature of the surface of the closed end of the tube.

A variety of different devices may be made use of for the sensitive element. One of the simplest is to use a small thermo-couple as illustrated in fig. 1; this being connected by leads D from the pyrometer head to an indicating or recording millivoltmeter E or suitable current measuring device whose scale is calibrated in terms of the temperature of the closed end of the tube. Other devices might be used depending for their principle of operation on the change of resistance of a wire with temperature, or the expansion of metals with temperature, &c.

The only part of the pyrometer subjected to the full temperature being measured is the portion of the tube A near the closed end A^2. Provision is therefore made for renewing this portion by making the tube in two parts. The renewable end portion A need not necessarily be of the same material or size as the other permanent portion; and while the latter will usually be of steel, the renewable portion may be of steel, porcelain, silica, plumbago, &c., according to the temperature and purpose for which the instrument is used.

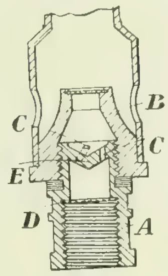
Modifications in carrying the invention into effect would allow a convex lens to be used, although, owing to the fact that such a lens absorbs a large proportion of the heat rays it receives, it would not be so satisfactory as a mirror. Or, as in fig. 2, a diaphragm F may be interposed in the path of the rays to insure that the sensitive element B^1 shall be subjected to a constant definite fraction of the radiant heat proceeding from the hot end of the conduit.

Atmospheric Gas-Burners.

NIESER, E., of Kensington, W., and POLESCHOWSKY, J., of Bowes Park, N.

No. 28,218; Dec. 3, 1909.

This invention relates to connector devices or thimbles to be attached to the gas-fitting at one end and to the burner or nipple containing the gas spit or nozzle at the other end, with the object of securing that the streams of gas issuing therefrom "will not interfere with each other, but will be directed tangentially towards the sides of the chamber and in a whirling manner."



Nieser and Poleschowsky's Atmospheric Gas-Burner.

In carrying the invention into practice, the thimble A is threaded at one end for attachment to the gas-fitting and at the other for screwing into the gas spit or nozzle B. Holes C are drilled in the solid outer or head portion E of the device at different axial angles or tangentially about the centre of the device, so that if (as shown) three holes were made they would serve to direct the three separate streams of gas tangentially and forwardly against the side walls of the chamber formed within the part B. This action imparts to the gas a whirling motion, and effectively breaks the gas up against the sides of the chamber. A gauze disc D (or a perforated metal plate) is arranged in the body of the thimble to assist in the initial breaking up of the gas, and also for protecting the gas-orifices C.

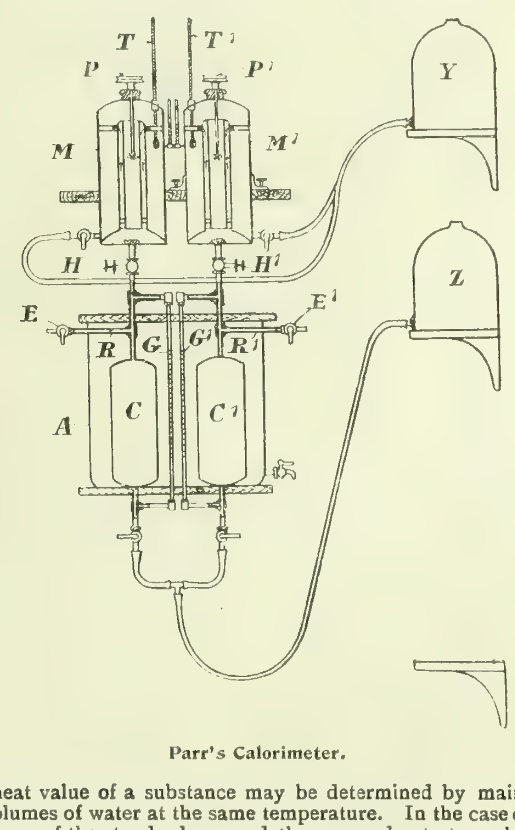
Calorimetric Processes and Apparatus.

PARR, S. W., Illinois, U.S A.

No. 1329; Jan. 18, 1910.

This invention has for its object to provide a calorimetric process and apparatus in which a standard substance (or substance the calorific value of which is accurately known and readily ascertainable from standard books of reference) is burned under like conditions with the substance under test, "which will give accurate, and therefore reliable, results, and which may be practised and used without peculiar skill."

The heat value of the substance under test is determined in terms of the calorific value of the standard substance; the absolute calorific value of the latter in heat units being known. In the case of gases, the standard gas and the gas under test are burned under identical conditions of pressure, volume, and temperature; and the heat produced by the combustion of each is imparted to equal quantities of water, which are subjected to the same external conditions as to radiation, and the initial temperature of each of which is known. If the rise in temperature due to the burning of the gas under test be represented by t, the rise in temperature due to the burning of an equal volume of the standard gas be represented by t^1, and the heat value of the standard gas per cubic foot be represented by h^1—then the heat value per cubic foot of the gas under test will be $\frac{t\,h^1}{t^1}$. The quantity h^1 will be obtained from any standard work giving calorific values; and the quantities t t^1 will be obtained by observing the readings of the thermometers with which the calorimeters are equipped.



Parr's Calorimeter.

The heat value of a substance may be determined by maintaining equal volumes of water at the same temperature. In the case of gases, the volumes of the standard gas and the gas under test would vary;

and these volumes would be inversely proportional to the heat values of the two substances. Thus, if the volume of the standard gas required to maintain a given temperature in a given volume of water be represented by v^1, the volume of the gas under test required to maintain the same temperature in an equal volume of water to be represented by v, and the heat value of the standard gas be taken as before to be h^1—then the heat value h of the gas under test will be given by $\frac{v^1 h^1}{v}$.

The illustration (p. 205) shows diagrammatically (in sectional elevation) a calorimeter which embodies the invention, and by which the process may be carried out, where the substance under test is a gas.

In the water-tank A are submerged two identical gas receivers C C[1], with which pipes communicate at their lower ends, the flow through which is regulated by taps. Connected with both pipes is one end of a hose, the other end of which is connected to the pressure bottle Z. The upper ends of C C[1] communicate with pipes, from which extend laterally to the outside of the tank the charging pipes R R[1], in the outer ends of which are mounted two taps E E[1].

On a shelf above are two water-heaters M M[1], both jacketed with felt and connected by pipes with the filling or levelling bottle Y. The interiors of the water-heaters are fitted with flues for the passage of the products of combustion. They are further provided with thermometers T T[1], and with agitators P P[1], driven by some suitable device. The water-heater M[1] is provided with levelling screws, by means of which any discrepancy in size between the two heaters may be compensated for by raising or lowering one or the other heater.

In using the apparatus, the tank A is filled with water; and since the volumeters C C[1] are submerged in the tank, the contents of the volumeters will be maintained at the same temperature. By raising the pressure bottle Z from the lowest shelf to the centre one, water flows from the bottle into the volumeters C C[1]. The volumeter C[1] is charged, through the pipe R[1], with some standard gas the heat value of which has been accurately determined or is known. Similarly, the volumeter C is charged, through the pipe R, with the gas which is to be tested. By manipulating the valves E E[1], the water-level in the gauge-glasses G G[1] is brought to the same level. The gas in the volumeters will then be under exactly the same conditions as to temperature, pressure, and volume. The filling bottle Y, containing water, is placed upon the top shelf, and water flows from it into the water-heaters M M[1]. The levelling bottle Y may be lowered so that the water will drain away and mix in the water-bottle, whereby it is ensured that the initial temperature of the water in both water-heaters is the same. Upon raising the bottle again, the water will, of course, rise to the same level in both heaters; and any discrepancy there may be in the dimensions of the two can be compensated for. In order that the water may be kept constantly circulating, the agitators P P[1] are driven during the test.

On the valves H H[1] being opened and the gases ignited, the flames of the gas heat the bottoms of the water-heaters, and the products of combustion flow through the system of flues, whereby the water is heated. By manipulating the valves H H[1], the water-level in the gauge-glasses will be kept even, and the gases in the two volumeters will be exhausted at the same time. At this moment, the reading of the thermometers T T[1] is taken, and the rise in temperature in each water-heater is noted.

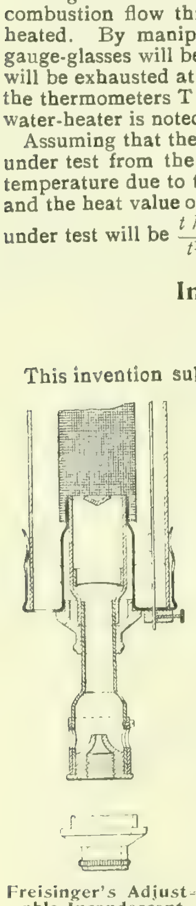
Assuming that the rise in temperature due to the burning of the gas under test from the volumeter C is represented by t, the increase in temperature due to the burning of the gas in the volumeter C[1] by t^1, and the heat value of the standard gas is h^1, the heat value h of the gas under test will be $\frac{t\,h^1}{t^1}$.

Incandescent Gas-Lamps.

Freisinger, A., of Berlin.

No. 5844; March 8, 1910.

This invention substantially consists in making the burner gallery, with the incandescence body and chimney, axially adjustable relatively to the burner—that is to say, vertically movable relatively to a stationary burner-head—as shown.



Freisinger's Adjustable Incandescent Burner.

The neck of the burner is externally screw-threaded, and a screwed ring is adjustable thereon. The burner-head is screwed on to the upper end of the neck; while the gallery has a tubular inner part which rests at the bottom upon a shoulder of the ring, and at the top fits closely around the burner-head. By screwing the ring upwards and downwards upon the neck, the gallery is vertically adjusted as desired relatively to the burner.

This axial adjustability of the gallery has the same advantages as have heretofore been obtained by adjusting a burner-head relatively to a stationary gallery, and the gallery is the more accessible of the two parts. It can always be accurately adjusted, so that it does not extend beyond the level of the burner-head. If the gas-pressure is low, the luminosity can be increased, by lowering the gallery, without enlarging the burner orifice, and without lowering the mantle towards the gallery (which, the patentee remarks, involves risk of damaging the mantle). He also points out that "a saving of mantles can be effected, inasmuch as a mantle damaged at the bottom can be lowered with the gallery, and retained in use."

Centrifugal Pumps.

Pulsometer Engineering Company, Limited, and Björnstad, J., of Reading.

No. 29,260; Dec. 14, 1909.

This invention relates to centrifugal pumps wherein end-thrust, due to difference of pressure at opposite sides of the impeller, occasioned by unequal leakage of liquid past it, is eliminated by connecting the spaces at opposite sides of the impeller (or at opposite sides of each of a number of impellers in a multiple impeller pump), by passages, through a stationary part of the pump-casing. The object of the invention is to simplify the construction of pumps by connecting the diffuser and casing parts together by hollow screws and utilizing the latter as the means for establishing communication between the chambers or spaces at opposite sides of the impellers.

The invention (which can be variously carried into effect) may be incorporated in centrifugal pumps having one or more impellers with the inlet for liquid on one side only, and provided with means, in the region of the boss, for balancing the end-thrust caused by the inflowing liquid; and its application to such a pump is described in the specification by the aid of diagrams.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Testing of Gas-Fires.

Sir,—Having given some attention to the use of the thermopile as a means for the quantitative measurement of the thermal effect of radiation, I was much interested to read the communication of "Experimenter" in the last number of the "Journal." I do not quite agree with his explanation of the discrepancies to which he refers. The function of a thermopile is to measure the intensity of the radiation at various points of a hemispherical or other form of surface, which intercepts the radiation from a fire. If the thermopile indications were always proportional to the radiation, the objection raised by "Experimenter" would not exist, even with the extreme widths of fires he refers to. I am of opinion, however, that the thermopile readings are not proportional to the intensity of the radiation. I referred to this matter in a paper and subsequent discussion at a meeting of the London and Southern District Junior Gas Association in April and May last.*

In the discussion, it was pointed out that a very large proportion of the radiation which enters the mouth of the conical receiver of the thermopile can only reach the pile by successive reflection along the receiver; but, on account of the taper of the receiver, the rays may, after a few reflections, be reversed, and be reflected outwards. Again, it is easy to show that the proportion of the radiation which reaches the pile by reflection to that which reaches it by direct transmission, will vary with the position round the fire and with the width of the fire, owing to the variation of the solid angle subtended at the centre of the pile by the incandescent surface of the fire. Another feature is that the true centre of the thermopile is an uncertain quantity. The centre of the pile itself is sometimes taken; but there is reason to think that the centre of the large end of the receiver should be regarded as the centre of the instrument, since the radiation is collected there.

In reading through "Experimenter's" letter, I felt that the objections to the thermopile enumerated above were primarily responsible for the discrepancies he refers to.

There is another important point which, so far as I know, has not received much attention—*i.e.*, the necessity for eliminating the error due to conduction of heat into the radiometer from the warm surrounding air. In the paper already referred to, I pointed out this source of error, and explained a method of eliminating it and of avoiding the uncertainties of the thermopile.

I was very pleased to see the subject raised by "Experimenter." It is a highly important one, and, in view of the rapid development of the gas-fire, is well worth careful consideration.

J. G. Clark.

Oct. 14, 1910.

Automatically Lighting and Extinguishing Public Lamps.

Sir,—I would like to reply to some of the statements of your correspondents in the last issue of the "Journal" on the above subject.

I think if Mr. Francks had read my article carefully, he would not have required to use such adjectives as "incongruous."

May I point out that I had no desire, and have none now, to criticize any individual lighter. I tried to deal with the subject generally.

As regards the type of pressure apparatus which uses the whole of the pressure to operate same, and the other type which uses a portion only, the difference is in degree—assuming that both use a bell sealed in mercury. In the former case, the bell is used only to turn the tap; and the inlet and outlet of gas to and from the chamber is effected by other means. The gas pressure has to do two things—lift the bell with its outside mechanism, and, through the agency of the mechanism, turn the tap.

I do not know the weight of the bell; but it requires a certain pressure to lift it. Let x represent that pressure. Now, the pressure required to turn the tap with a margin of safety, may be represented by l. Therefore, it must be quite clear that the apparatus will not work when the pressure is below $x\ l$. I have no exact knowledge of the value of $x\ l$ in the apparatus referred to; but I am quite certain there are plenty of gas-works in this country, and on the Continent, that work with pressures below $x\ l$. Therefore, in those gas-works, this apparatus would be useless.

As regards the other type, which uses a portion of the pressure. As in the former, let x represent the weight of the bell, and l the friction on the valve. In this case, the gas-chamber is always full of gas, and not intermittently so; and the excess of pressure above $x\ l$ has to be balanced by leaden weights.

Generally speaking, the value of $x\ l$ is greater in the former type than in the latter type—partly because the power required to turn a tap exposed to the weather is greater than that required to open or close (for example) a mercury valve.

* See "Journal," Vol. CX., pp. 236, 564.

May I point out that in my article I did not say, nor infer, that there was no limit in the latter type. Obviously there is. An apparatus of a different type that I examined recently operated at about 11-10ths—engaging at about 7-10ths.

As regards the mercury-seal blowing. I described in my article exactly what I have seen, not once, but twenty times. It must not be forgotten that when the apparatus is designed to go under the lantern inside the frog, the size of the latter limits that of the former. Otherwise, new frogs or cradles are required, entailing considerable expense in fixing, and adding to the capital cost of the installation. Thus an extra margin of safety is not always obtainable, and more often than not the bell has to travel more than $\frac{1}{2}$ inch. Of course, where there is no limit in size, you can obtain any depth of seal you choose.

Mr. Francks—referring to my statement that the range cannot be mechanically altered—again misunderstands me. I did not say, nor in any way infer, that the range cannot be altered in any machine, because I know of at least three where this can be done. But it cannot be done in the ordinary apparatus I was describing when I made that statement —*i.e.*, one with a bell sealed in mercury, the operating pressure of which is controlled by weights placed on the bell. Of course, the operating pressure can be altered, as much as you wish. But the engaging pressure is always at a fixed point below the operating pressure; and that range or difference between the two points cannot be purposely altered or adjusted.

I note with pleasure that "Eureka" can light at a high pressure and extinguish at a low one; and, as an alternative, he can extinguish on a rise of pressure, though lower than the lighting pressure. This is entirely a step in the right direction.

I am indebted to "Interested" for his kindly reference to my article. He says: "It would have been of greater utility if I had suggested the lines to be followed (as well as those to be avoided) in any attempt to obtain a satisfactory solution of the problem." May I point out that to do this is tantamount to inventing a lighter. To anyone who is ambitious enough to invent a "lamplighter," the information that I gave in the article must be useful, inasmuch as he will know what to avoid; and this will save him endless experimenting.

As regards the pilot-flame being permanent. I do not think that is necessary. I am informed that in a particular district of a suburban gas company, which is hilly and exposed, the lamps of which have pressure controllers having intermittent pilots, they were watched, among other things, for pilot failures over a period of several months, and, out of 12,800 lightings-up, there have been less than a dozen pilot failures—something under 0·1 per cent.; and these occurred during very heavy gales of wind.

The time of lighting can be accommodated to atmospheric conditions only when it is done by the corporation owning their own gas-works; a gas company, having to work to a time schedule under contract, cannot be expected to take note of the weather.

With regard to the suggestions made by "Interested," I am inclined to think, after reading "Auto Lighter Limited's" letter, that the "Automaton" will meet all the difficulties dealt with in those suggestions.

Oct. 15, 1910. CONTRIBUTOR.

SIR,—The communications on the above subject in your issues of the 4th and 11th inst. emphasize the important fact that the automatic lighting and extinguishing of street gas-lamps has now become a recognized desirability for all gas undertakings, and, moreover, evidence the great progress made by the system in this country and Germany.

Your correspondent "Interested," in last Tuesday's "JOURNAL," points out the main impediment to the rapid and universal adoption of the system—viz., the difficulty of selection from the legion of devices clamouring for favour. This difficulty is so real as to call for an absolutely independent inquiry and the appointment of an advisory body. If this step be not taken, gas undertakings will continue in the present hopeless state of uncertainty and hesitation. Advertisements are of little assistance; and communications to the Technical Press (unless they come from users, giving results from personal and practical experience) often emanate from interested parties, and constitute advertisements for a particular manufacturer or apparatus.

Theoretically, the perfect system is "pressure;" the principle comprising all the desirable attributes. It should (and will undoubtedly) prove equally perfect in practice. The "clockwork" alternative is theoretically wrong, and can never be perfect in practice except under special circumstances and on a small scale.

Ingenuity has produced exceedingly clever clock devices, and enterprise, in the form of advantageous "hiring" terms, has secured their quite extensive adoption. Equal ingenuity has been shown in respect to pressure devices; but the difficulties in this case have been far greater, owing to the wider aims in view.

Of the numerous pressure devices on the market, there are several constructed to cope with all conditions of pressure. One of these has been working successfully for several years. Another has been experimentally proved equally efficient, but as yet has not been in practical use. Other pressure devices, already adopted successfully, have more limited utility.

With such an extensive field, there is room for many varieties; and efficiency and price will be the determining factors. To these characteristics should be devoted the suggested independent inquiry; and the gas industry is wide enough to produce any number of adjudicators possessing the necessary qualification.

The communications in the "JOURNAL" are of great value; but in many cases the remarks of the authors are vague, inaccurate, and misleading. I give the following examples.

Herr Göbrum says: "Pressure ignition effects an economy of about 10s. per lamp per annum." The economy (or saving) depends upon many things, and may vary from 1s. to £1, but will certainly not average (or be "about") 10s. per lamp.

Herr Dobert says: "Only a few tenths are requisite." In this case it would appear that "few" means 12-10ths to 13-10ths, which might mean too much to give in many places; and an apparatus requiring such pressure would be out of court. "The economy in wages and gas effected by the adoption of the system wipes out the expenditure thereon—*i.e.*, capital outlay, interest, and depreciation—in a space of about three years." Whether this be the fact or not must, of course, depend upon the first cost of the apparatus, ranging from (say) 15s. to 60s., and its construction; the latter materially affecting maintenance (or depreciation).

Herr Buhe says: "Pressure ignition does not present advantages for all towns;" "pressure devices may give rise to considerable difficulties in towns of the size of Breslau and smaller." The failure at Breslau was probably not due to the conditions, but to the limitations of the particular device. Moreover, if Herr Buhe were better acquainted with pressure devices generally, he would possibly modify his present opinions.

Finally, the statement by the author of the article on "Automatically Lighting Street-Lamps," that, "almost without exception, pressure lamplighters will only meet one set of pressure conditions," is surely erroneous, and is certainly a damaging remark.

Obviously, then, independent expert knowledge and advice are urgently needed in the interests of all concerned. Automatic lighting and extinguishing means economy in gas, labour, and mantles, and consequently lower competitive price. It also means greater efficiency. Lessened cost, *plus* simultaneous lighting and extinguishing at any hour, means further conquests over electricity.

Oct. 13, 1910. G. W. H.

The Relations of Municipal Gas and Electricity Departments.

SIR,—As you have indicated frankly your full acceptance of the principles on which electricity charges are (or ought to be) based, I have secured the object I had in view when writing.

Your acceptance was all the more welcome because the criticism I have hitherto usually had to meet from those interested in gas undertakings has amounted to an utter negation of the principles now recognized. The criticism has, in fact, been based on the assumption that average costs obtained by dividing total cost of all supplies by total units sold, necessarily gave a cost applicable to any or all supplies. Could anything be more absurd?

Regarding the difference now remaining between us—viz., the application of the principles in everyday practice, I am afraid there is not much to be gained by further correspondence. Neither of us can take a judicial attitude; we are both too interested. I, therefore, merely ask: Is it not evident, in view of the very large power sales in Manchester, that if the wide disparity between Manchester's lighting and power prices had not been based on adherence to the admitted principles, would not financial disaster have occurred long ago? The lighting sales account for only 14½ million Board of Trade units out of the total sales of 71½ millions.

Manchester Corporation Electricity Works, Oct. 10, 1910. S. L. PEARCE, Chief Engineer.

[It would be wrong to say we are sorry not to be able to accept Mr. Pearce's letter as an answer to the comments in our "Electricity Supply Memoranda" of Oct. 4. Principles may be sound enough and acceptable; but their abuse and want of uniform application is another matter. It is the abuse and want of application in the case of electricity supply, that cause complaint. Two or three suggestions were made by us on Oct. 4 that were unencumbered by any complication, upon which we thought Mr. Pearce would fasten in illustrating how fairly, from the standpoint of the central station engineer, the principles that he affects to worship and obey are applied in practice. But our correspondent dismisses the suggestions with the remark: "Regarding . . . the application of the principles in every-day practice, I am afraid there is not much to be gained by further correspondence." That is precisely the point at which electrical engineers usually shunt from the main line of argument in this matter. As to the last question in the letter, and the information given in the final two lines, Mr. Pearce has the advantage of being in possession of certain information that we have not by us. We wonder whether he will favour us by filling up the blanks in the following table, which refers to the sales in the last financial year:

	Sales. Units.	Average Price Obtained.	Revenue from each Source.
Traction . . .	28,526,468	..	..
Power . . .	28,386,223	..	..
Private lighting.	14,500,000	..	..
Public lighting .	144,696	..	..
Total sale. .	71,557,387	..	Total revenue £367,702

It will be remarked that the power supply is almost equal to the traction supply. In addition to stating the average price for power, will our correspondent tell us the quantity supplied for power purposes at a lower rate than that for traction, and the various charges for that quantity? We should be interested in knowing, too, the amounts included in the power supply for domestic purposes other than lighting—that is to say for heating, cooking, and so forth; and the prices charged. There is peculiar interest in diving into a matter such as this, where principles and practices are concerned.—ED. J.G.L.]

Inverted v. Upright Incandescent Burners.

SIR,—We have read with much interest the editorial note on "Lighting Efficiency at Low Pressures" in the last number of the "JOURNAL." Indeed, if you had only sung the praises of the inverted burner, without in the same breath lamenting the decay of the upright, his brother, we should have remained silent. But, as we are intimately connected with the manufacture of an upright burner which, as we are defending a principle and not advertising our goods, will remain nameless, you

will allow us to discuss some of the statements put forward in your article.

You say, for instance, that inverted gas-burners are now being constructed "so that their regulation can be effected at any time." But there is nothing new or progressive in this, as there are at least twenty equally good means of quick regulation for upright burners. They are not more generally used because the manufacturers deem it safer not to give inexperienced consumers a possibility of tampering with the regulation, and consequently the consumption, of the burner.

You also contend that "there are burners now, regarded as quite ordinary ones, by which an efficiency, at district pressures, of about 30 candles per cubic foot of gas consumed can be obtained." Your epithet of "quite ordinary" is not over-flattering to that excellent concern which has but lately secured some important contracts for public lighting, and which claims only an efficiency of 100-candle power per $3\frac{1}{2}$ cubic feet, or, roughly, 28 candles per cubic foot, for its standard inverted burner, rightly considered to be one of the most efficient, if not the most efficient, of its type on the market. Now, we are positive that among the numerous makers of upright burners one at least is prepared to guarantee 28-candle power per cubic foot as a minimum (30 or 32 candles being currently obtained), and this even at the low pressure of 7-10ths, as has been proved in the lighting of Palermo, in Italy, recently carried out.

We do not wish to reopen the discussion upon the advantages of the inverted as compared with the upright burner. There is room for both under the wings of the gas companies. The inverted burner which throws a powerful light on a restricted surface immediately beneath the burner itself, leaving the rest of the room in comparative gloom, is excellent for a watchmaker, for instance; it might even be preferred for street lighting, in view of the curious way in which automatic tests are conducted in this branch of lighting. But for a shop or for a living-room, which must be pleasant and cheerful, where there must be a whole atmosphere of light as well on the upper parts of the walls as on the ceilings, there is nothing that will beat the old upright burners.

As for the inverted gas-burners "practically sweeping all before them," are you aware that less than a month ago the upright burner—the same that shall remain nameless—obtained in open competition the lighting of the streets of Madrid? Do you know also that the burner in question, a high-priced one, has been manufactured for the last seven months at the rate of 2000 a day—a figure which we are ready to substantiate; the quantity being insufficient to meet the demand? Also that, though we offer to buy back our old burners at 50 per cent. of the selling price, not one of these has been returned. We therefore think it advisable to make it clear that many people keep their upright burners because they realize that the change to inverted would not be any improvement, and merely replace them when worn by other upright burners of a more modern type, such as are to be found, and for which the manufacturers claim an efficiency more than equal to that of the best inverted burners.

We think you will now agree with us that this type of burner, which you consider as moribund, on the contrary enjoys very good health.

J. MARSE AND CO.

Imperial Buildings, E.C., Oct. 13, 1910.

[Our correspondents must have been looking at the short editorial article on "Lighting Efficiency at Low Pressures" through eyes and glasses that considerably distorted the words employed. We cannot see in what we wrote any "lament" regarding the "decay" of the upright burner. "Decay" suggests a falling away (in relation to a burner) from the state of efficiency to which it had attained. Our words were: "Little or nothing is heard in these days about improvements in the vertical type of incandescent burner. Whether there is merely a marking of time in relation to them, or whether we have reached the limit of their susceptibility to advance in point of efficiency, is not a matter we need here stop to discuss." Surely there is nothing that can be construed into "decay" there. Regarding the second paragraph of the letter, if our correspondents had burnt their fingers in using the regulating arrangements above the flames of some of the older types of inverted gas-burners, there would have been immediate appreciation of the improved facilities to which reference was made by us. As to the next paragraph, "that excellent concern" to which reference is made are the possessors of a burner that will give an efficiency of 30 candles per cubic foot of gas consumed at district pressures; and their "claim" to a rather lower efficiency per cubic foot for their street-lighting burners is based on commendable prudence. We have already expressed in the "JOURNAL" our opinion regarding the vertical burner in which our correspondents are interested; and there is nothing to retract now. Time has given confirmation. We also quite agree that there is room for both vertical and inverted burners "under the wings of gas companies;" but why we should be charged with considering the former "moribund" entirely passes our comprehension. Concerning the remainder of the letter, the views of our correspondents may be left without comment to the judgment of technical readers.—ED. J.G L.]

Improved Lighting and Heating of the Burton-on-Trent Market Hall.—The following paragraph appeared under the heading "Talk of the Town" in the "Burton Daily Mail" last Thursday: "The decision to improve the heating and lighting of the Market Hall will be received with approval not only by the stall-holders, who have a right to decent comfort in view of the tolls they pay, but by the public generally. In winter evenings, shopping in this building has frequently been the reverse of comfortable; and visitors to the town, who, chilled to the marrow, have gone into the hall expecting to find warmth as well as bargains, have been grievously disappointed in the former respect."

MISCELLANEOUS NEWS.

A NEW GASHOLDER AT EXMOUTH.

A large number of shareholders and others interested in the Exmouth Gas Company assembled at the works last Thursday afternoon, when a new gasholder which has been erected by Messrs. Willey and Co., of Exeter, was formally inaugurated. The holder has a capacity of 300,000 cubic feet, and is in two lifts; the diameter being 100 feet, and the depth of each lift 20 feet. The tank is constructed of wrought steel plates, and stands 20 feet above the ground-line. It is 102 feet in diameter, and has a chequered steel platform, 2 feet wide, round its top edge, with a suitable hand rail. The guide-framing consists of 16 cantilever standards, constructed of 7 in. by 3 in. channels, braced with steel bars and connected together by two tiers of latticed girders. The height of the structure, which is of steel throughout, is 65 feet.

Among those present at the ceremony were the Chairman of the Company (Rev. C. R. Carr) and the Directors; Mr. Percy S. Hoyte, Engineer and Manager of the Plymouth and Stonehouse Gas Company, who has acted as Consulting Engineer to the Exmouth Gas Company; Mr. J. T. Foster, the Manager and Secretary; Mr. F. Templer Depree, Chairman of Messrs. Willey and Co.; and Mr. H. J. Long, Chairman of the Exmouth District Council. Mr. Hoyte explained that the provision of a new holder had been rendered necessary by the rapid way in which the business of the Company had developed. Hitherto, they had storage for only 130,000 cubic feet of gas; while the output in winter had reached as much as 250,000 cubic feet in 24 hours. In these circumstances, a new holder was an absolute necessity. The structure had been thoroughly tested; and the Contractors and the Gas Company were to be congratulated on a thoroughly satisfactory piece of work. Mr. Depree then called upon the Chairman of the Company to turn the gas into the new holder. The Rev. C. R. Carr did this, and remarked that the business of the Company was growing in a very gratifying manner. They looked for further extensions in the neighbourhood; and now that they had a sufficiency of storage, they would be in a better position to make such developments as were needed.

HOLBORN PUBLIC LIGHTING.

A Petition to the Borough Council.

At the Meeting of the Holborn Borough Council last Wednesday, as the result of a strenuous canvass of the inhabitants of the borough by the electrical industry, following the announcement of the Gaslight and Coke Company's terms for the public lighting, a petition, which it is claimed was signed by 2671 persons, was presented. The petitioners, who were represented by only four persons (the spokesman being Mr. A. W. Gamage, of Holborn), asked for improved lighting in the main thoroughfares—viz., Holborn, High Holborn, and New Oxford Street to its termination at Tottenham Court Road. They also protested against the contract for lighting the borough being handed over for ten years to the Gaslight and Coke Company without inviting tenders from the other three Companies having lighting powers in Holborn.

Mr. GAMAGE, in introducing the deputation, said he did not think it was advisable to give such a large contract without getting other schemes and prices; they therefore asked that the whole matter should be reconsidered by the Council. With regard to the Gas Company's offer, ten years was too long, as so many changes were taking place. In electric lighting they had lately had the advent of the metallic filament lamp, which had proved a saving of 70 per cent. on carbon lamps; and these metallic filament lamps had dropped considerably in price. If they put up the contract to open competition, they would get light at a much lower rate. He maintained that the electric light was more penetrating in fog than gaslight.

Several members of the Council expressed dissent.

The MAYOR (Alderman Max Clarke): No; that is not so.

Mr. GAMAGE (continuing) said it had been stated that trade followed the flag; but he would say that it followed the light. Light meant prosperity for the people of Holborn. He had only to contrast this thoroughfare with Oxford Street; it was like stepping from darkness into sunshine. It was freely admitted that Holborn was badly lighted. He had visited the principal commercial cities of the world, and as regards lighting Holborn was far behind even the smallest of them. It was the duty of municipal authorities to look after the welfare of tradespeople, because if these were prosperous the borough would benefit. In his opinion, the borough could be made the lightest in the Metropolis at the lowest cost.

The MAYOR promised that the matter would receive the consideration of the Council, who, he pointed out, had not given the contract to the Gas Company for any number of years.

Mr. GAMAGE said he thought this was so.

The petition was referred to the Works Committee for consideration and report.

EDINBURGH PUBLIC LIGHTING.

Annual Report of the Inspector.

We have received the report of the Inspector of Cleaning and Lighting to the Corporation of Edinburgh (Mr. Geo. A. D. Mackay) for the year ended the 15th of May, and extract the following particulars.

In his introductory statement, Mr. Mackay says that in connection with the incandescent gas lighting of the streets there is practically nothing of outstanding interest that falls to be reported for the municipal year now under review. The system of half-lighting authorized by the Council in the interests of economy in 1907, is still in operation

during the summer months; and this means that from May 1 to Aug. 31 only half the lamps were lighted. From Sept. 1 to April 30 full lighting obtained up till midnight, when every alternate lamp was extinguished. Though complaints as to want of light were hardly so rife as in previous years, he draws attention to the fact that, notwithstanding that the public have had ample time in which to get accustomed to the changed conditions, considerable dissatisfaction still exists; and a large number of communications have been addressed to the department by citizens, raising strong objections to the half-lighting system. The Inspector's opinion is that partial darkness of the streets causes considerable inconvenience, and is anything but conducive to the safety of life and property.

On the 15th of May last, the streets of the City were lighted by 10,293 incandescent gas-lamps, 1229 electric arc lamps, and 22 electric incandescent lamps. In the previous year, the number of gas-lamps was 10,242; and the increase of 51 is accounted for by additional lighting in areas on the outskirts of the city, &c. The number of electric arc lamps has been increased by 26. The 10,293 incandescent gas-lamps have a varied consumption, particulars of which are as follows: 386 have 2-feet, 9717 have 2½-feet, and 190 have 3-feet burners. The Inspector says the 2½-feet burners give every satisfaction; and as those at present consuming 3 cubic feet become worn out, they are being replaced by the 2½-feet size.

As to the automatic lighting and extinguishing of public gas-lamps, Mr. Mackay remarks that, though some corporations have in part adopted this system, Edinburgh has so far done nothing in the matter. The Gas Commissioners, it may be noted, however, asked leave in January to carry out experiments on the public lamps at Seafield Road, Portobello; and permission was granted, on condition that the department was put to no inconvenience or expense in connection therewith, either now or at any future stage.

An offer of the Gas Commissioners to convert the flat-flame burners in the common stairs into incandescents, to maintain the lights in efficiency, and to extinguish them at sunrise, was accepted. The agreement is for 3½ years. The incandescent burners to be provided by the Commissioners are to be rated to burn on an average 1 cubic foot of gas per hour; and the pressure of gas is not to be less than 18-10ths, or such higher pressure as is necessary for efficient incandescent lighting—the candle power being under normal conditions equal to 16 candles or thereby. During the subsistence of the agreement, the Corporation are to pay to the Commissioners monthly a sum equal to 17s. 6d. per annum per jet, which sum shall be in full payment for the gas supplied and the fitting up, maintenance, and renewal of the incandescent installation, and extinguishing the lights, and generally of all obligations undertaken by the Commissioners under the agreement.

The following is a summary of the expenditure on public lighting for the year under review:—

Street gas lighting, including cost of gas, with lamplighters' wages and incidental expenses	£18,709 2 10½
Electric lighting, including incidental expenses	11,541 5 7
Stair lighting, including gas, wages, and other expenses	11,046 5 5
Total	£41,296 13 10½

The expenditure for 1909-10, compared with that of the previous year, shows a decrease of £5669 1s. 10½d. This saving is accounted for partly by the fact that the contributions to the cost of conversion of the flat-flame gas-lamps to incandescents are now completed, and therefore the third and last instalment, which was included in last year's expenditure, drops out of that for this period. Then there was a saving under the headings of pillars, lanterns, &c., and workshop expenses, due to the number of new lamps erected being considerably less than last year, and to fewer mantles, &c., being used; and owing to difficulty experienced in getting burners satisfactorily adjusted as to consumption of gas, the conversion of the remaining upright burners to inverted had to stand over.

Mr. Mackay gives tables showing the progress of electric lighting from 1895-6 onwards and of street gas lighting from 1891, as well as the variations in the gas-rates during the latter period. The value of the lighting plant, as returned to the City Chamberlain, on the 15th of May last, was £20,066 13s. 7d.

GAS v. ELECTRICITY FOR PUBLIC LIGHTING.

Several references have been made in our "Electricity Supply Memoranda" to the letter which Mr. H. B. Renwick, the Chairman of the Electric Supply Publicity Committee, has been sending to the newspapers all over the country with the view of showing that London is an electrically lighted city, so far as the public lamps are concerned. The letter was published in the "Shields Daily Gazette" a few weeks ago; and it has now been answered by a well-informed correspondent, whose letter appeared last Wednesday. In the course of it, he made the following remarks.

The London County Council (including the City of London) have, according to their official statistics, 150,313 public lamps apportioned as follows: Arc lamps, 8825; incandescent electric lamps, 14,489—total, 23,314. They have also gas-lamps (as per the Board of Trade returns), 126,999. There are, therefore, 103,685 more gas-lamps than electric lamps, or, in other words, there are 5·4 gas-lamps to 1 electric. Certain of the local authorities owning electric lighting stations have apparently adopted electric street lighting in all or part, in order to bolster up their undertaking. In the City of Westminster, where they are now converting 71 existing electric arc lamps to high-pressure incandescent gas-lamps, the City Council are satisfied that they will get better lighted streets at a much cheaper cost to the ratepayers with incandescent gas as against electricity. Mr. Renwick evades the fact that the Electric Light Company quoted for a continuation of electric arc lamps and for the conversion of the whole of the incandescent gas-lamps in the City of Westminster (the contract for which expires at the end of the current year) to electricity, but were defeated by the Gaslight and Coke Company's quotation, which was about 77 per cent. cheaper.

Mr. Renwick proceeds to show that Marylebone, in adopting electricity for street lighting, has effected during the past year a saving of £1550 in respect of a portion of their area only. But he does not state that Marylebone owns the electric light undertaking; and that if they had adopted the new inverted incandescent gas-burner lamp they could have effected an annual saving, based on the Gaslight and Coke Company's recent tender to the Holborn Borough Council, of £2892—*i.e.*, £1341 per annum more than by adopting electricity, while the capital expenditure necessary would have been considerably less because the existing gas-lanterns could have been made adaptable to the inverted burner.

The truth is that electricity at present prices cannot compete with incandescent gas for public lighting in point of cost, light for light; and Local Government Board Inspectors have specifically stated this on several occasions. In these days of heavy rates, it behoves local authorities to adopt the budding town councillors' stereotyped phrase, "Efficiency combined with economy," in its fullest meaning; and incandescent gas public lighting is a case in point whereby this object may be attained in reality.

METER-RENT CHARGES AT SALFORD.

The re-imposition of meter-rents by the Salford Corporation is evidently keenly resented by many of the consumers; and the members of the Town Council seeking re-election this year are being severely heckled on the subject at the ward meetings. Many householders who have not followed closely the proceedings of the Town Council were surprised to find in the past quarter's gas bill a charge made for meter-rent, and have written letters of protest to the department.

It was at the June meeting of the Council that it was decided, by 25 votes to 18, to re-impose meter-rent charges. At the previous meeting, the proposal had been rejected; but at a subsequent General Purposes Committee, it was resolved (after an explanation had been given by the Mayor and Alderman Phillips, the Chairman of the Gas Committee), that it was necessary the charge for meter-rent should be re-imposed. It was in 1893 that the Gas Committee abolished this charge; and the necessity for its re-imposition was brought about mainly by the increased demands on the Gas Department in the way of grants in relief of rates and the advance in the cost of coal. At the same time, it was decided to reduce the quantity of gas supplied for a penny to automatic meter users—the alternatives being to increase the price of gas or raise the rates.

In the course of an interview on the subject, a member of the Salford Gas Committee said there were something like 69,000 meters in use under the Corporation in Salford; and these cost thousands of pounds to provide and maintain. "Many of these meters," he added, "are on premises where electricity is used; and they are maintained there simply for the purpose of meeting a failure of the electricity supply. The Gas Committee, therefore, consider that, having regard to what is expected from them in the way of relief of rates, a small charge should be made to those having meters upon their premises. In a large number of cases, the meters are not in any sense of the word revenue producers; and the scheme was decided upon as an alternative to increasing gas prices."

CHESTER GAS COMPANY'S PROFIT-SHARING SCHEME.

Nine Years' Successful Work.

The general meeting of profit-sharing employees of the Chester Gas Company was held lately, under the presidency of Mr. J. G. Ford, the Chairman of the Company, who was accompanied by the Secretary (Mr. F. A. Pye) and the Engineer (Mr. J. C. Belton).

The ninth annual report of the Profit-Sharing Committee, covering the twelve months ended the 30th of June last, was presented. It set forth that the scheme of co-partnership had entered its tenth year; and a hope was expressed that a renewed effort would be made to ensure that before its close every eligible employee would not only be a profit-sharer but also a co-partner in the concern by becoming a holder of stock. The bonus added for the past year was £289, with £22 interest. The total standing to the credit of the employees on June 30 was £858; and £140 of the Company's stock was bought during the year at a cost of £157. The total purchase of stock since the commencement of the scheme amounts to £880.

The Chairman, in moving the adoption of the report, expressed his pleasure at seeing that the balance shown in the accounts was £100 more than it was four years ago, when he first submitted a report. There were, however, other results which might not be so apparent, but which had a still more permanently beneficial effect, among which the finest was the stimulus afforded to personal interest in the success of the undertaking which afforded them employment. At the risk of repetition, he would emphasize this point. Profit-sharing, leading to, and comprising, co-partnership, stood or fell on the realization of the feeling of ownership—that was to say, that employees were working for the benefit of their own business. Let it once be accepted as simply a part of the daily wages or deferred payment of wages, and then its life would be short. It was dependent on their collective and individual interest in their work—an interest which must be expressed by an effort to secure the best obtainable results. The Company's employees might be roughly divided into outside and inside men; and the clerk or workman outside must realize that he represented the Company, and could improve or damage its reputation by the character of his work and the civility and intelligence he displayed in its execution, while the clerks and men in the offices or works could quite equally do their share with those who met the Company's customers outside. It would be observed from the report that they had entered the tenth year of their profit-sharing scheme; and he most earnestly hoped they would individually brace themselves up with the determination that the next report would quite eclipse all its predecessors. One of their principal

objects was to enable all the employees to become co-partners by purchasing and holding stock; they still had sufficient on hand to meet all likely inquiries.

Mr. J. R. Machin, in seconding the motion, said the report must be a great encouragement to the employees to avail themselves of the opportunity offered for participating in the profit-sharing scheme. It was nine years since their first meeting was held; and he well remembered some talk in disparagement of the scheme at the beginning, when it was thought it would exist for only a few days, or perhaps a year or two. In spite of the cold water poured upon it, the scheme was still boiling, and he believed would keep on doing so.

The report and accounts were adopted.

A vote of thanks having been accorded to the officials and others for their voluntary work in connection with the scheme last year,

Mr. Crosby, in acknowledging the compliment, expressed the thanks of the employees to the Directors of the Company for instituting the profit-sharing scheme, which he trusted might have a long career. It behoved them to put forth renewed efforts to secure its continuance. If only for the benefits it had conferred in cases of sickness and death, he thought the scheme had justified its existence.

On the motion of Mr. Belton, seconded by Mr. Pye, a vote of thanks was accorded to the Chairman.

The Chairman, in reply, expressed the hope that next year he would meet a larger number of profit-sharers.

FATALITY TO A STOKING-MACHINE DRIVER.

Last Wednesday, Dr. Ambrose, the Coroner for the Metropolitan District of Essex, held an inquiry, at the Barking Town Hall, into the circumstances attending the death of George Robinson (44), a machine-driver. It occurred at the Beckton station of the Gaslight and Coke Company, on the previous Saturday.

Mr. W. C. Beasley Robinson (Messrs. Monier-Williams, Robinson, and Milroy) appeared for the Company; Mr. R. C. Belton attended on behalf of the widow and family of the deceased; and Mr. C. F. Hunter, one of His Majesty's Inspectors of Factories, represented the Home Office.

Mr. *J. N. Reeson*, the Engineer and Manager of the Beckton station, produced some photographs of the place where the accident occurred. He said the two retort-stoking machines concerned were some distance apart when deceased was found. The left-hand one was for pushing the coke out, and the right-hand one for putting the coal in. The former worked in advance of the latter at a distance, on an average, of 20 to 30 feet, so as to clear the retorts in time for the machine that was following. Both the machines were worked by compressed air. He had never known one to be drawn by another. On the day of the accident there was some slight defect in the motive power. On starting, it was off the discharging-machine, owing to the pressure-pipe having broken; and the man in charge should have waited for it to be put right, which would have been a matter of only a few minutes. Apparently the deceased looked about for some means of coupling-up the two machines, and eventually found a piece of sling chain which was used for connecting the shoot on the other side of the machine. He then fixed the hook of the chain between the nut and the frame of one machine, and put the ring of the chain over the projecting nut on the frame of the other. To do this, he had to put one foot on the guard of one machine, and the other foot on the guard of the wheel of the second machine; and then he got his head fixed between the framing of the two. The usual thing, when pipes went wrong, was to wait till the fitters came to put them right. Had the deceased done this, the accident could not have happened. It was not his duty to do anything but drive the machine; and what he did was entirely on his own initiation. There was a definite rule that if anything went wrong with a machine the workman should report it to the foreman, who would attend to it.

Edward Gentry said the discharging-machine of which the deceased was driver was stationary at the end of the retort-house on the Saturday in question. The deceased asked him (witness), who was on the other machine, to "just move up steady;" and at the same time he fixed a chain on to his (witness's) machine as well as on his own, holding on with both hands—one on each machine. He (witness) moved the machines about 10 feet, and did not know that anything had happened until he saw the deceased lying face downwards between them, with blood oozing from him. The deceased could not move the machine by its own power, because the pressure-pipe was broken, and he was waiting for it to be repaired.

By the Jury: He could not tell why the deceased wanted to move the machine. There was no object in it, so far as he knew. The men were waiting to charge the retort.

Joseph Charles Ross deposed to seeing deceased attach the chain to the machines and Gentry start one. So far as he was aware, they both started very steadily. He did not know there had been any accident until he saw the blood, and then he went to Robinson's assistance. He had been three years on the works, and had never seen such a thing before.

Samuel John Allsop said he saw the fixing of the chains, and it seemed to him that the face of the deceased was between the frames of the machines. He thought it was hardly safe; but he did not warn him. He saw the charging-machine pulling the other, but did not know any accident had happened until Gentry called out that Robinson's head was "pinched." He had been on the works since the house was first started, but had never known the machines to be used for the purpose of pulling each other along.

George Day, foreman of the retort-house where the accident happened, said no report was made to him on the day in question about anything being wrong. He was there when the pressure went off. The pressure-pipe broke, and the air escaped. He at once sent for a man to repair

it; and this would generally take from ten to fifteen minutes. There was no reason why the deceased should want to move his machine. There was no hurry at all for the retorts—in fact, they could have waited for an hour or even two hours, when they came down for the next charge.

Dr. *John Guest* said the deceased was a very healthy man, every organ of the body being sound; and there was no question of any sudden illness which threw him forward. The cause of death was shock caused by the pressure of the machines upon his head.

The CORONER having addressed the Jury, they consulted for a short time and returned the following verdict: "The Jury have agreed that they think this man met his death accidentally; but they are of opinion that he was doing his best to expedite the work while the machine was out of order." They added a rider to the effect that something should be fixed on the machines in the way of buffers, so that it would be impossible for them to come close together, or that an accident of this kind should occur again.

Mr. ROBINSON: There is a buffer on.

The CORONER: But if you had a buffer say 18 inches long?

Mr. REESON: They would most probably get their bodies in between the buffers.

The CORONER said he thought they might safely leave this matter to the Factory Inspector and Mr. Reeson.

Mr. REESON said the Company were most anxious to do everything to protect the lives of their workpeople.

The CORONER said the verdict was one of "Accidental death."

SALES OF STOCKS AND SHARES.

In accordance with the announcement which appeared in our advertisement columns, Messrs. A. & W. Richards offered for sale, at the Mart, Tokenhouse Yard, E.C., last Tuesday, by order of Directors, four new issues of gas and water capital. The first lots consisted of £1000 of 4 per cent. perpetual debenture stock of the Great Yarmouth Water Company; and the stock was all sold at £105 per £100. Some lots of the Company's new ordinary stock, which ranks for a maximum dividend of 7 per cent. per annum, and will bear one of 4 per cent., followed, and were sold at from £92 10s. to £94 per £100. An issue of £10,000 of "D" capital water stock of the Barnet District Gas and Water Company was next offered. This is a 7 per cent. stock, on which $5\frac{1}{4}$ per cent. per annum has been paid for the last eight years; and it was all sold at from £114 10s. to £118 per £100. A parcel of 500 £10 "C" shares (7 per cent.) in the Harrow and Stanmore Gas Company, ranking for a dividend of £7 7s. per cent. per annum as from the 1st prox., fetched £15 2s. 6d. to £15 15s. each. A new issue of "C" consolidated 5 per cent. stock of the Aldershot Gas, Water, and District Lighting Company was sold at from £101 to £105 per £100; while some 4 per cent. consolidated preference stock fetched £94 to £95 per £100. At the Bank Auction Mart, Bristol, Messrs. John E. Pritchard and Co. (successors to Messrs. Alexander, Daniel, and Co.) recently sold, in accordance with the announcement which had appeared in the "JOURNAL," £15,000 of the Bristol Water Company's 7 per cent. maximum consolidated ordinary stock. The reserve was £136 per £100 of stock; and the prices realized ranged between £138 and £139. The total amount obtained by the sale, which lasted only fifteen minutes, was £20,748 5s.; and the average price of the stock was £138 6s. 5d. Tenders invited by the Sutton District Water Company for an issue of £10,000 of $4\frac{1}{2}$ per cent. preference stock were opened last Thursday. They amounted to £16,150, at prices ranging from £120 to £120 15s. per £100 of stock; the average price obtained being £120 12s. 2d.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The gas transfer at Kirkcaldy has been lost sight of for a time. It was thought that the parties would be able to come to terms in a private way. This expectation, however, is not in course of being realized, and the belief is almost universal that it will never be, but that the proceedings will follow the usual course of a disputed arbitration. The situation is somewhat complicated by an action which has been brought before Lord Dewar in the Court of Session by the Kirkcaldy Gaslight Company against the Provost, Magistrates, and Councillors of the Royal Burgh of Kirkcaldy. The particulars of this litigation have not been disclosed; but one thing about it is known—viz., that it has to do with a claim made by the Corporation to have discount in respect of gas consumed in the public lamps. At a meeting of the Town Council this week, it was reported that the Law Agent for the town—Mr. J. Prosser, Writer to the Signet, of Edinburgh—had consulted Mr. J. Avon Clyde, K.C., on the subject. The proposal was made by the Committee who have had charge of the negotiations regarding the gas transfer that a small Committee should be appointed to advise Mr. Prosser in the conduct of the case. In speaking against the proposal to appoint a Sub-Committee, Mr. Mackinnon said the whole question turned upon the meaning of the word "private." In a circular issued by the Gas Company in 1906, interest and discount were offered to private consumers. When the question first came before the Council, the Town Clerk gave his opinion against the town. Mr. Clyde's opinion was directly against the Council. The case simply turned upon what was public and what was private lighting. The Company maintained that the Town Council represented the public, and that whatever gas was given to the Council for the purpose of street lighting must be considered public. Mr. Mackinnon got no support; and a Sub-Committee of three was appointed. After this, there was a long discussion upon a proposal, which emanated from the Gas Committee themselves, that a Sub-Committee should be appointed to

act along with Councillor Wright and Mr. Prosser in the matter of the gas arbitration. Mr. Wright was opposed to the appointment of a Sub-Committee, as he had taken the responsibility in the negotiations all along; and it was resolved to send the matter back to the Gas Committee to consult with Mr. Prosser, and judge as to whether an Advisory Sub-Committee should or should not be appointed. In the course of the discussion, Mr. Wright said he had the assurance of their legal adviser that within a period of three months the whole thing would be settled. He also stated that, in consequence of Mr. Silverthorne having been appointed Arbiter on behalf of the town, it was illegal to consult him any further upon the subject of the arbitration. But the matter could not be more fully explained while the arbitration was going on. The Council would appear to be in want of a technical adviser, having lost the services of Mr. Silverthorne. The Company have secured the services of Mr. W. R. Herring, of Edinburgh.

On Monday, the Town Council of Dunfermline had before them the subject of supplying gas to Kingseat, an outlying village. Mr. T. Stewart, the Convener of the Gas Committee, said they estimated that the cost of laying a gas-main and making connections would be £1300. They anticipated that they would get 200 customers; and assuming that these used, on an average, 8000 cubic feet of gas, the total consumption would be 1,600,000 cubic feet per annum. Sinking fund and interest charges on £1300 would amount to 1s. 8d. per 1000 cubic feet, which would be charged above the price in Dunfermline. In other words, while gas was being supplied in the burgh at 2s. 3d. per 1000 cubic feet, in Kingseat the price would be 3s. 11d. Three-fourths of the people in Kingseat were burgh ratepayers, and the other fourth were in the county. Burgh ratepayers in the village would naturally object to pay more for gas than the price charged in the burgh. Unless the Council were prepared to supply gas in Kingseat at 2s. 3d. per 1000 cubic feet, the Gas Committee did not see how it was practicable to go into the matter at all. In the Council, some doubt was thrown on Mr. Stewart's calculations—his estimate being considered by some to be exaggerated; and the subject was sent back for a report upon it by the Gas Manager.

In the Arbroath Town Council this week, it was reported that, owing to disputes and breakdowns at the collieries, there was likely to be delay in the delivery of the Banknock coal contracted for, and that the Manager recommended acceptance of an offer by the Lothian Coal Company, Limited, to supply another 1000 tons of Newbattle single nuts, for delivery this season, at the contract price of 11s. 2d. per ton. The recommendation was adopted.

The important subject of liability for damage to pipes by underground mine workings was before the Town Council of Hamilton on Tuesday. The Town Clerk read the opinion of Counsel, which was obtained in 1884, and which was to the effect that, although the Town Council were entitled to vindicate for the surface of the streets the ordinary measure of support from subjacent owners, there was no liability on mineral owners for damage to pipes, but that if there were a case of undoubted subsidence of the roadway and damage to pipes therein, an action might be raised against the parties working the minerals, for declaration that the Council were entitled to support, both for streets and pipes; that no liability rested on mineral owners to pay compensation for damage to water-works and railway undertakings, but that the owners of these were empowered by statute to purchase the minerals in order to protect their works. No such provision was, however, made in regard to gas-works. The Gas Committee reported that they had considered the matter, and they recommended that no action be taken against the mine owners whose workings had caused subsidences in the roadways. This was agreed to.

An extraordinary meeting of the Cambuslang Gas Company, Limited, was held on Wednesday last, when a resolution was adopted unanimously to the effect that the capital of the Company be increased from £27,000 to £36,000, by the creation of 9000 shares of £1 each. Mr. David Rankine, J.P., who presided, explained that the increase in the capital of the Company was necessary to meet the capital expenditure in connection with the extension of the gas-works in the immediate future. It was proposed to introduce new sulphate plant, to extend the retort-bench, and to erect public offices in the vicinity of the present gas-works. There was also a new railway which it was proposed to lay down from the Caledonian Railway Company's system into the gas-works. Arrangements for the proposed railway had not yet been completed, either with the Railway Company or the County Council.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 15.

Sulphate of Ammonia.

During the past week there has been renewed strength in the market, and a good business has been done at steadily advancing prices. There has again been a considerable amount of purchasing in order to fulfil shipments against old contracts; and this, coupled with the appearance of an appreciable volume of new orders, has had the natural effect of further stimulating the tone. The closing values are £12 17s. 6d. to £12 18s. 9d. per ton f.o.b. Hull, £12 18s. 9d. to £13 per ton f.o.b. Liverpool, and £13 1s. 3d. to £13 2s. 6d. per ton f.o.b. Leith. A fair inquiry has been experienced in the forward position, and sales are reported at £13 per ton f.o.b. Leith for January-April delivery, and at £12 15s. per ton f.o.b. Liverpool for January-December 1911.

Nitrate of Soda.

There is no new feature to comment upon in this article; the spot market being rather idle at 9s. 4½d. per cwt. for ordinary, and 9s. 7½d. for 96 per cent. quality.

LONDON, *Oct.* 17.

Tar Products.

The markets for tar products have been steady throughout the past week, but there has been little of interest doing. Pitch has been quiet. The majority of makers are very easy in their position, and are quite determined to wait before placing any further quantity. One or two,

however, have sold at prices varying from 35s. 6d. to 36s. 6d. per ton f.o.b. east coast. Benzol, 90 per cent., is quiet, and makers are fairly firm in their ideas. But there are few orders except for delivery all over next year; and for this period consumers appear to think that they can get on at a very low figure indeed. Fifty-ninety per cent. benzol is quiet, and the value is unaltered. In toluol, there is not much demand, and makers are very well sold. Solvent naphtha is quiet in London; but there are reports in the North that it is very firm, although it seems to be difficult to get confirmation of this. Heavy naphtha is steady; and business has been done at improving prices for delivery all over next year. Creosote is still very quiet; and makers in the North appear disposed to sell some quantity at any rate at the market price. Business is reported at 1⅞d. to 2d. per gallon at makers' works.

The average values during the week were: Tar, 18s. 3d. to 22s. 3d. *ex* works. Pitch, London, 36s. to 36s. 6d.; east coast, 35s. 6d. to 36s.; west coast, 37s. to 38s. 6d. Clyde ports, 35s. 6d. to 36s. Liverpool, 35s. to 36s. Manchester. Benzol, 90 per cent., casks included, London, 7d. to 7¼d.; North, 7d. to 7¼d.; 50-90 per cent., casks included, London, 7½d. to 7⅝d.; North, 7¼d. to 7½d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3½d. to 4d.; North, 3½d. to 3¾d.; solvent naphtha, casks included, London, 1s. to 1s. 0½d.; North, 11d. to 1s.; heavy naphtha, casks included, London, 11d. to 11½d.; North, 10⅝d. to 11d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2⅛d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s., bags included. Anthracene, "A" quality, 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market is very firm indeed, and prices still continue to advance for near delivery. The principal Gas Companies are asking £12 10s. to £12 11s. 3d. for prompt delivery, and a further increase for forward is reported. In London, the market for outside makes, Gas Companies terms, is about £12 5s. to £12 7s. 6d. In Hull, £13 has been paid; and in Liverpool, £13 1s. 3d. In Leith, £13 2s. 8d. is asked; while in Middlesbrough, £13 is reported to have been paid.

From other sources we learn that the healthy tone in the market for tar products referred to last week continues. The phenol series are greatly in evidence. Creosote is about the same in the North, and slightly better in London. One of the large Gas Companies is sold out in pitch; and it is generally believed that many distillers are well sold in this article. In some parts of the North the supply is not equal to the demand at present. Shipments and deliveries are being made at prices near the following: Tar, 20s. to 26s. 6d. per ton. Pitch, London for export, 41s. per ton; Manchester, 39s. per ton; Liverpool, 40s. per ton; Glasgow, 40s. On the east coast, during the last few weeks, it is reported that a large order has been placed at 40s. per ton. Creosote sells at 2d. to 2¼d. per gallon, according to position of maker's works; bulk oil, 2⅜d. firm. Benzol, 50-90 per cent., fetches 7½d. per gallon, casks included; solvent naphtha, 1s. per gallon naked; crude naphtha, 3½d. per gallon naked; light oil, 3⅜d. per gallon naked; carbolic acid, 60's, 1s. 0½d. per gallon; drained salts, 50s. per ton naked.

One with an intimate knowledge of the trade writes: With reference to your correspondent's remarks in last week's "JOURNAL," I take exception to the pitch prices referred to by him—they are so high that they do no good to either buyer or seller. In London, pitch was offered by an important maker at 37s., without finding a buyer; and even the principal Gas Companies are willing to accept 40s. In Manchester, 35s. has been accepted in one instance; while offers have been made at 36s. without resulting in business. In Liverpool, sales have been made at 35s. 6d. to 36s. f.a.s.; and in Glasgow there are sellers at 38s. to 38s. 6d., and one lot has been sold at 37s.

COAL TRADE REPORTS.

Northern Coal Trade.

There has been a rather better demand for coals, and the shipments both of steam and gas coals are better; but the prices do not seem to have moved much. In steam coals, best Northumbrians are from 9s. 9d. to 10s. per ton f.o.b., second-class steams are from 8s. 6d. to 8s. 9d., and steam smalls are from 5s. 6d. to 6s. 6d. Production is fairly full, and the output is better taken up. In the gas coal trade, the increase in the demand continues, and should show itself more rapidly in the next few weeks. The price of Durham gas coal, of the usual classes, varies from 8s. 9d. to 9s. 9d. per ton f.o.b., according to the quality; while for "Wear" specials, up to 10s. 3d. is the current quotation. As to contracts, the most important is that for Stockholm, which has gone in the usual channels, at a price of about 13s. 1½d. per ton, delivered—a price below that of the preceding contracts, which were taken when the values of coal were rising. Other smaller contracts are in treaty; but some of the best gas coal collieries have now a large part of their output bespoken for some months. Coke is steady; but gas coke is more plentiful, and may be quoted at from 13s. 3d. to 13s. 9d. per ton f.o.b.

Scotch Coal Trade.

Trade has been a little more active. Ell is in better request, and splint has been moving off more freely. Colder weather has also enhanced the sale of house coal. On account of the lock-out in the shipyards, the demand for small sorts has been poor. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 338,730 tons—a decrease of 6186 tons upon the previous week, but an increase of 3513 tons upon the corresponding week of last year. For the year to date, the total shipments have amounted to 12,476,313 tons—an increase upon the corresponding period of 724,618 tons.

Fair-Contracts Clause at Oldham.

In the course of the business at the last meeting of the Oldham Town Council, Mr. Heywood asked the Chairman of the Gas Committee for information respecting a complaint from the Oldham Trades Council that the Contractors for the erection of the Higginshaw gasholder had not complied with the requirements of the fair-contracts clause. Alderman Thompson, in reply, said it was recorded in the minutes of the previous Council meeting that the Gas Committee had received a deputation from the Oldham Trades and Labour Council, who made allegations that the Contractors for the Higginshaw holder were not complying with the conditions of the fair-contracts clause. Certain charges were made with reference to the wages paid; the Trades Council maintaining that the holders-up for the riveters came under the same heading as the holders-up for riveters at boiler-works. The Contractors were found to have one or two men, for certain reasons, under the standard rate of wages; and they complied with the request to pay all the standard rate. The rate of wages for riveters was 35s. 6d. per week; and one man, who had left the trade for some time, and had come back recently, was paid 32s. for the first fortnight, and afterwards 34s. for a time. Whether they raised the man's wages or discharged him, he could not say. Then they came to the holders-up, where the dispute was really caused. The Contractors maintained that the average wage for these was 6d. per hour, which they paid; but the Trades Council said it should be 31s. 6d. per week. From inquiries made from the Manchester Corporation as to the wages paid on the construction of their gasholder, they thought that the wages for holders-up were 6d. per hour. The Committee gave the Trades Council further opportunity to furnish additional information, because they had only spoken from what they had heard, and not from anything positive. To sum up, as far as the investigations of the Committee had gone, there was no reason to believe that Messrs. R. Dempster and Sons were not adhering to the fair-contracts clause; and they could not see that the Corporation had any cause to interfere with them and their workpeople at the present time.

A Gas Manager's Power and Duties.—Mr. Denham, the Manager of the Ashburton (Devonshire) Gas-Works, wrote to the District Council at their last meeting asking to be informed as to his position, power, and duties, and applying for assistance. Mr. Lamerson said the Gas Committee had referred Mr. Denham to the terms of his appointment, and had told him he would receive assistance at the proper time. Mr. Cock asked if it was not a fact that more gas was being made now than when Mr. Denham was appointed, and said he believed the Manager had a real grievance. Mr. Lamerson remarked that Mr. Denham was simply the Works Manager, and his duty was to make gas and other products for the Council. Mr. Butcher stated that there was talk outside of friction between the Council and their employees; and the whole matter ought to be cleared up. Mr. Lamerson said that no doubt when the work now in progress at the gas-works was completed the question would be gone into by the Committee, and things put straight.

Defalcations by a Gas Company's Clerk.

At the Bournemouth Quarter Sessions last Tuesday, Herbert Buckley, head clerk in the office of the Bournemouth Gas and Water Company, was charged with falsifying the accounts of the Company to the extent of between £1700 and £1800 by omitting from the cash-book various receipts of moneys. The accused, who had been in the Company's service upwards of eighteen years, was charged in respect of about £600 only; and the Directors intimated that they did not wish to press the matter. Prisoner pleaded "Guilty;" and it was explained that the money had been lost on Stock Exchange speculations and transactions with money-lenders. The Recorder, in passing sentence of twelve months' imprisonment in the second division, said he thought the offences of the accused would probably not have been committed if a better system of auditing the accounts had been in existence.

Claim for Gas-Fitting Work.

In the Shoreditch County Court, a few days ago, before his Honour Judge Smyly, K.C., Mr. George Snow, of 33, Smalley Road, Stoke Newington, sued Mr. W. G. Hayes, of 7, Mildmay Road, Stoke Newington, to recover £2 10s. for gas-fittings and plumbing work done. The plaintiff proved having carried out certain gas-fitting work by order of the defendant, for which he now declined to pay. Defendant said he did not consider himself called upon to pay anything, as it had cost him more to put the work right than the amount claimed. When the plaintiff had finished, there was a smell of gas all over the house, and he called the plaintiff in again. He professed to do something; but the smell was just as bad directly afterwards. Plaintiff said he had done his work thoroughly, but defendant left a tap turned on, and, of course, there was a bad escape of gas. For the defence, Mr. Leonard, a gas-fitter, said he was called in to stop an escape, and found the work had been executed in so unworkmanlike a manner that it would have to be done over again. Plaintiff had used lead piping which cost 2d. a foot, but had charged for it at the rate of about 6d. Not only was the piping unsuited to the work, but the cost was excessive. He had stopped escapes of gas on numbers of occasions. His Honour referred the account to the Registrar.

Skipton Water Supply.—An application by the Skipton Urban District Council to the Local Government Board for permission to borrow £11,800 in connection with the Embsay Moor water scheme has been the subject of an inquiry by Mr. R. G. Hetherington. There was no opposition; and the inquiry was taken up solely with an examination by the Inspector of the details of expenditure in connection with the scheme. The estimate for the works was £69,000; and this has been exceeded by £8030. Mr. T. Duckett, the Chairman of the Water Committee, assured the Inspector that the Committee had gone thoroughly into all the matters connected with the expenditure.

A Question of Rating.

A local correspondent writes: Municipal electricity undertakings, when they are in competition with company-owned gas-works, can always count upon some advantages. They get the public lighting in the better streets, charging practically what they like for it; and they have also the benefit of any advantage which may accrue from the lighting of buildings under the control of the corporation. Another old practice is to favour electricity works in the matter of assessment to the rates. The Chairman of the Plymouth Electricity Committee, Mr. Anthony, complained at a meeting of the Town Council yesterday week, of the burden put upon the undertaking by what he described as the over-assessment of the works. This complaint was endorsed by Mr. Crowle, a member of the Committee, who argued that, as the property is being developed for the good of the town, it is unfair to handicap it by heavy rates. No one seems to have thought of the Gas Company, whose assessment was recently increased by no less than 50 per cent., and who, if anyone, have certainly the more right to complain of unfairness. A "friendly appeal" to the Assessment Committee to remedy the grievances of the Electricity Committee was suggested by another member of the Council. It will be interesting to watch the developments. The Gas Company's friendly appeal was without result; and though they probably did not ask for special treatment because of what they are doing for the benefit of the town, they could make at least as good a claim on this ground as the Electricity Committee. The advantages of a supply of cheap gas are known and appreciated by all classes in Plymouth; and there is nothing which the Electricity Committee are doing which can compare in advantage to the town with its gas at 1s. 8d. per 1000 cubic feet.

Mersea and District Gas Company, Limited.—In the last number of the "Journal," it was announced that Mr. Alec. E. Whitcher had been appointed Manager of this Company. According to the "East Anglian Times," the undertaking promises to be in every way successful. Our contemporary says: "The rapidly-increasing population of Mersea Island—a pleasant seaside resort—have hitherto, save in the rare instance of a private installation of electricity, had no artificial light except that supplied by mineral oil and candles. But the island, which is 5½ miles long by 2½ miles wide, has developed so rapidly, and is attracting such an excellent class of visitors, that the new Gas Company will undoubtedly, to use a stereotyped phrase, supply a long-felt want. The capital is fixed at £6000, of which it is understood that about £4000 has been already subscribed. The Chairman of Directors is Mr. W. J. Bean, a substantial local landowner; the Secretary being another well-known resident, Mr. Percy Hutchinson. The site for the gas-works has been already selected and surveyed, and the work of erecting the necessary appliances will be proceeded with forthwith. The Contractors for the plant are Messrs. Drakes Limited, of Halifax; while Mr. Thorp, of West Mersea, will erect the buildings. The Company is receiving locally very influential support."

Extended Use of "Coalexld."—In the notice of the recent Smoke Abatement Exhibition in Glasgow which appeared in the "Journal" for the 20th ult., reference was made to the stand of Coalexld Limited, of Lancaster. We learn that, as the result of the exhibit, the Glasgow Corporation have adopted the process, and are now doing a large trade in "Coalexld."

Charge for Water by Rate and Rent.—The Northampton Corporation are contemplating applying to Parliament next session for various powers; and at a recent meeting the Water Committee submitted certain proposals for inclusion in the Bill. Mr. E. Lewis suggested the addition of a clause empowering the Council to charge in two ways for water—by rate and by rent; and he moved that powers be sought for the purposes he had mentioned. He said the present system was very unjust to people who were compelled to have water laid on to their premises, but who, while using very little, had to pay the percentage on the rateable value. In this connection, he instanced solicitors' offices and large business premises, and said that the present system of charging could not be altered unless powers were obtained. Mr. Collier said the Water Committee were selling a commodity at a remunerative price; and those whose premises were so situated that they did not need a supply of water ought not to be called upon to pay. Water used in street flushing and purposes of that kind was paid for in the district rate. Mr. T. D. Lewis remarked that under present arrangements the owners of premises on which only 2s. 6d. worth of water was used might have to pay £2 10s. for it. Property of the rateable value of £26,000 escaped its share of the water undertaking. The motion was carried.

Interruption of Electric Lighting in Paris.—France was thrown into a state of disorganization last week by the strike of a large number of the men engaged upon the principal railway lines; and, in sympathy with them, the electricians in Paris ceased work at seven o'clock on Thursday evening, with the result that some of the main thoroughfares of the city were deprived of the light usually afforded by this illuminant. According to the "Daily Mail," at six o'clock the lights began to grow dim at the Ministry of the Interior, and paraffin lamps had to be hastily procured. Then the electricity failed in the Madeleine quarter, the Champ de Mars, the Trocadéro, the Arc de Triomphe, the Boulevard St. Germain, and in other districts. M. Lépine, the Prefect of Police, engaged a motor-car, and on arriving at the Elysée found the President, M. Fallières, and his Secretary sitting in a room lit by candles. After fifteen minutes the light suddenly reappeared in one or two districts; but at midnight the Elysée Palace, the Ministry of the Interior, the Prefecture of Police, and all the district lying on the southern bank of the Seine, were totally deprived of electricity. All electrically worked clocks, lifts, and most of the suburban tramway lines were at a standstill; many vehicles being left in the middle of the roadway. It appears that the Government had anticipated something of the kind, and had held a certain number of engineers and firemen in reserve. As a result, no further interruption of the supply was likely to occur.

The Lighting of Bideford.—It was announced at the last meeting of the Bideford Town Council that the Gas Company had reduced the cost of public lighting for the ensuing year by 1s. 6d. per lamp. Satisfaction was expressed with a new light which the Company had installed as an experiment; and Mr. Cocks suggested that the money saved on the lighting through the reduction of price should be utilized in fixing these new lights throughout the town. A Committee was appointed to communicate with the Company on the matter, and report as to the cost of installing improved lights.

St. Petersburg Gas Supply.—The members of the St. Petersburg Town Council have made a tour of inspection of the city gas-works, which not long ago were taken out of the hands of a private Company. They are very old, but in a fairly satisfactory condition—indeed, they are now stated to be working better than they did when they were in the Company's hands. A pood of coal (36 lbs.) under municipal management yields 165 cubic feet of gas, whereas before the yield was only 144 cubic feet. The gasholders are working tolerably well. One is considered to be rather dangerous; and, in view of this, a water-pipe has been fitted on the crown to deal with an outbreak of fire if it should occur. With regard to the thorough reconstruction of the works, which is in all respects desirable, it is proposed to transfer the whole establishment to the Gutuieff Island, which it is considered would be advantageous from both the sanitary and the economic point of view. Coal could be delivered there at something like 2 copecks (½d.) per pood less than at the present works.

Gas v. Electric Lighting at Chepstow.—At a recent meeting of the Lydney Rural District Council, a member, who is also a guardian, stated that the electric light at 6d. per unit was equal to Chepstow gas at 3s. 6d. per 1000 cubic feet. This statement brought a reply from Mr. James Robb, the Company's Engineer, Manager, and Secretary, and it appeared in a local paper last Saturday in the form of a letter to the Council. He pointed out that in January last year the Monmouth Guardians inquired at Chepstow as to the relative costs of the two lights, and it appeared that for the year ended September, 1908, the electric light at 6d. a unit had cost £94 8s., compared with the gas for the corresponding period for the old building of £23 12s. 5d. Mr. Robb added that the Gas Company were prepared to prove that the lighting of the same premises with gas with an equally good light would only amount to £35 per annum. He said the Company did not want to prevent anyone supplying electric or any other light, as they were satisfied that gas would hold its own on its merits, as it had done in Westminster and elsewhere. They, however, asked the Council to stipulate that where the electricians came into close proximity to any of the Company's pipes with their columns, wires, &c., they should keep at a sufficient distance, so that the Company might be able to get at them for repairs and making connections thereto. They also asked that where the wires, &c., were embedded in the ground they should be perfectly insulated, as if this was not properly done it destroyed pipes, more especially the water-pipes, besides endangering life, and causing disastrous fires and ground explosions.

APPLICATIONS FOR LETTERS PATENT.

22,666.—Alley, S.E., "Stop-valves." Sept. 30.
22,675.—Schuh, J., "Compressing gases." Sept. 30.
22,678.—Agopian, H., "Artesian wells." Sept. 30.
22,759.—Bruneau, G., "Gas heating apparatus." Oct. 1.
22,760.—Liddle, J., "Time-switch for lighting-circuits." A communication from Rudolf Buderer and Co. Oct. 1.
22,761.—Day, C., and Dexter, W. A., "Rotary pumps or compressors." Oct. 1.
22,794.—Cohn, S., "Mantles." Oct. 1.
22,838.—Richmond Gas Stove and Meter Company, Ltd., and Thornton, H. M., "Gas-fire fittings." Oct. 3.
22,862.—Still, C., "Distilling hydrocarbons dissolved in tar-oils." Oct. 3.
22,891.—Prosser, H. R., "Gas-burners." Oct. 4.
22,892.—Thomas Piggott and Co., Ltd., and Barker, T. P., "Jointing steel pipes, tanks, or the like." Oct. 4.
22,907.—Fabry, R., "Bye-product coke-ovens." Oct. 4.
22,908.—Beilby, H. N., "Distillation of coal." Oct. 4.
22,931.—Ellwood, T. B., "Stop-cocks." Oct. 4.
22,951.—Zechnall, L., "Incandescent burners." Oct. 4.
22,971.—Specht, P., "Inverted gas-lamps." Oct. 4.
23,000.—Barralet, T. E., and Parkinson Stove Company, Ltd., "Combined gas and water taps for geysers." Oct. 5.
23,004.—Seaton, A. I., "Meter cash-box." Oct. 5.
23,008.—Richmond Gas Stove and Meter Company, Ltd., and Sherburn, W. H., "Burner-taps." Oct. 5.
23,022.—Charters, H., "Gas-stoves." Oct. 5.
23,033.—White, W., "Gas-stoves." Oct. 5.
23,036.—Kelley, F. A., Dutchman, E., and Jessop, S., "Gas-burners of the automatic lighting and governing type." Oct. 5.
23,040.—Marken, J. C. van, "Production of gas." Oct. 5.
23,072.—Feeny, V. I., "Gas-cocks." Oct. 5.
23,080.—Verity, J. W., and Lewis, F. C., "Increasing the calorific value of fuel." Partly communicated from E. B. Higgins. Oct. 5.
23,085.—Hatton, E., "Incandescent gas-lamps." Oct. 6.
23,118.—Bernhard, E. E., "Generating acetylene gas." Oct. 6.
23,124.—Summers, W., "Controlling the flow of liquids." Oct. 6.
23,125.—Tanne, J., and Oberlander, G., "Separating solid hydrocarbons from naphtha residues and tars." Oct. 6.
23,137.—Brooks, B. W., "Cocks or valves." Oct. 6.
23,179.—Edgar, W., "Coin or token freed apparatus for supplying gas for a predetermined period." Oct. 6.
23,187.—M'Robbie, W., "Rotary compressors or pumps." Oct. 7.
23,211.—Wilson, W. A., "Gas-tap for duplex burners." Oct. 7.
23,235.—Price, H. S., "Water-meter." Oct. 7.
23,269.—Rossbach-Rousset, F., "Vent-valves for gas lighting apparatus." Oct. 7.
23,290.—Kent-Johnston, A. G., "Lighting and extinguishing gas-lamps." Oct. 8.

The New Holder at Burton-upon-Trent.—The new gasholder and tank at Burton-upon-Trent described by Mr. R. S. Ramsden in his Presidential Address to the Midland Junior Gas Association, as reproduced in the "JOURNAL" last week (pp. 127-130), were, we understand, constructed by Messrs. Clayton, Son, and Co., Limited, of Moor End Works, Hunslet, Leeds.

Lighting Refuge Lamps in Westminster.—The Works Committee of the Westminster City Council report that they have been informed that there are 7 gas-lamps on refuges to be dealt with within the area of the new contract with the Gaslight and Coke Company for public lighting. There are also 15 gas-lamps on refuges which do not come within the contract, but which the Company are willing to treat on the same lines. The present annual charge for these lamps is £5 5s. 2d. each. The annual charge, under the contract, for 180-candle lamps is £4 10s. per lamp; the cost of converting existing lanterns is 12s. 6d. each, and the cost of new lanterns £1 5s. each. The Committee have given instructions that the 22 refuge gas-lamps above referred to be converted to 180-candle lamps, and be lighted and maintained under the new contract with the Gas Company.

Clark's Syphon Stove Company, Limited, issue an excellently prepared catalogue of their "pure-heat-giving" syphon and other gas-stoves. The whole of these have been recently revised and brought up to date; and special attention has been given to the construction and materials used, with the object of reducing costs of maintenance to a minimum. Pure heat only is obtained, the Company point out, by means of condensing the products of combustion in a manner scientifically correct. The catalogue is in a stiff cover; and the numerous illustrations include two in colour.

The Directors of the Bombay Gas Company, Limited, have declared an interim dividend of 3 per cent. for the six months ended the 30th of June.

The Directors of the Monte Video Gas Company, Limited, have declared an interim dividend of 6s. per share, less income-tax, for the half year ended the 30th of June.

The Richmond Gas Stove and Meter Company have just received an order to supply a suite of cooking apparatus for one of the largest public institutions in Italy. This will make the twenty-fourth installation of its kind—each capable of dealing with the requirements of 1000 persons. The whole of the installations have been supplied by the "Special Apparatus Department" of the Richmond Gas-Stove Company.

A Local Government Board inquiry regarding the water supply of the district east and south of Rotherham was held last week by Mr. M. K. North. Applications had been made by the Rotherham Rural District Council to borrow £8596 for purposes of water supply for the contributory places of Bramley, Brampton-en-le-Morthen, Hooton Levett, Laughton, Maltby, Ravenfield, Ulley, and Wickersley, including the execution of certain works at Aughton. It was explained that the Council had come to the conclusion that the only sure way of getting at all times a full supply was from the Sheffield Corporation mains at Aston. Mr. William Terrey, the Manager of the Sheffield Water Department, stated that the Corporation undertook by agreement to supply water in bulk at Aston, at the rate of 9d. per 1000 gallons; the minimum quantity being 90,000 gallons a day for the parishes named, and the agreement to be for fifty years. This was part of a large scheme for supplying water over a wide district.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEER AND MANAGER. Stafford Gas and Electricity Department. Applications by Oct. 24.
DRAUGHTSMAN. No. 5302.
CARBONIZING FOREMAN. No. 5303.
FOREMAN BURNER MAINTAINER. Winchester Water and Gas Company.
WASTE WATER AND TAP INSPECTOR. Wombwell Gas and Water Department.

Situations Wanted.

ASSISTANT IN GAS-WORKS. No. 5304.

Plant, &c. (Second-Hand), for Sale.

GAS-WORKS (DISPOSAL OR LEASE), Beaumaris. Particulars of Mr. Cripwell, Birmingham.
RETORT-HOUSE GOVERNOR. No. 5301.
TAR-WORKS. No. 5300.

Patent Licence, &c.

"REGULATING THE TEMPERATURE OF COMBUSTION IN A GAS PRODUCER FURNACE FOR HEATING RETORT OVENS, &c." Page and Rowlingson, New Bridge Street, E.C.

Meetings.

CEARA GAS COMPANY. London Office. Oct. 28. One o'clock.
GAS AND COMMERCIAL SECURITIES CORPORATION. Offices. Oct. 19. 10.30 o'clock.

Stocks and Shares.

BOGNOR GASLIGHT COMPANY (BY AUCTION). Oct. 25.
GRAYS AND TILBURY GAS COMPANY (BY AUCTION). Oct. 25.
LOWESTOFT WATER AND GAS COMPANY (BY AUCTION). Nov. 8.
REDHILL GAS COMPANY (BY TENDER). Nov. 1.
TENDRING HUNDRED WATER COMPANY (BY AUCTION). Oct. 25.

TENDERS FOR

Benzol (Crude).

BRIDGEWATER COLLIERIES COKE-WORKS. Tenders by Oct. 24.

Cyanide Cake.

GLASGOW GAS DEPARTMENT. Tenders by Oct. 25.

Retort Ironwork, &c.

DEVONPORT GAS DEPARTMENT. Tenders by Nov. 5.

Washers.

DEVONPORT GAS DEPARTMENT. Tenders by Nov. 5.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 183.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord.	86—88*	+½	5 13 8
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95—98	..	4 1 8
200,000	5	May 12	7	Bombay, Ltd.	6⅜—6⅝	..	5 5 8
40,000	5	,,	7	Do. New, £4 paid	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	+¼	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246—249	..	5 0 5
330,000	,,	,,	9½	Do. New	184—186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215—218	.	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	157—160	+2	5 0 0
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90		5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	+1	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4¼—5½	−1	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	50½—51½	..	5 16 6
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk.	105—108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	..	3 14 1
800,000	Stk.	June 10	5	Continental Union, Ltd.	97—99	..	5 1 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103—105*	+½	4 15 3
486,090	10	July 14	12	European, Ltd.	23¾—24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	105½—106½	−½	4 7 7
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,002,235	,,	,,	4	Do. 4 p.c. Con. Pref.	104—106	..	3 15 6
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½*	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112—114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental	187—189	..	4 15 3
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	162 164	..	4 5 4
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅝—4⅞	+1/16	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd.	12½—13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	101½—102½	..	4 5 4
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138—140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd.	6—6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A.	131—133	..	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	+3	4 16 2
398,490	5	Apl. 29	7	Primitiva Ord.	7⅜—7⅝	+⅛	4 11 10
796,980	5	June 29	5	Do. 5 p.c. Pref.	5¼ 5½	+⅛	4 10 11
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼*	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord.	110—112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c.	139—141	..	4 15 9
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Hampstead, N.W.
'Phone: 3842 P.O. Hampstead.

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The Reliance Lubricating Oil Company, 19 & 20, Water Lane, Tower St., London, E.C. Agents wanted.

COAL TAR wanted. Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

CITY and Guilds—Courses in Gas Engineering and Supply (over 100 Passes and 6 Medals in Two Years), Structural Engineering and Heating and Ventilating (two new subjects) for the 1911 Examinations.

Correspondence College Company, Dept. W. 26, Green Street, Cambridge.

£5 REWARD will be paid to anyone Securing for a Young Engineer (Age 18) a suitable Permanent Position as ASSISTANT IN GAS-WORKS. Three Years' training at Gas Contractors' Works. Good Secondary and Technical Education.

Address No. 5304, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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Apply, by letter, to No. 5302, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

BOROUGH OF STAFFORD.
(Gas and Electricity Department.)

THE Corporation of Stafford invite APPLICATIONS for the Appointment of ENGINEER and MANAGER to take Entire Charge of the Gas Department and Supervise the Electricity Department.

Applicants must possess a thorough knowledge of Gas Engineering, and be capable of Designing, Superintending, and Carrying Out any Extensions or Alterations that may be required at the Gas-Works, and undertake the General Supervision of the Electricity Department.

Salary to commence at £350 per Annum, rising (subject to satisfactory services) by annual increments of £25 to £500 per Annum.

Candidate's age to be between 28 and 45.

Applications, stating Age, Training, and Experience (with *Copies* of not more than Three recent Testimonials), to be sent to me on or before Monday, the 24th of October instant.

Canvassing in any way whatever will be a disqualification.

Richd. Battle,
Town Clerk.

Borough Hall, Stafford,
Oct. 4, 1910.

WANTED, a Carbonizing Foreman, used to Regenerators, Retort-House Plant, Stoking Machinery, &c.

Applications, by letter, with full Particulars of Experience, Age, &c., to No. 5303, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, at once, a Smart, Active Cyclist, of Good Appearance, as Uniformed WORKING FOREMAN BURNER MAINTAINER. Wages 27s. 6d. per Week.

Apply, with *copies* of Three recent Testimonials, to the Water and Gas Company, 19, Staple Garden, Winchester.

WANTED, at once, an Experienced Man as WASTE WATER and TAP INSPECTOR. Wages, 32s. per Week. Must have had Experience in Reduction of Waste by the Deacon Waste-Meter System, Meter Reading, &c.

Apply, in own Hand Writing, giving Three References (not Testimonials), to P. D. Walmsley, B.Sc., Gas and Water Engineer, Wombwell, Yorks.

RE THE BEAUMARIS GAS-WORKS,
BEAUMARIS.

THE Trustee of the above Estate will be pleased to receive OFFERS for the above BUSINESS, together with the PURCHASE OF PLANT, &c.

The Works and fixed Plant may be had upon Lease. Full Description and Particulars, including turn-over, &c., on Application to Mr. Albert Cripwell, Accountant and Auditor, 12, Cherry Street, Birmingham.

FOR SALE—A Well Situated, Old Established, TAR WORKS. Good Contracts. Satisfactory reasons for Selling.

Address No. 5300, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—An 8-inch Retort-House GOVERNOR. Condition equal to new. Has been replaced by a larger Governor.

Address No. 5301, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—Complete Gas-Making PLANT, including New Gasholder and Steel Tank, 10,000 Cubic Feet capacity, ready for delivery, with Condensers, Scrubber, Purifiers, &c. Erected complete in England for £1200. Detailed Plan and Specification submitted.

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GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.

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COUNTY BOROUGH OF DEVONPORT.
(Gas Department.)

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1—The Supply and Erection of new IRONWORK for Twelve Benches of Through RETORTS.
2—The Supply and Erection of Two ROTARY WASHERS and One LIVESEY WASHER.

Full Particulars may be obtained from the undersigned.

Tenders, endorsed "Tender No. 1" or "No. 2," to be sent, addressed to the Town Clerk, Devonport, on or before the 5th of November, 1910.

W. P. Tervet,
Engineer and Manager.

Gas-Works, Devonport,
Oct. 3, 1910.

BRIDGEWATER COLLIERIES COKE WORKS.
(The Earl of Ellesmere.)

TENDERS are invited for a quantity of from 8000 to 12,000 Gallons per month of CRUDE BENZOL, testing 80 per cent. at 120° C., during the next Six Months, delivered into Contractor's Tanks at the Bridgewater Collieries Wharton Hall Siding (Pendleton and Hindley Branch of the Lancashire and Yorkshire Railway) or at the Brackley Siding (Little Hulton Mineral Branch of the London and North Western Railway).

Tenders, endorsed "Tender for Crude Benzol," to be received at The Bridgewater Coal Offices, 4, Chapel Walks, Manchester, not later than the 24th inst.

Manchester, Oct. 11, 1910.

CORPORATION OF GLASGOW.
(Gas Department.)

CYANIDE CAKE FOR SALE AT THE GAS-WORKS.

THE Corporation are prepared to receive TENDERS for the Purchase of the CRUDE FERRO-CYANIDE of SODA CAKE produced at their Provan and Dawsholm Gas-Works, during the Three or Five Years from and after the 1st of December, 1910.

Forms of Tender and Particulars regarding Conditions of Sale may be obtained on Application to Mr. Alexander Wilson, Gas Engineer, 45, John Street, Glasgow.

Sealed Tenders, marked outside "Tender for Cyanide—Gas Department," must be lodged with the Subscriber on or before Tuesday, the 25th of October, 1910.

The highest or any Tender may not be accepted.

A. W. Myles,
Town Clerk.

City Chambers, Glasgow,
Oct. 14, 1910.

TO MAKERS OF GAS PRODUCER FURNACES.

THE Proprietors of the Patent No. 19,716, of 1905, for "Improvements in Processes of Regulating the Temperature of Combustion in a Gas Producer Furnace for Heating Retort Ovens or for Other Uses," desire to enter into Negotiations with one or more Firms in Great Britain either for the SALE OF these PATENT RIGHTS, or for the Grant of LICENSES to Manufacture under Royalty. For further Information, address,

Page and Rowlingson, 28, New Bridge St., London, E.C.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the
TENDRING HUNDRED WATER-WORKS COMPANY.

(Supplying Harwich, Parkeston, Dovercourt, Walton-on-Naze, Frinton-on-Sea, and adjacent places.)
NEW ISSUE OF 351 £10 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
GRAYS AND TILBURY GAS COMPANY.

NEW ISSUE OF 400 £10 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
BOGNOR GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £4000 ADDITIONAL ORDINARY CONSOLIDATED STOCK "A"
AND
£2000 FOUR-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES.
AND
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 8, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

THE REDHILL GAS COMPANY.

SALE OF ORDINARY "B" STOCK.

NOTICE is Hereby Given, that it is the intention of the said Company to SELL BY TENDER £5000 of ORDINARY "B" STOCK of and in the Redhill Gas Company. The last day for the reception of Tenders will be Tuesday, the 1st of November, 1910, at Twelve o'clock at Noon.

Forms of Tender, with Particulars of Sale and Conditions of Tender attached, can be had upon Application at the Company's Office, Brighton Road, Redhill.

By order of the Directors,
Horace Long,
Secretary.

Redhill, Surrey,
Sept. 30, 1910.

CEARA GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY ANNUAL GENERAL MEETING of the Shareholders will be held at the Offices of the Company, 9, Queen Street Place, Cannon Street, in the City of London, on Friday, the 28th day of October, 1910, at One o'clock in the Afternoon, to receive the Report of the Directors; to declare a Dividend; to elect Directors and an Auditor; and for General Purposes.

The TRANSFER BOOKS WILL BE CLOSED from the 15th of October to the 28th of October, both days inclusive.

By order of the Board,
George R. Guyatt,
Secretary.

Oct. 14, 1910.
Dividend Warrants will be sent out on Nov. 5.

GAS AND COMMERCIAL SECURITIES CORPORATION, LIMITED.

NOTICE is Hereby Given, that the FIRST ORDINARY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 39, Lombard Street, London, E.C., on Wednesday, the 19th day of October, 1910, at 10.30 o'clock a.m., and for the following purposes, viz.:

1. To receive and consider the Directors' Report and Statement of Accounts.
2. To sanction the declaration of a Final Dividend.
3. To elect a Director.
4. To elect Auditors and to fix the amount of their Remuneration.
5. To transact any other Ordinary Business of the Company.

The TRANSFER BOOKS OF THE COMPANY WILL BE CLOSED from the 12th of October to the 26th of October, both days inclusive.

Dated this 11th day of October, 1910.

By order of the Board,
L. MAYNARD BROWN,
Secretary.

39, Lombard Street,
London, E.C.

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BRETTELL'S ESTATE, LIMITED,
FIRE-CLAY & BRICK WORKS,
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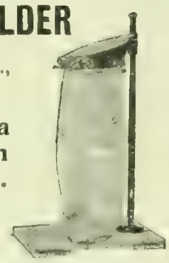

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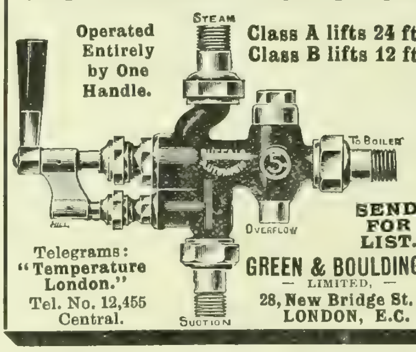

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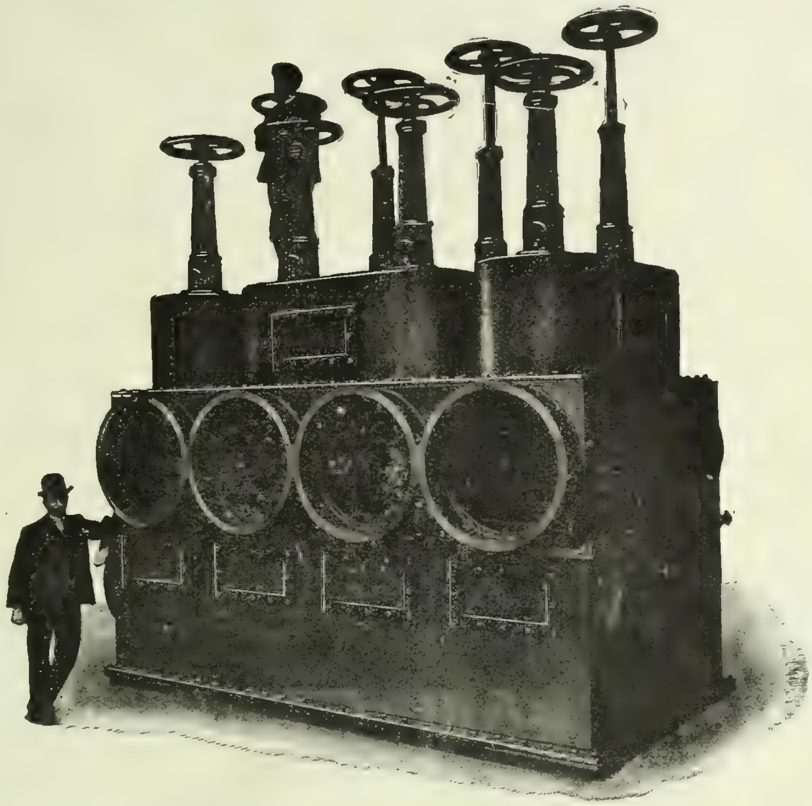

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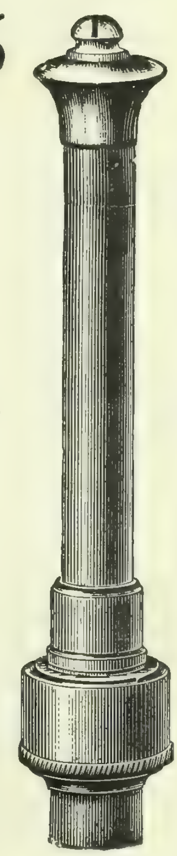

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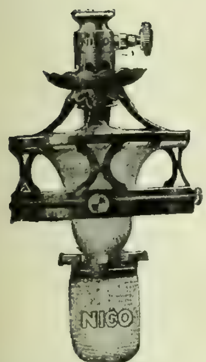

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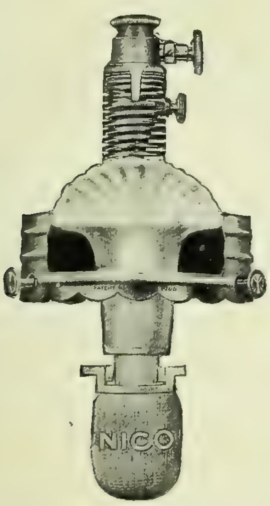

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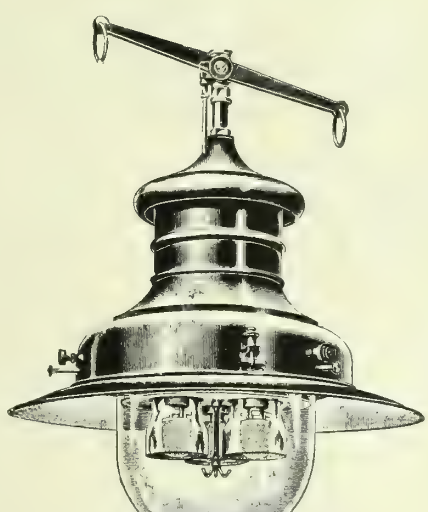

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Malmö, Sweden	350,000
Malta	400,000
Manchester	3,500,000
Manchester (2nd)	3,500,000
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Merthyr Tydfil	300,000
Middlesbrough	1,250,000
Namur, Belgium	175,000
Nelson	400,000
Newburgh, N.Y.	600,000
New York	5,200,000
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North Middlesex (3rd)	75,000
Norwich	1,000,000
Norwich (2nd)	300,000
Norwich (3rd)	500,000
Nottingham	1,000,000
Nottingham (2nd)	1,000,000
Nuneaton	125,000
Oberhausen, Germany	175,000
Oldenburg, Germany	200,000
Ostend, Belgium	100,000
Ostend (2nd)	200,000
Perth, W.A.	125,000
Poole	1,500,000
Port Elizabeth, S.A	400,000
Portsmouth	1,000,000
Posen, Germany	450,000
Posen (2nd)	700,000
Prague, Austria	140,000
Preston	1,400,000
Reading	1,000,000
Redhill	275,000
Redhill (2nd)	300,000
Reichenberg, Bohemia	200,000
Reichenberg (2nd)	200,000
Revel, Russia	350,000
Rhymney Valley	175,000
Romford	300,000
Romford (2nd)	350,000
Rotterdam, Holland	850,000
Rotterdam (2nd)	1,500,000
Rotterdam (3rd)	750,000
Rotterdam (4th)	750,000
Rotterdam (5th)	600,000
St. Albans	700,000
St. Gallen, Switz.	225,000
St. Gallen (2nd)	225,000
St. Joseph, Mo.	750,000
San Paulo, Brazil	700,000
Santiago de Cuba	400,000
Scarborough	800,000
Schwelm, Westphalia	100,000
Shanghai	225,000
Shanghai (2nd)	225,000
Shanghai (3rd)	1,600,000
Southampton	800,000
Southampton (2nd)	500,000
Southampton (3rd)	600,000
Southgate	400,000
Southport	750,000
Southport (2nd)	900,000
South Shields	650,000
Stafford	500,000
Staines	600,000
Stettin, Germany	880,000
Stockholm	1,500,000
Stockholm (2nd)	1,750,000
Stockport	600,000
Stockport (2nd)	600,000
Stockport (3rd)	400,000
Stockton-on-Tees	500,000
Swansea	750,000
Swansea (2nd)	1,000,000
Swansea (3rd)	450,000
Swindon	300,000
Swindon (2nd)	450,000
Sydney—Harbour	500,000
Sydney—Harbour (2nd)	500,000
Sydney—Mortlake	500,000
Sydney—Mortlake (2nd)	500,000
Syracuse, N.Y.	850,000
Taunton	225,000
Taunton (2nd)	350,000
The Hague Holland	1,000,000
The Hague (2nd)	500,000
Tilburg, Holland	400,000
Torquay	350,000
Tottenham	750,000
Tottenham (2nd)	750,000
Tottenham (3rd)	350,000
Tottenham (4th)	1,000,000
Tottenham (5th)	1,000,000
Tottenham (6th)	1,250,000
Tunbridge Wells	1,000,000
Utrecht, Holland	1,000,000
Utrecht (2nd)	1,000,000
Verviers, Belgium	1,000,000
Vienna	3,500,000
Vienna (2nd)	2,500,000
Waltham	400,000
Wandsworth & Putney	1,800,000
Watford	300,000
Watford (2nd)	350,000
Wellington, N.Z.	350,000
West Bromwich	550,000
West Ham	1,500,000
West Ham (2nd)	800,000
Weston-super-Mare	350,000
Weston (2nd)	350,000
Wexford, Ireland	100,000
Wiesbaden, Germany	850,000
Winchester	225,000
Winchester (2nd)	125,000
Wolverhampton	1,500,000
Zwolle, Holland	200,000
Zwolle (2nd)	200,000

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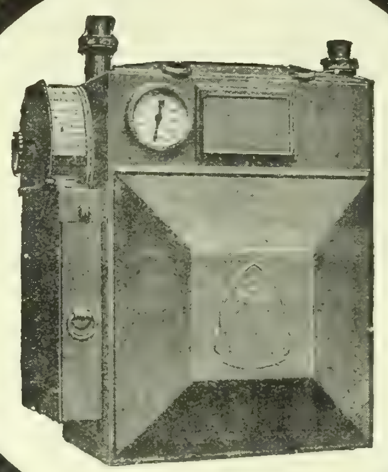

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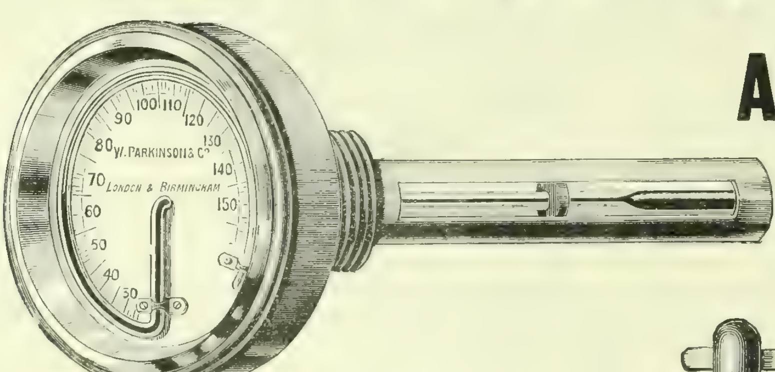

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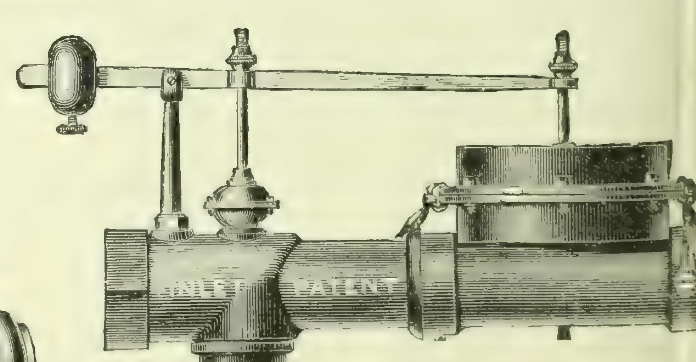

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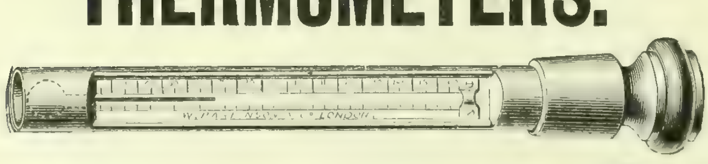

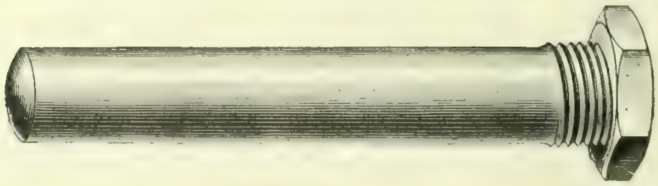

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2476.—TUESDAY, OCTOBER 25, 1910.

EDITORIAL NOTES—GAS, &c.

Novel and Other Provisions in Gas Legislation.

o the followers of the legislative record published in our ıges relating to gas supply, it will have been observed that ertain clauses that appear session after session in the pro- ıoted measures seem to have reached the unalterable status ıat is proverbially attributed to the laws of the Medes and 'ersians. This is due to the form of clause being dignified y the approval of the parliamentary authorities, and its ıstallation in the Model Clauses, after which there is no articular fear that the clause when inserted in a Bill will ot go through. The authorities dealing with Private Bill egislation are very jealous of interference with the forms f clause to which they have given their sanction; and some ery good reason has to be presented before they will allow ny departure therefrom. But at the same time, they do ot shut eyes and ears to special considerations advanced in ıvour of change; otherwise the Model Clauses to-day would ot have contained, *exempli gratiâ*, the new auction clauses nd existing illuminating power and testing clauses. Some hanges from stereotyped clauses are noticed in the review n our columns this week of the Scotch gas legislation for he session; and, without pronouncing any fixed opinion in egard to them, it may be suggested as being worth the vhile of promoters to devote a little consideration to them, vith the view of seeing whether they are suitable for adop- ion, in their own particular circumstances, in future.

The first change that will be noted is in the provision ıs to a reserve fund in the Falkirk Corporation measure. Under the old legislation of 1847, maximum price gas companies were, and are, allowed to form "reserved" funds up to one-tenth of their nominal capital, or up to any other sum prescribed in their Special Act, from profits in excess of the prescribed maximum rate of dividend. In the case of sliding-scale companies, as is also well known, they are allowed to form a reserve fund to an unlimited extent, but only out of divisible profits applicable to the payment of dividend in (under the sliding-scale) excess of the standard rate. There is, by the way, no particular virtue in Parliament permitting gas companies to form a reserve fund up to any amount under such a condition. In the case of local authorities who desire a reserve fund in connection with their gas undertakings, practice varies; but, as a rule, there is some sort of identity with the terms of the 1847 Act as applying to maximum price companies. It is sometimes found that they are permitted to set aside from revenue such sums as they may think reasonable until a fund is accumulated equal to 10 per cent. of the aggregate capital expenditure for the time being; and in other Acts—such as the Egremont and Mallow this session—the fund is allowed to go up to one-fifth of the aggregate capital expenditure. We have Glasgow limited to a fund equal to 10 per cent. of the capital outstanding; and in their case the extent of the appropriation for the fund is also defined—at 10s. per cent. upon outstanding borrowings. Now in the Falkirk Order, we have—is it for the first time?—the basis of contribution to a reserve fund formed by the price of gas and the quantity of gas sold. When the price does not exceed 3s. 3d. for lighting purposes, not less than 2d. is to be taken per 1000 cubic feet sold for the purpose of the fund; when the price is 3s. 3d., but does not exceed 3s. 6d., the contribution is to be 1½d.; and when the price exceeds 3s. 6d., it is to be 1d. Fundamentally, this arrangement appears to be sound; for the greatest contributions should be made when times are good. When times are good in gas supply is when the price of gas for lighting purposes is lowest; and conversely when the price of gas is raised, it indicates those bad times against which the reserve fund has, in part purpose, been built up. This Falkirk reserve fund (which, by-the-by, is a compulsory one, seeing that the clause says "the Council "*shall*" for the purposes of the fund), in addition to the ordinary purposes to which such a fund may be applied, may be used for defraying the costs of extensions, but is not to be applicable to the cost of renewing meters and stoves.

The question of depreciation on gas-works plant and appliances is associated with the general one of the disposal of the gas profits in the case of the Glasgow Gas Consolidation Act. It will be remembered that the Corporation are prohibited from appropriating any of their gas profits in relief of the rates. The Gas Department are not at all sorry that this is so; and when the low-price gaseous fuel supply of the city renders the atmosphere less murky, and more sunshine is thus permitted to penetrate to the general environment of the citizens, they, too, will have good cause to be grateful to the wisdom of Parliament in this matter. But in the clauses stating how the revenues of the department are to be disposed of, it will be observed that the Corporation have had defined for them the amounts that they may set apart as depreciation upon the various assets of the department as calculated on the book values at May 31, 1906, together with the subsequent net additions to the assets. The rates allowed for depreciation are these: On gas-works, 1½ per cent. per annum; on chemical works, 3 per cent.; on pipes, 2 per cent.; on meters, 6 per cent.; on stoves, 10 per cent.; on premium, 2½ per cent. The allowances for the gas and chemical works certainly do not err on the side of liberality; but this prescription of fixed amounts for depreciation on various assets is not by any means the least important and interesting novelty in the session's gas legislation. It should be mentioned that, after meeting all ordinary expenditure, and making provision for reserve and depreciation, any balance remaining in any year is to be carried forward to the revenue account for the next succeeding year; and as soon as there is an amount sufficient for the purpose, it is to be applied to the reduction of the gas charges equally throughout the limits of supply. This is as things should be in the case of a municipal undertaking, with the qualification that any financial aid from the rates at any time should be a debt to be discharged.

Another matter that receives prominence in the Scotch measures reviewed this week is that of differential prices for gas supply. There has been a change—more compulsory than voluntary—in policy and view in this connection. Flat-rates for gas could, at one time of day, be defended by the fact of an undisputed possession; but it is not the case to-day. There is a scramble for business in lighting, heating, and power between a number of very keen competitors; and prices, in each line of business, must be governed not by the policy of a past day, but by what the competitors of town gas—whether coal, suction and other producer gas, or electricity—can, or do, offer. There are a few areas in which town gas is at such a price that probably a flat-rate suffices for all purposes. But this does not apply to very many supply districts; and so, in the majority of cases, each line of business has to be considered separately in relation to its own competitive conditions, unless the whole gas business, instead of expanding, is to shrink down to perhaps little more than the lighting business supplemented by a comparatively moderate use of cooking-stoves. This session, we have Glasgow, with its low price within the city of 2s. for lighting and 1s. 8d. for manufacturing purposes, obtaining from Parliament authority for charging a different price from lighting for all other purposes, provided that the rate charged for the gas supplied for any such purpose shall be the same under like circumstances to all persons. Outside the city supply area, differential rates for different purposes may also be charged, but on a higher scale than in the city area. The Falkirk Corporation have also secured authority to charge differential rates. These are the reflections of changed circumstances and of open competition, which claim greater liberty in trading condition.

Coal Economies in Gas-Works.

If we cannot induce Professor H. E. Armstrong to acknowledge that the gas industry has been, and is, doing something in the matter of the provident use of coal, it is hoped there will be better fortune with Mr. J. S. S. Brame, Lecturer on Fuel at the Sir John Cass Institute. In the report of the lecture by him published in our columns last week, on "Power Gas and its Development," there appeared these words: "Of course in some special industries, it would be "impracticable to economize in the use of coal for purposes "for which it was required. For instance, in gas-works "they must not expect any reduction in quantity, but rather "the reverse." We feel almost inclined to inflict a little censure on Mr. Brame for being somewhat behind the times in his knowledge in relation to the economies of gas production. It must be, of course, with such a progressive industry as that of gas supply, that the consumption of coal for carbonizing purposes will not show any substantial recession quantitatively, but already there has been a small one, which indicates that it has been found practicable in the gas industry to economize in the use of coal, and yet do a larger business than ever. It would indeed have been strange if the increased productions of gas per ton of coal carbonized—increased to the neighbourhood of 12,000 cubic feet—had not had some effect in this direction.

In the last-issued Board of Trade returns, the statistics of 19 more statutory gas undertakings—790 against 771—were included than in the preceding year; and, notwithstanding that these 19 gas undertakings threw the weight of the coal they carbonized on to the year represented by the last-issued returns, that year showed that (the total quantity of coal used being 15,394,307 tons for the statutory concerns) 12,446 tons of coal *less* were carbonized; but the make of gas from the smaller consumption of coal for the year—168,289,876,000 cubic feet—was 63,066,000 cubic feet *more*. If the last-published accounts of the Gaslight and Coke Company, the South Metropolitan Company, and numerous other undertakings are studied in comparison with those of five years ago, Mr. Brame will find something that will surprise him even more than the figures now quoted for the whole of the undertakings working under statutory powers in respect of the relations between coal consumption and gas production. Reverting to the returns for the whole of the statutory concerns, to show the further economy of the industry in the use of coal (it is true the position of the oil market comes into play here), there was not only the quoted increased quantity of gas made from the smaller amount of coal used, but the residual coke was brought into service to a greater extent than in the year before, with the result that the 21,628,862,000 cubic feet of water gas made represented an advance in production during the year of no less than 1,368,979,000 cubic feet. In the result, we have this significant fact that the total quantity of coal and water gas made in the year of the last returns was 189,918,738,000 cubic feet, against 188,486,693,000 cubic feet the year before—a difference of 1,432,045,000 cubic feet—although a less quantity of coal was carbonized.

We think these few figures will show that economies in the use of coal in the gas industry have been found practicable; and that the gas industry has not neglected its opportunities in this respect. Of course, it cannot be expected that, with the growth of the removal of coal from the domestic grate to the gas-works retorts, the carbonization of coal for gas-supply purposes will show a continued diminution; but it will be found that there is an advancing economy in the use of coal in proportion to the gas produced and sold. If we mistake not, the current year and immediate future years will exhibit a progressive movement in this direction.

High-Pressure Gas in Public Lighting.

It was not long since that the occupiers of the palatial buildings lining Victoria Street, Westminster, were crying out for more light; and it must be confessed that Victoria Street, one of the arterial ways opening out to the Houses of Parliament and Westminster Abbey at the one end and to important railway termini at the other, had a perfect right to a more brilliant system of artificial lighting than that which had done duty for so long. It is wonderful what can be accomplished by approaching a problem in improvement with a broad mind and in an open spirit. There were those who at one time said, there were those who hoped, that the days of gas were numbered so far as the lighting of the principal thoroughfares of our cities and towns was concerned, and that gas must for ever renounce (in favour of flame arc lighting) all claim to public partiality—rightly or wrongly bestowed—for high-power sources of light in such situations. But the error has been demonstrated by the Gaslight and Coke Company in a manner without parallel, first in the City and now, as part of the high-pressure section of the Westminster lighting scheme, in Victoria Street, Westminster. The occupiers of that thoroughfare, with illumination almost the equal of daylight during the evening and night hours over pathways and road, would declare a partizanship if they said aught else than that they now possess one of the most generously illuminated thoroughfares in the Metropolis, and that conferred by 24 1800-candle power high-pressure inverted burner gas-lamps—the majority on standards on the pathway, and one on each central refuge at important crossings.

The street is the first to be lighted from gas distributed by the extensive high-pressure system in the West-end; and the completed installation will provide a spectacle in the West-end in high-pressure gas lighting that will be a veritable delight to the many and a torture to the few, and that a noisy few. It is a high degree of perfection in illumination that has been reached in the street, and that too by employing lamp standards rather than central aerial suspension, for the adoption of which, in Cheapside and Cannon Street, the City Fathers are still endeavouring to find some rational excuse, though the drawbacks are several and obvious. The street affords an excellent test under the worst conditions for any illuminating agent, whatever its character. It has to be self-reliant in the matter of distribution; for in the greater part of the thoroughfare there is practically no assistance in the matter of reflection from the drab surfaces of the high blocks of buildings, constituting in the main the borderings of the street. It is the antithesis to a street lined on either side with large shop windows and lightly painted façades. When the shops of Oxford Street are lighted up in the early evening, they render generous help in the general illuminating of the pathways and roadway to the flame arcs running centrally down the street; and when the shops are closed, the reflective power is still considerable. Replace these shop fronts by buildings such as one has in Victoria Street, and Oxford Street would then present the same doleful patchwork of illumination as was witnessed at one end of the former thoroughfare when the Jandus flame arcs were put up as an experiment, and were promptly removed when gas was victorious in securing the lighting contract for the extensive part of Westminster that was open to competition. The principal of a well-known emporium in Holborn was saying the other day, in advocating the electric light for Holborn at a meeting of the Holborn Borough Council (*ante*, p. 208), that just as it was true that trade followed the flag, so it was true that trade followed light. The education of this gentleman as to the power of gas for producing light, as must be also that of the shopkeepers of Regent Street who petitioned the Westminster City Council some time since to retain electricity and not adopt gas, is deficient. It can readily be improved by making an evening trip to Victoria Street and to other quarters of the West-end recently mentioned in the "Journal." As we have said before, we say again that the character of gas lighting that will be seen in several districts in London this winter far surpasses anything that has ever been seen in those areas before.

Promotions and Public Ignorance.

We are sorry to see the recrudescence of the promotion of gas undertakings that are palpably over-capitalized; the East Hants Company being the latest in this new group which, together, form a masterpiece in small gas company flotation. It is with surprise, not unmingled with regret on our part, that it is learned from two distinctly separate sources that the capital asked for by the East Hants Company promoters was more than over-subscribed. This means that the Company will have a present capital of £22,500, of which £14,000 in cash and £2500 in shares go into the pocket of the vendor, Mr. F. W. Talbot, who is believed to be the same Talbot who was identified at one time with the Laindon concern. Mr. Talbot may congratulate himself that the scheme has worked so well—for him, and that the public has swallowed so completely the inviting bait that was so deftly dangled before it. We should much like to see a valuation made by a gas engineer of recognized standing of what the Company have purchased from Mr. Talbot for the thousands of pounds named.

This £22,500 for the East Hants Company is not th

only capital that is going to be employed in connection with the supply of gas from the Company's works. The Liphook and Liss Gas Companies are formations all within the last few months; and they are the prospective purchasers of gas in bulk from the East Hants Company, estimated at a total of 12 million cubic feet, out of a calculated make of 20 millions. It is a case of wheels within wheels. The nominal capital of the Liphook Company is £5000, and of the Liss Company £10,000. We do not know the amount that these Companies succeeded in issuing. Let us suppose that between them they have a capital of £7500. Adding this to the £22,500 of the East Hants Company, makes a total capital of £30,000, for a gas consumption estimated at 20 million cubic feet per annum, if it works out as traced in the prospectus. This represents the outrageous capital of £1500 per million cubic feet for a sale that has largely yet to be realized. There are not very many data available as to the actual total capital costs of small gas-works of modern construction to contrast with this. But a recent instance is that of the Fazakerley Gas-Works, designed for the Liverpool Corporation by Mr. Isaac Carr. These have a carbonizing capacity of 35 millions per annum, with the remaining plant equal to 60 millions, and the present capital expenditure is only £12,710, though the foundations, being quicksand, required special treatment. Let Mr. Alexander Ritchie, J.P., Mr. Edward H. Jellett, and Mr. Thomas Webb, the Mayor of Andover as Directors, and purchasers on behalf, of the East Hants Company, compare the capital and capacity of what they have acquired from Mr. Talbot with the Fazakerley condition of affairs. The Directors, we imagine, will find they will have all their work to do, with such a capital as they have built up over this little concern, to make any return, let alone a satisfactory one, for the shareholders, notwithstanding charges of 5s. and upwards per 1000 cubic feet, which is again a crippling price for obtaining consumers. When the First Garden City Gas-Works were started, with a capacity of only 6 millions (which soon had to be levelled-up to 20 millions, and we believe has since been raised to a higher productive level still), gas was supplied at 3s. 3d. per 1000 cubic feet for domestic purposes, and was early reduced to 3s., with prices ranging between 2s. and 3s. for power purposes. Contrast this with the East Hants, Liphook, and Liss Companies, which three promotions appear to be part of one scheme.

It is an almost unvarying experience, too, that these over-capitalized gas concerns are not advised by recognized gas engineers. In this East Hants case, the Engineer reporting on the project is Mr. C. Chambers Smith, a member of the Institution of Municipal and County Engineers. In the case of the Liss Gas Company, Mr. P. J. Jarvis, "C.E.," was the Engineer. He was for a time the Manager of the Petersfield Gas Company, the shareholders of which have nothing for which they are indebted to the promoters of the concern, except a wicked weight of capital. We are not prepared to defend Mr. Jarvis's title to the use of the appendix "C.E." Enough has been said. Mr. T. Ranson, who reported on the Liphook Gas Company, is not recognized as a gas engineer of our acquaintance. Not one of the names mentioned, so far as we can trace, stands on the roll of membership of the Institution of Gas Engineers. But their names are printed in black capitals at the foot of their report, and the public no doubt believe them to be men of some station in the gas-engineering world. So capitals are formed for such promotions on public ignorance.

An Income-Tax for Municipal Purposes.

Among the varied matters raised at the autumn meeting of the Association of Municipal Corporations, was the question of broadening the basis of local taxation; and in this connection reference was made to a local purposes income-tax. It seems that certain members of the Bradford City Council are among those who are dissatisfied with the present basis of municipal taxation; and one of them who, in committee, had proposed a resolution in favour of making representations to Parliament with a view to the adoption of the principle of rating on income for municipal purposes, quoted Berlin in support of his views. He said that in that city in 1904 (the latest year for which he could get particulars) practically half the rates were raised by means of such a tax; there being in addition taxes on land, trade occupations, and property sales. The tax was a graduated one, and took in incomes as low as £21. Another councillor, pointing out some of the anomalies of the system existing in this country, expressed the opinion that if it were possible to bring about some alteration by which the overburdened shopkeeper would be rated upon his income and not upon his plate-glass window, there would be reason to be grateful that the question had been raised. Whether, however, this gratitude would be universal is open to some doubt; for if tradespeople paid less under the new system, some other persons would clearly have to equalize matters by paying more.

The Public Lighting Question in Paddington.

It will be seen from the account of the proceedings at the last meeting of the Paddington Borough Council which appears elsewhere, that, as a last resource, the report of the Works Committee has been again referred back to them, because it has been discovered that there is an old Standing Order to the effect that such references should go to the General Purposes Committee. It was also resolved that prices should be obtained from the Metropolitan Electric Supply Company for lighting only a part of the district. The Company are unable to light 25 miles, because they have no mains in that portion of the borough, and would have to open the roads for the purpose. So much for their taunt against the Gaslight and Coke Company that they have to tear up the main roads to lay mains for high-pressure gas lighting. To lay their mains, the Electric Supply Company would have to incur a capital outlay of between £20,000 and £30,000, which would have to be entirely found by the Borough Council in the lighting bill; while the Gas Company have their mains in every street. Attention may be specially directed to the cool request of the Electric Supply Company that they may send in a "sealed tender" to be considered at the same meeting as that of the Gas Company, in spite of the fact that the latter Company's figures have been made public. The Chairman of the Works Committee (Mr. Elgood) very properly exposed this suggested piece of unfairness.

The Meeting of the American Gas Institute.

According to the official notice of the fifth annual meeting of the American Gas Institute issued by the Secretary (Mr. A. B. Beadle), the proceedings were to be opened in the Auditorium of the United Engineering Societies' Building, New York, last Wednesday, and the meeting was to close with a steamboat excursion on Friday. The President is Mr. W. H. Bradley, Chief Engineer of the Consolidated Gas Company of New York. The following papers had been prepared for the meeting: "Lighting and Ventilation of Gas Appliance Display Rooms," by Mr. T. Scofield; "Manufacture of Balloon Gas in Water-Gas Apparatus," by Mr. G. H. Waring; "Pneumatic Caulking with Lead Wool of 30-Inch, 36-Inch, and 48-Inch Gas-Mains," by Mr. C. C. Simpson, jun.; "Cultivation of Friendly Relations between the Public and the Lighting Company," by Mr. W. J. Clark; "Construction of a Reinforced Concrete Tank for a Gasholder," by Mr. V. L. Elbert; "Brick, Concrete, and Steel Gasholder Tanks," by Mr. H. W. Aldrich; "The Laying of One 48-Inch and Two 36-Inch Gas-Mains under the Harlem River," by Mr. C. C. Simpson; "The Laying of a Pair of 30-Inch Cast-Iron Mains under the Passaic River," by Mr. A. H. Strecker; "Apparatus Designed for Remote Control of District Pressure," by Mr. J. S. Kennedy; "Pumps for Gas-Works Purposes," by Mr. H. L. Underhill; "Removal of Organic Sulphur from Gas," by Mr. H. M. Pabst; "Extraction of Cyanogen from Coal Gas at the Astoria Works," by Mr. M. E. Mueller; "Determination of Calorific Value and of Operating Conditions from Analysis of Industrial Cases," by Mr. J. M. Morehead; "Review of Recent Decisions of the Public Service Commissions which Affect Gas Companies," by Mr. A. E. Forstall; and "The Public Deceived by Faulty Data and Misleading Analysis of Data," by Dr. A. C. Humphreys.

Lighting of the West End.—The "Pall Mall Gazette" yesterday said: "The new system of lighting Victoria Street by high-pressure gas-lamps has now been completed; and the Westminster City Council are to be congratulated on the result. The many thousands of visitors to London who arrive at the Victoria Stations cannot fail to receive a favourable impression of the Metropolis if their first experience is to be driven along Victoria Street after dark—or rather after sun-down—for the new lamps, each of 2000-candle power, have entirely banished darkness from what was previously a rather gloomy thoroughfare. When the installation of modern gas-lamps has been completed in Regent Street, Pall Mall, Piccadilly Circus, and Shaftesbury Avenue, London will make a far better comparison with Berlin and Paris in the matter of street-lighting than ever before. Unfortunately, the Westminster City Council cannot extend their improvements to all their West End thoroughfares, as, owing to their hands being tied by a thirty years' contract, electric arc lamps will continue to be used in the district of St. George's, Hanover Square."

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 282.)

Movements in the chief departments of the Stock Exchange last week were fluctuating and irregular, according as various factors came into operation. Chief among these were the state of the Money Market, a feeling of relief when the Bank rate was fixed, the revolt of the boiler makers, and the rise in Americans and South Africans. Consols have been the principal sufferer. At the opening on Monday, things looked rather promising; the gilt-edged group, Railways, and the Foreign Market being firm, as well as many speculative lines. Tuesday was quieter and scarcely so strong, though there was no fall in prices to speak of. On Wednesday, business was on a reduced scale, and the tone was dull and heavy; money having much to do with it. Consols lost $\frac{1}{8}$; Rails were dispirited, with shrinking prices; and most of the rest were a bit the worse. Thursday opened dull, and things dragged while awaiting the Bank's decision. When this became known, there was some recovery from the worst prices. A better tone was the feature of Friday, and even the usual realizing did not do much harm; but the speculative markets were in much better favour than the higher-class securities. On Saturday, the tendency was barely as good; but Government securities were all fairly steady. In the Money Market, rates for loans were at first easy, in the face of an abundant supply. Discount terms hardened, but were inclined to relax before the close. The Bank rate on Thursday was raised from 4 per cent. to 5 per cent. Business in the Gas Market was more active in the aggregate, and attention was more widely distributed among all groups of undertakings than in the week before. There were very few alterations in prices, but they were mostly easier—no doubt affected by the monetary conditions. In Gaslight and Coke issues, the ordinary was a sufferer to a mild extent, and closed at a fall of $\frac{1}{2}$. Transactions ranged from $105\frac{1}{4}$ to 106. The secured issues were pretty busy, and were unaltered. The maximum was done at from $87\frac{1}{4}$ to 88, the preference at from $104\frac{1}{2}$ to $105\frac{1}{2}$, and the debenture at from $80\frac{1}{2}$ to $81\frac{1}{4}$. South Metropolitan was moderately dealt in at about the same figures as the week before—121 to $122\frac{1}{2}$. For the third week running, Commercial capital stocks were untouched; but there was one bargain in the debenture at 80. Among the Suburban and Provincial group, Alliance and Dublin changed hands at from $86\frac{3}{4}$ to $87\frac{5}{8}$, British at from $44\frac{1}{2}$ to $44\frac{3}{4}$, Brentford debenture at $99\frac{1}{8}$, and South Suburban at from $120\frac{1}{4}$ to $120\frac{3}{4}$. In the Continental companies, Imperial was unchanged at exactly the same figures as the previous week—187 to $188\frac{1}{2}$. Union was marked at from $96\frac{1}{2}$ to 98, European fully-paid at from $23\frac{3}{4}$ to $24\frac{1}{2}$ (a rise of $\frac{1}{4}$), and ditto part-paid at from $17\frac{7}{8}$ to $18\frac{1}{16}$. Among the undertakings of the remoter world, Ottoman realized $6\frac{3}{32}$, Primitiva $7\frac{7}{16}$ and $7\frac{9}{16}$, ditto preference from $5\frac{7}{32}$ to $5\frac{3}{8}$ (a fall of $\frac{1}{16}$), ditto debenture $98\frac{1}{8}$, San Paulo $15\frac{3}{8}$, and ditto debenture $51\frac{1}{2}$.

ELECTRICITY SUPPLY MEMORANDA.

Are We Downhearted?—Bearing False Witness by Omission—Feelings of Sympathy—Taller Prices and Tall Talk—Assessment for Rating Purposes—Want of Parallel in Reduced Average Prices and Costs.

These notes are being written before the "Outdoor Lighting" issue of the "Electrical Times" is to hand; but there will be an opportunity found for dealing in another part of the "Journal" with what is promised by "Meteor" to be a wonderful production. "Meteor" has our sincere sympathy. In the note announcing, a week beforehand, the marvel that was to be expected, we detect a deep sigh of relief that he and the staff of the paper have nearly got to the end of their self-imposed task. Writes our friend, "The labour has been considerable." Just so. What a depth of meaning there is in the quoted words. The difficulty of getting material; the midnight oil—pardon, electricity—that has been expended; the tormented brain in constructing a case for public lighting by electricity against what has happened lately in the successes of gas in competitive tendering. It can all be pictured from that one short confession—"The labour has been considerable." But never mind "Meteor." Think of the great reward that awaits in the vast hereafter—or shall we say "in the land flowing with milk and honey" as viewed from Mount Pisgah?—all altruistic souls such as you. But we do wish that you had not, prior to the confession, dropped into such altiloquence, or rather strained language, as is traceable in these lines: "The hysterical triumph over the thankless experiment [why "thankless?" and why "experiment?"] in Westminster should have been enough in itself to suggest that our competitors were not feeling cheerful at the prospect. Next week we propose [not "shall," but only "propose"] to explain the reason for their downheartedness, and to show that they are richly entitled to sympathy." Ah! "the labour has been considerable." But are we downhearted? The "considerable labour" surely upset "Meteor's" judgment.

In connection with this public lighting question, there are two things that we cannot get electrical people to notice. The first is that the "successes" of electricity in public lighting happen to be in the districts of municipal electricity suppliers who are also the lighting authority, and not in districts supplied by electricity companies unless they do a little bit of street lighting for the sake of any commercial advantage that it is considered arises from advertisement in this way; the other is, that price comparisons are made with gas lighting as it has been and not as it can be, using, at the same time, costs per unit for electricity at which the undertaking cannot possibly afford to supply private consumers for lighting, unless its managers want to hurry it into a state of absolute insolvency. There was an instance of this evasion of facts at the meeting of the Plymouth Borough Council the other day, when Mr. Anthony, the Chairman of the Electricity Committee, was talking about the annual report. Among his remarks was this one: "A great deal has been made of the fact that in Westminster electricity has been displaced by gas; but it is also true that only a portion of the district is lighted by gas." Has Mr. Anthony never heard about that singular piece of business known as the St. George's (Hanover Square) Vestry electric lighting contract? Has he never heard what Alderman Everitt said, in the Westminster City Council, only in April last, about that electric lighting contract? If not, here it is: "He wished to make it perfectly clear that he was absolutely in favour of gas, instead of electric lighting, for the streets. He was not always so, because electric lighting was introduced into the streets, by the St. George's Vestry, on his casting vote as Chairman. If the Gas Company had started to make improvements before, the streets of St. George's would never have been lighted by electricity. There was no comparison now between the two illuminants; gas was unquestionably the better and the cheaper." Then Mr. Anthony went on to say that "there were three other places where electricity had replaced gas—Marylebone, Shoreditch, and Hampstead. In the first-mentioned place, a saving of £2600 a year was estimated." Does Mr. Anthony know that these three places own the electricity supply? Does he know the prices per unit charged for public lighting, in comparison with the prices charged for private lighting? Does he know that the statement as to the estimated saving is based on cut-prices for electricity on the one hand, and on the old prices for gas and old system of gas lighting on the other, and not on what the Gas Company can now offer—a large additional illuminating power by the new inverted gas-burners at a lower price than ever before? Does it not occur to him, too, that if the public lighting cannot be done at the price that is charged per unit to private consumers, and the gas-lamps then be kicked out of the field on the grounds of uneconomy and inefficiency, public lighting by electricity must be a poor recommendation to the private users of artificial illumination?

There is much more in this matter than Mr. Anthony and many other electrically-inspired chairmen of electricity committees can see or understand. It is patent from what is said above that Mr. Anthony's information badly wants supplementing. The Local Government Board can see a lot more than Mr. Anthony and others occupying similar positions. It is on the Board's suggestion that the governing body of Watford have instructed their Finance Committee to prepare a comparative statement, showing the present cost of lighting the streets by electricity, and the cost of lighting them by incandescent gas lighting. We are afraid the Board's Inspectors find rather common the experience that Mr. H. Ross Hooper had at Tonbridge the other day. He could not, at an inquiry held into an application for a loan for, *inter alia*, public lighting by electricity, ascertain whether or not the local Council had really given any consideration to the question as to whether a tangible saving was to be obtained for the ratepayers by making the change from gas lighting. All the reply he could get to his inquiries was the parrot-cry as to the Council patronizing their own shop. But Mr. Hooper was insistent concerning what would be the gain of the ratepayers by making the change; and he laid down the very serviceable rule of conduct for local authorities in connection with this subject, that "No change should be made in the system of lighting purely out of feelings of sympathy." There is a common-sense ring about that. If local authorities would always deal with this matter on a strictly business basis, the gas industry would not care. To the gas industry the commonplaces of competitive business are not the only issues; their strong objection is to the unfair uses made by municipal electrical possession to suppress the competition of private enterprise. It is asked that local authorities shall deal with the public lighting service upon an independent basis. But they will not, though, as pointed out last week, a certain writer in an electrical paper was expressing most pious horror at any local authority daring in these times, in the interests of ratepayers, to deal with the public lighting except on the open tender system. What about Hampstead and other authorities?

The metallic filament lamp has now been with the electricity supply industry a sufficient length of time for the managers of undertakings to have ascertained whether the revenue-reducing effect of the lamp can be compensated by increased business in other directions. This naturally largely depends on the character of the district. In many cases, it is being found that new business cannot be obtained to the equivalent of the loss due to the metallic filament lamp, which produces a loss not only in the sale of current, but, as many of the charges incurred in supplying consumers' premises do not diminish, in that connection also. In the case of some companies, it has been determined that the only thing to be done to maintain the profits is to raise the price per unit to be charged to consumers; in the case of local authorities, they have the alternative, which is not possessed by the companies, of forcibly extracting something out of the pockets of the ratepayers to compensate for the loss. The Metropolitan

Electric Supply Company, the Brompton and Kensington Company, and the Wakefield Electricity Department are examples of concerns that have quite recently increased their prices for current; while the Corporation of Kingston-on-Thames have put another ½d. on the rates. Now tell us, Mr. "Electrician," which is the more moral course. It is truly grotesque to see the vast amount of sermonizing and gratuitous advice that certain of the electricity companies are getting who talk of raising, or who really do raise, their charges for current, while no protest goes forth from the same quarters when the ratepayers have burdens imposed on them year after year in the name of the electricity undertaking. We read in the "Electrician" that the objection to raising the price of electricity is that it "is particularly inopportune while the rivalry between electricity and gas is so keen." As bad as that is it? Then what comes of all the boast that electricity at 3d. to 6d. per unit is as cheap as gas-lighting by the new incandescent burners, that it is safer than gas lighting, that it prolongs life, and incarcerates doctors, house decorators, and washerwomen in workhouses and other asylums through their services not being required by the users of electricity for lighting purposes? The "Electrician" remarks that "the action of the two companies [named above] appears the more regrettable when attention is drawn to the charges for energy which are in force in the neighbouring districts. Thus, the Hammersmith Council supply current for lighting at 3d. per unit; and several instances of a supply being given at 3½d. per unit occur in the London area. When consumers and prospective consumers are aware of this fact, it will not be surprising if they should fail to appreciate the difference in the two cases." Perhaps consumers will not; but we take it the "Electrician" does, or, if it does not, perhaps it will explain a little more explicitly the nature of the reflection it intends to cast upon the managements of the Metropolitan and Brompton and Kensington Companies. It is gathered further that our contemporary does not consider the incandescent gas mantle occupies at all a strong position now. "Electric supply undertakers possess a strong weapon in the metal lamp with which to attack the *hitherto* strong position of the gas mantle." Why attack the gas mantle if its strength is of the past? Under such circumstances, there should be a "walk-over" for the metallic filament.

At one time, during the tenure by Mr. A. H. Seabrook of the engineership of the West Ham electricity undertaking, a great deal of noise came from that quarter. Noise always attracts attention in proportion to its strength; and much attention was directed to the marvels that were being wrought, according to official estimation, at West Ham. The electric light was going to turn the West Ham Gas-Works into a scene of desolation, as it was much cheaper than gas lighting. Deficits were being transformed into profits; but some meddling individuals pointed out that the undertaking was not meeting its due financial obligations —among other things, it was said an indulgent assessment authority was injuring other industries in the neighbourhood by letting the electricity concern go almost scot-free. Since Mr. Seabrook and his faithful henchmen migrated to Marylebone, and Mr. H. H. Couzens has been in charge at West Ham, there has been less braying of trumpets, and, among other things, the assessment of the concern has been adjusted, so as to place it on a (we assume) proper footing in relation to other industrial undertakings in the district. The result is that for the past year there is a deficiency of £2900, which has been met out of the reserve fund, and which leaves a balance to the credit of that fund of only £2081. But no less than £5200 of the increased expenditure for the year was accounted for by additional rates. This shows how the concern was formerly favoured. In the Seabrookian days, it was said that electric lighting at 3d. per unit for the current was cheaper than gas lighting; and there was such a stir in the West Ham Electricity Department over the boasted greater economy, that one could not help fancying the estimable Mr. Seabrook, Mr. Holmes, and others had visions of an early laying to waste of the West Ham Gas-Works. That was some time since. What are the current facts? Last year there was a total increase in the electricity output of West Ham of 3,634,344 units; but of this only 20,269 units (representing at 3d. per unit a revenue of merely £253) represent the increased consumption for private lighting. And the Treasurer reports that the net result of the operation of the sales department is a loss of £600! The great growth for power is already showing its effect upon the financial position. The average price obtained per unit over the entire output fell from 1·02d. to 0·93d.—a difference of 0·09d. But we see that the cost of production has only declined from 0·996d. to 0·93d. per unit—a difference of 0·066d. So that the decline per unit in the average price was 0·024d. greater than the reduction in expenses. It does not look as though increased business of this character is improving the financial position of the concern.

Outdoor Lighting by Gas and Electricity.—The issue of the "American Gaslight Journal" for the 10th inst. contains an article by Mr. Norton H. Humphrys, of Salisbury, on "Outdoor Lighting in England." In the course of it, he gives some figures showing the number of gas-lamps to one electric lamp in the following places: London (City), 3; Edinburgh, 9; Leith, 9; Perth, 11; Aberdeen, 20; Glasgow, 22; Dundee, 62; Liverpool, 122; Bradford, 141; and Manchester, 220. On the Continent, the number of gas-lamps to one electric lamp in the places named was as follows: Berlin, 4; Dusseldorf, 5; Munich, 9; Vienna, 19; Cologne, 25; Dresden, 25; and Brussels, 29.

PERSONAL.

We are pleased to find, from the published results of the recent examination for the final degree of LL.B. of the University of London, that Mr. C. E. Brackenbury, Barrister-at-Law, was successful in passing with honours.

Mr. W. Tomlinson, Manager of the Rochdale Water-Works, closes his official connection with the Water Department on the 31st inst., after forty years' service; Mr. F. H. Brunt, the new Manager, takes up his duties on the 1st prox.

Mr. Norman S. Mitchell, who was for some time employed in the gas-works of the Cockermouth Urban District Council, recently obtained an appointment at the Toronto Gas-Works, and he has now left England for Canada. Before starting, however, he was the recipient of a useful gift, in the shape of a Gillette safety razor, from the workmen and officials, as a mark of their esteem. The presentation was made by Mr. James Black, who, on behalf of the subscribers, wished Mr. Mitchell good health and prosperity in his new field of labour.

THE LATE MR. JOHN BIRCH PADDON.

The following appreciation of the late Mr. John Birch Paddon, whose death was noticed in the "Journal" last week, has been sent by a correspondent who says he will "ever be affectionately grateful to the deceased for many kindly considerations to a young and struggling fellow-workman."

Very few of those still working in the busy ranks of the gas world can recall the events in its history which were marked by the personality of the high-class and dignified professional gentleman who has just been laid with his fathers. Beyond a special ability as a mechanical and civil engineer, as proved by various inventions and originalities, Mr. Paddon was distinguishable by an unswerving consistency and loyalty to truth and high principle; so that quite early he became detached from the yeoman duty of his profession, and was picked out to join the boards of administration of a numerous collection of companies of which he had previously been Engineering Adviser. In these positions, he was greatly esteemed for his powerful grasp of policy and not less for his cheery friendliness and the old-world polish of a considerate manner, self-respecting and respect-compelling. To those admitted to his private friendship he ever extended a refined and generous, though unpretentious, hospitality.

Memory recalls how he pioneered the Brighton and Hove Gas Company's Bill for amalgamation (at that time a rare policy) through a crucial parliamentary contest, from which the Company emerged with a staggering reduction in its maximum price, and with other arduous restrictions. How, further, to the surprise of all, he worked through these hard conditions, and brought the United Company into a front rank position with good dividends. Many other successes of this sort marked his career; but he shone best in the genius of engineering construction which drove back the sea, and planted the substantial and enduring gas-works at Portslade on what had been a storm-wrought beach of sand and drift. His experience and knowledge of the modes of reinstating the sea defences and of procuring the accumulation of beach to protect the limits of the site were unique, and it is to be trusted are somewhere preserved for the guidance of coast protecting engineers at large. His faithful co-operator in this—Mr. Joseph Cash, M.Inst.C.E.—would render service to his profession if he could crystallize this special experience in a contribution of it to the annals of the engineering world.

Mr. Paddon's triangular ties to the girders at the heads of gasholder standards, his works in concrete tank building, his rotary scrubber-washers, which thirty-five years ago pioneered all modern examples of this principle, and notably the invention of the leather diaphragm regulator of forty years ago, are only some of the evidences of the constructive ability which attracted the admiration and respect of his professional friends, among whom the writer was always proud to be reckoned.

More Gas Publicity.—The Gaslight and Coke Company are continuing their highly effective advertisements in the Woman's Supplement to "The Times;" and evidence reaches us almost daily that other gas companies are equally impressed with the value of publicity. Reference was made last week to the South Metropolitan Company. Their neighbours, the South Suburban Company, are also to the front with advertisements occupying considerable spaces in prominent positions in the local newspapers. The "Reading Standard" for last Saturday contained the Gas Company's "Facts! not Fiction," advertisement to which attention was directed in the "Journal" last week. Upon the other side of the page is the Electric Supply Company's advertisement, also noticed. On Wednesday, the Sheffield Gas Company figured prominently in a page advertisement in the "Sheffield Daily Independent;" a view of a corner of one of their show-rooms occupying the centre of the page. This is all very well; but, as already emphasized, something more is required. The gas industry must keep pace with, and even ahead of, the electricity industry in the matter of publicity.

QUALITY OF LONDON GAS.

The results of the testings made of the gas supplied by the three Metropolitan Gas Companies in the area for which the London County Council is the controlling authority have now been published for the past quarter, and according to custom we have prepared a summary of them and of the similar figures for the corresponding quarters of 1908 and 1909. The period referred to as the third quarter of the present year is, in fact, the thirteen weeks ending on Oct. 1; and the quarterly periods taken for comparison are the thirteen weeks ending on Sept. 25, 1909, and Sept. 26, 1908.

Illuminating Power.

The average and minimum results obtained in the testings of illuminating power with the "Metropolitan" argand burner No. 2 are shown in Table I. The gas is required by Statute to have an illuminating power of 14 candles; but no forfeiture is incurred unless the deficiency amounts to half-a-candle or more; and, provided that it does not exceed one candle, the results obtained on any one day are averaged with those for the preceding and following day in computing the illuminating power for a day. In 1908 and 1909, however, the Gaslight and Coke Company (only) were required to supply gas of an illuminating power of 16 candles, instead of 14 candles as at present. It will be seen from the results given in Table I. that not only has the gas supplied by all the Companies been, on the average, well above the statutory requirements in respect of illuminating power, but also that the minimum results are such that there has been no question of any one of the Companies incurring a forfeiture. It is instructive to notice that the South Metropolitan Company have seen their way to making a distinct reduction in the average illuminating power of the coal gas which they supply, though the average is still 1·85 candles above the standard of 14 candles which is specified in their Acts. The other two Companies have been able to work closer to their standard, doubtless owing to the gas which they supply being a mixture of coal gas and water gas. But they have kept well above it on the average.

Table I.—*Testings of Illuminating Power (Argand) for Third Quarter of Year (Candles).*

Company.	Average.			Minimum.		
	1908.	1909.	1910.	1908.	1909.	1910.
Gaslight and Coke .	17·09	16·77	15·17	15·81	14·92	13·57
South Metropolitan.	16·79	16·23	15·85	14·96	14·16	14·15
Commercial . . .	15·36	14·71	14·79	14·03	13·38	14·06

The testings with a flat-flame burner for "information" only are not now made with the same regularity and frequency as in past years, and little more need be said in regard to them than that the averages of the results for the quarter were: For the Gaslight and Coke Company, 8·96 against 12·26 and 11·64 candles in the corresponding quarter of 1908 and 1909 respectively; for the South Metropolitan Company, 10·24 against 11·52 and 10·63 candles in 1908 and 1909; and for the Commercial Company, 8·71 against 9·78 and 8·83 candles in 1908 and 1909. It will be seen that the mixed gas of the Gaslight and Coke Company now develops less light in the prescribed flat-flame burner than the coal gas of the South Metropolitan Company relatively to the actual illuminating power of the gas, though when the former Company were working to a 16-candle standard, their gas gave superior results in the flat-flame burner. The difference between the average results with the argand and the flat-flame burner is now 6·21 candles for the Gaslight and Coke Company and only 5·61 candles for the South Metropolitan Company. Taking the corresponding quarters of 1908 and 1909 together, the flat-flame average was 4·98 candles below the argand average for the Gaslight and Coke Company, and 5·43 candles below for the South Metropolitan Company. It would thus appear that the values for flat-flame lighting of the supplies of these two Companies have been reversed relatively to one another in the course of the last twelve months or so. Owing to the irregularity of the flat-flame testings in the past quarter, however, it would be unwise to accept this conclusion as final.

Calorific Power.

The average and minimum results of the testings for calorific power are given in Table II. Their chief interest perhaps lies in the support which they afford to the view held by us, in common with many well-known gas engineers and experts, that the standard of calorific power of 125 calories net per cubic foot named in the Gaslight and Coke Company's Act, 1909, does not correspond with gas of an illuminating power of 14 candles. This Company supplied last quarter gas averaging 15·17 candles, yet the net calorific power averaged 122·4, and upon one occasion it was only 113·3 calories per cubic foot. Similarly, the Commercial Gas Company supplied gas averaging 14·79 candles and 122·8 calories net. If the Gaslight and Coke Company were to decide to supply gas closely conforming in respect of illuminating power to the quality which is required of them by Statute, it is obvious that the net calorific power of the gas would average about 117½ calories per cubic foot, and might fall on occasion,

Table II.—*Testings of Calorific Power for Third Quarter of Year.*

[The results are expressed, as in the London County Council reports, in "calories" per cubic foot, but may be converted into B.Th.U. by multiplying by 3·968.]

Company.	Average.			Minimum.		
	1908.	1909.	1910.	1908.	1909.	1910.
Gaslight and Coke, gross .	..	144·5	137·2	..	135·4	127·5
,, ,, net .	131·5	129·1	122·4	122·4	120·5	113·3
South Metropolitan, gross.	..	146·8	145·8	..	130·3	135·7
,, ,, net .	134·0	130·5	129·8	123·1	117·3	120·1
Commercial, gross . . .	..	140·5	137·6	..	130·1	125·7
,, net. . . .	127·5	125·5	122·8	117·6	116·7	112·4

in the ordinary course of manufacture, to (say) 108 calories. Now the Company are liable to incur a forfeiture if the net calorific power of the gas which they supply is ever less than 112½ calories per cubic foot on the average of three consecutive days' testings, or less than 106½ calories on any one day. The one-day catch-penalty limit for the illuminating power is 13 candles; and gas of 13-candle power is likely to give occasional tests showing only about 103 or 104 calories net per cubic foot. On the average of three consecutive days' testings, the Company escapes penalty in respect of illuminating power if the gas is above 13½ candles, which figure appears to correspond on the average to about 113 calories net per cubic foot. But the relation between illuminating power and calorific power is by no means constant; and it would not be surprising if gas testing above 13½ candles over three days showed only about 107 or 108 calories net per cubic foot. That is to say the Company may supply gas of a quality which does not impose on them any liability to forfeiture in respect of illuminating power, and yet be subjected to penalty on account of insufficiency of calorific power. It can, however, be fairly supposed that Parliament, when fixing provisionally the standards of calorific power named in the Gaslight and Coke Company's Act, 1909, did not intend thereby to compel the Company to supply gas of considerably higher illuminating power than that prescribed in the same Act. There prevailed at the time the Act was passed uncertainty as to what calorific power really corresponded on the average to gas of 14-candle power; and, consequently provision was made in the Act for a revision of the standard of calorific power after three years' experience of its application. Experience so far seems to suggest that the standard figures named in the Act may remain, provided they are made to refer to the gross or true calorific power of the gas instead of to the pseudo-scientific and misleading so-called net calorific power. A gas company who are required to supply gas of 14-candle power may fairly be expected to conform to a standard calorific power of 500 B.Th.U. (or, say, 125 calories) gross per cubic foot, with liability to incur a forfeiture if it falls below 450 B.Th.U. gross on the average of three days' testings.

Sulphur.

The results of the testings for sulphur in the third quarter for the three years are shown in Table III. The feature of them which attracts notice is the remarkable fall experienced this year in the proportion of sulphur in the gas supplied by the South Metropolitan Gas Company. This gas is wholly coal gas, and, naturally, the sulphur in it was appreciably greater in quantity in

Table III.—*Sulphur (Grains per 100 Cubic Feet) in Gas for Third Quarter of Year.*

Company.	Average.			Maximum.		
	1908.	1909.	1910.	1908.	1909.	1910.
Gaslight and Coke .	39·9	34·7	37·3	72·9	57·5	71·9
South Metropolitan .	48·3	41·0	30·3	76·2	64·3	52·3
Commercial . . .	22·0	35·5	26·6	45·3	49·2	43·2

past years than in the mixed gas supplied (*e.g.*) by the Gaslight and Coke Company. This year, however, the coal gas contains on the average only 30·3 grains of sulphur, as against 37·3 grains for that mixed gas. It would be interesting to know to what change in methods of purification or working this diminution in the proportion of sulphur in the coal gas is due, and on what grounds the change has been primarily made. The sulphur returns for the other two Companies show very little difference from those for the corresponding quarter of past years.

Midland Association of Gas Managers.—The autumn general meeting of the Association will be held at the Grand Hotel Birmingham, next Thursday. In addition to some formal business, the proposed alterations of rules will be further considered and Mr. J. S. Lucking, of Clay Cross, will read a paper entitled "Some Notes on Carbonizing in Bye-Product Coke-Ovens, and Some Experiences in Utilizing Surplus Gas therefrom for Lighting Purposes." The paper will be illustrated with lantern slides There will be a discussion on this, and the resumed discussion of the paper on "Carbonizing Systems and Results," read at the Spring Meeting by Mr. A. T. Harris, of Market Harborough Mr. S. Glover, of St. Helens, Mr. T. Glover, of Norwich, and Mr. J. F. Bell, of Derby, have consented to open the discussion.

SCOTCH GAS LEGISLATION.

[FIFTH ARTICLE.]

It is impossible for the final words to be said yet on the gas legislation of the year, owing to the Standard Burner Bills and the Warrington Corporation Bill still awaiting the completion of formalities. Meanwhile, there are four Scotch measures to be reviewed.

The Order obtained by the Dunblane Gas Company, Limited, confers additional money and works construction powers. It is provided that the share capital shall not exceed £16,000, comprising £6000 ordinary "A" share capital already raised, further ordinary "B" share capital of £3000 still to be issued, and £7000 additional share capital. The "B" shares are to be issued to the holders of "A" capital rateably according to their respective holdings of capital as fully paid up; and, save as otherwise provided in the Order, the "B" capital is to be subject and entitled to all the same powers, privileges, and rights as shares in the "A" capital. The additional capital is to be issued under the new auction clauses. The dividends are limited to 10 per cent. on the "A" capital, 7 per cent. on the additional capital, and 5 per cent. on the "B" capital. Borrowing powers are allowed up to one-third of the amount of capital paid up, including the "B" capital and any premium that may be obtained on the sale of shares; but borrowed money is not to carry a higher dividend than 5 per cent. Power to construct further works is conferred. Succeeding clauses are of ordinary form, including one prescribing a standard illuminating power of 14 candles, tested by the "Metropolitan" No. 2 burner. The standard price of gas is 5s., and penny variations will carry increases or decreases (as the case may be) of dividend of 5s. per cent. on the 10 per cent. capital, 3s. 6d. on the 7 per cent. capital, and 2s. 6d. on the 5 per cent. capital. Special purposes and reserve funds are allowed. [*Parliamentary Agent: Mr. John Kennedy.*]

The Falkirk Gas Order Confirmation Act refers in its principal part to additional money powers. The amount authorized to be borrowed is £55,000, provided that "from and after the commencement of this Order, the sums required to be set apart as a sinking fund for repayment of moneys borrowed under the powers of the Act of 1894 and the Act of 1900 shall not be less than 1½ per cent. per annum on the amount for the time being borrowed; that the sum to be set apart as a sinking fund for repayment of moneys borrowed under the powers of this Order shall be not less than 2 per cent. per annum on the amount for the time being borrowed; that in the event of repayment of any moneys borrowed under the powers of the said Acts or this Order being made by way of instalment or annuity, the annual amount of such instalment or annuity shall be sufficient to pay off the moneys so borrowed within a period from the date of borrowing not exceeding the period within which full repayment would be provided by way of sinking fund in terms of the said Acts and this Order." The provision for a reserve fund is of unusual character, and is worth reproducing:

In the year ending May 15, 1911, and in every subsequent year, the Town Council shall, for the purposes of, and in connection with, the reserve fund authorized by sub-section (4) of section 29 of the Act of 1894, contribute to the said fund from the revenues of the gas undertaking a sum not less than an amount calculated at the rates hereinafter mentioned on every 1000 cubic feet of gas sold in each year—that is to say,

(1) When the price of gas sold for lighting purposes does not exceed 3s. 3d. per 1000 cubic feet, the said contribution shall be at a rate not less than 2d.

(2) When the price of gas sold for lighting purposes exceeds 3s. 3d., but does not exceed 3s. 6d. per 1000 cubic feet, the said contribution shall be at a rate not less than 1½d.

(3) When the price of gas sold for lighting purposes exceeds 3s. 6d. per 1000 cubic feet, the said contribution shall be at a rate not less than 1d.

The said reserve fund shall, in addition to the purposes mentioned in the said sub-section, be applicable towards defraying the cost of extensions of the undertaking, but, notwithstanding anything contained in the said sub-section, shall not be applicable towards the cost of renewals of meters and stoves.

The prescribed illuminating power is 14 candles, using in testing the "Metropolitan" No. 2 burner; but "the method of reporting periodical tests shall be such as to carry forward the average of the previous tests in the following manner—viz., the test made on any one occasion shall be added to the tests made on the two previous occasions, and the average of the three shall be reported as being the illuminating power so ascertained." The Council have obtained authority to charge differential rates as between gas supplied and used for private lighting purposes and gas supplied and used for any other purposes, "provided that the rate charged for gas supplied for such other purposes shall not in any case exceed the rate charged for gas supplied for private lighting purposes, and may be agreed between the Town Council and any person or persons requiring such supply, having regard to the times and periods of supply and the quantity used, and shall be the same to all persons under like circumstances." The old 10 and 15 per cent. discounts clause is adopted. [*Parliamentary Agents: Messrs. Beveridge, Greig, and Co.*]

The voluminous Act consolidating the Gas Acts of the Glasgow Corporation falls next for notice. The larger part of the clauses are not new; but they conveniently bring together all the existing legislation affecting the gas undertaking which has current application and serviceability. The limits of supply are defined; and the area is divided into the city supply district and the supplementary supply district. The Corporation are given power to maintain, extend, renew, or discontinue their existing gas-works. Authorization is also given to the manufacture and supply of non-illuminating power gas; but the sections of the Act referring to price, discounts, pressure, and quality are not to apply to the non-illuminating power gas. The Corporation, however, are prohibited from laying mains and pipes for the supply of non-illuminating gas within any burgh or district outside the city, except with the consent of the town council of such burgh, or of the county council of the county in which such district is situate, as the case may be. In connection with this non-illuminating power gas service, the Corporation are allowed to supply fittings; and the rates of charge for the gas and the fittings are to be such as may be agreed between the Corporation and the consumer. Provisions as to railway crossings appear. Power to take land by agreement to the extent of 30 acres is allowed. Sanction is also granted to the sale of (should it be deemed inexpedient to retain) the Old Kilpatrick, the Dalmarnock, and the Milngavie gas-works. The maximum price of gas is placed at 4s. 7d. per 1000 cubic feet. A great deal of discussion took place, when the measure was before Committee, regarding the question of flat and differential prices. Finally the Corporation secured the right to charge the latter, with the result that these conditions are appended to the price of gas clause:

(2) Except as by this Act otherwise provided, the price to be charged by the Corporation for gas consumed by meter shall at all times be charged equally, under like circumstances, to all consumers within the city supply district.

(3) The Corporation may supply gas for heating, cooking, or motive power, warming, ventilating, and for the particular requirements of any trade, undertaking, industry, manufacture, or business, and may do all things needful therefor, on such terms and conditions in all respects as may be agreed between the Corporation and the person to whom such supply shall be given: Provided that the rate charged for gas supplied for any of such purposes shall be the same under like circumstances to all persons.

(4) The price to be charged for public lamps within the city supply district shall at all times be charged equally (regard being had to the consumption of such lamps respectively) to the Corporation and to all local authorities of burghs and other districts within the city supply district.

(5) The Corporation may, within the supplementary supply district, or any part thereof, charge rates for gas higher than those charged within the city supply district; and such higher rates may vary in different parts of the supplementary supply district, but shall not at any time exceed the rates charged for any similar purpose within the city supply district by more than 50 per cent. of the rate charged for private lighting purposes within the city supply district, and shall not in any case exceed the said maximum price.

Whereas Castlemilk Mansion House and offices, and Croftfoot Farm Steading situate on the Estate of Castlemilk, Fernhill Mansion House and offices and lodge, and Mid Farm Steading situate on the estate of Fernhill, and Cathkin Mansion House and three cottages, situate on the estate of Cathkin, all in the parish of Carmunnock, are supplied with gas for lighting purposes by the Corporation at the price charged in the city supply district. Now therefore be it enacted that, notwithstanding anything in this Act contained, the Corporation shall continue to give such supply to the said premises or any of them, in the same manner as heretofore, at the rates charged for the time being in the city supply district; and, if at any time hereafter, the Corporation shall lay gas-mains within the parish of Carmunnock, in the near neighbourhood of any of the said premises, the owners and occupiers of such premises shall, on their putting down at their own expense the necessary pipes to connect such premises with the Corporation mains, be entitled to a supply for such premises from such mains of the Corporation at the rates for the time being charged in the city supply district.

The discount clause has been altered from what was proposed in the original draft (see "JOURNAL," Feb. 15, p. 416) to the one prescribing 10 per cent. for prompt payment and 15 per cent. for large consumption. The prescribed illuminating power is 14 candles, tested by the "Metropolitan" No. 2 burner. In connection with the recovery of sums due for gas or meter rent, it is provided that "the Corporation may, in the case of sublets, and in addition to their recourse against the actual consumer, charge and recover from the tenant of any house or other premises who sublets such house or premises for a period not exceeding two months, the amount of rates and charges for gas used and consumed, and any other sums due to the Corporation in connection with the supply of gas by such sub-tenant during such subtenancy." In connection with money matters, one clause states that, in pursuance of their Gas Acts, the Corporation were authorized to borrow various sums of money, amounting in the whole to £3,700,000, of which £2,815,000 is applicable to the gas undertaking. "Therefore be it enacted that the borrowing by the Corporation of the said sum of £2,815,000 for the purposes of the gas undertaking shall be deemed to have been authorized by, and for the purposes of, this Act; and the security for the money borrowed or to be borrowed, and the interest thereon, shall be the gas undertaking, and the rents, charges, and revenues to be levied and received by them for the supply of gas and the sale of residual products: and the Corporation may again borrow any sums which may be repaid by them otherwise than by the appli-

cation of moneys received for lands and property sold by them or by sinking fund." It will be remembered that the Corporation were refused the right to apply any part of their profits in aid of the rates. There are some interesting points (more especially regarding depreciation) in the manner in which the revenue may be applied; and the clause may therefore be reproduced *in extenso*:

The Corporation shall apply all moneys from time to time received by them under the powers of this Act (not being money borrowed, or money for the application of which provision is hereinbefore made) in manner and order following, and not otherwise (namely):

(1) In payment of the expenses of, and incidental to, the raising, levying, and recovering the rents, charges, and revenues, and the borrowing of moneys for the purposes of this Act;
(2) In payment of the expenses of managing and maintaining the gas undertaking;
(3) In payment of the annuities and of the interest on money borrowed for the purposes of this Act;
(4) In payment of the amount necessary to be paid as sinking fund;
(5) In carrying the several powers and provisions of this Act into execution, including any extension and improvement of the gas-works and mains;
(6) In providing the sum necessary to meet depreciation at not exceeding the following rates:—
On gas-works at 1½ per cent. per annum;
On chemical works at 3 per cent. per annum;
On pipes at 2 per cent. per annum;
On meters at 6 per cent. per annum;
On stoves at 10 per cent. per annum;
On premium at 2½ per cent. per annum;
which rates shall be calculated on the book values of the respective assets as appearing in the accounts of the gas undertaking as at May 31, 1906, together with the net additions to such assets subsequent to the said May 31, 1906;
(7) In providing, if the Corporation think fit, a reserve fund by setting apart a yearly sum not exceeding 10s. per cent. upon so much as is outstanding for the time being of the moneys borrowed or reborrowed for the purposes of such undertaking, and investing the same, and the resulting income thereof, in statutory securities, and accumulating the same at compound interest until such fund amounts to a sum equal to 10 per cent. of the moneys so outstanding, which fund shall be applicable to answer any deficiency at any time happening in the income of the Corporation from their gas undertaking, or to meet any extraordinary claim or demand at any time arising against the Corporation in respect of that undertaking, or for payment of the cost of renewing any part of the gas works or mains of the Corporation; and whenever the said fund amounts to that sum, the income therefrom shall be applied in the same manner as moneys received by the Corporation by way of revenue in respect of the said undertaking: Provided that if and whenever the said reserve fund shall fall below the said last-mentioned sum, the Corporation may set apart such yearly sum as aforesaid until the said reserve fund shall again amount to such last-mentioned sum: Provided also that resort may be had to the reserve fund under the foregoing provision, although such fund may not at the time have reached, or may have been reduced below, the prescribed amount.

And any balance remaining in any year shall be carried forward to the revenue account of the gas undertaking for the next succeeding year, and shall, whenever and so soon as there shall be an amount sufficient for the purpose, be applied to the reduction of the gas charges equally throughout the limits of supply.

Succeeding clauses largely refer to annuities; and then there is a provision regarding a superannuation fund referable to officers or servants who have been employed for fifteen years or upwards. [*Parliamentary Agents: Messrs. Martin and Co.*]

In the section referring to gas supply of the Kirkcaldy Corporation Provisional Order Confirmation Act, opportunity is taken to incorporate the applicable parts of the Gas-Works Clauses Acts, 1847 and 1871, and to make the useful extension to section 13 of the former "provided also that every such contract entered into by the Corporation shall be alike in terms and amount, under the like circumstances to all consumers." Lands are scheduled for acquisition for gas-works purposes; and powers are given as to the construction and maintenance of works thereon. Provision is also made so that committees and their proceedings, and the audit of the accounts, shall be regulated by the Town Councils (Scotland) Act, 1900. The standard illuminating power of the gas is prescribed at 14 candles, tested by the "Metropolitan" No. 2 burner. There are several other clauses, but they are all of modern and ordinary form. The Order has been stripped of several proposals that appeared in it when under notice at the beginning of the year—an important one that has been refused being that which would have allowed surplus profits to be carried to the Burgh General Assessment.

A strange water-valve accident happened on a 30-inch main in New Orleans a few weeks ago. While a repair gang was engaged in removing a broken spreader in the valve, the spreader and disc were blown out so violently that two men were killed and two injured. It is thought the neighbouring valves on the line were manipulated in such a way that water was allowed to enter rapidly into a line containing considerable air, and a severe hammer effect was the result. But this is only a surmise.

"EXTRA-SPECIAL"

Or the "Outdoor Lighting" Number of the "Electrical Times."

THE "Outdoor Lighting" number of the "Electrical Times" made its appearance last Thursday; and we have given it the due consideration its bulk and general character deserve. As we finish reading the mass of superficial palaver it contains, we can the better understand the groan of "Meteor"—the chief of the staff of our contemporary—that found expression in the words "the labour has been considerable." It is in the main a hotch-potch of old published stuff, in a fresh garb of verbiage; and what there is new about it is compounded so much of hypothesis and worse, that really it is hardly worth while giving it consideration. If this is the kind of material that is to inspire the electrical people, and put heart into them in connection with the modern lighting methods of the gas industry—then, Heaven help them! for they will want all the help extraneous to the "Electrical Times" that is available. Against all that paper has to say, we put the concrete fact of public lighting tendering in Westminster, Hackney, Bethnal Green, Finsbury, and Stoke Newington, having resulted in favour of gas, and that gas in South London where the electricity supply is in the hands of Companies and not Borough Councils holds the public lighting field. It would be well, if, instead of all the absurd writing that is presented in this so-called special number, with assumption forming its principal ingredient, electrical journalists would go and see what is actually being accomplished in the matter of public lighting by inverted gas-burners by large concerns dependent for dividends solely upon the fruits of their commercial enterprise. Probably "Meteor" has been to see, and is sick at heart; for the notes prefacing the curious mass that succeeds lack that ordinary sprightliness to which one has become accustomed in his work.

Looking through the columns upon columns of what follows, one is left with the impression that the scheme for a special number of the kind is an easy matter to draw up, but the labour of carrying it through is immense. The general scheme is: Hunt up all the old published matter that is detrimental to gas (never mind whether or not it is relevant to present-day conditions), pad it with as much assumption and equivocation as possible, select all past published tests that are antagonistic to gas lighting and are not pertinent to the present time, avoid those that are in favour, say nothing about Mr. Bradley's strictures as to the "inefficiencies" of electric lamps or about the statements of illuminating engineering experts as to the difficulties of getting concordant illuminating power readings from electric arc lamps owing to their variability, deny the right of gas companies to charge for gas for street lighting any price lower than the average of their total expenditure per 1000 cubic feet of gas sold, but applaud electricity suppliers who charge the fraction of a 1d. for electricity for the same purpose, while charging several pence to the private consumer, add to the actual consumptions of gas-burners (to the extent of 100,000 cubic feet per annum in the case of the 3000 candle power ones), on no account whatever fail to bye-pass the truth with regard to all the modern methods of gas lighting, and never forget to convey the inference that all gas-men are liars. Link together the portions admitted by bland or else frivolous sentences (as best suits the immediate purpose); and there is the whole of the material for the outdoor number.

Now we would suggest to the "Electrical Times"—"Meteor" and the staff of that paper perhaps know the intellectual capacity and commercial ability of electrical men better than we do—that, if they desired to serve up a stimulant to electrical people in this matter of outdoor lighting, it could have been done in a much condensed and more effective form by giving some good photographs of the new high-pressure gas lighting in Victoria Street, Westminster, and also of some of the low-pressure lighting by inverted lamps in other quarters, pointing out that this is what they have to meet in future, and at prices that are considerably lower than before, owing to several causes—the new economies in gas manufacture brought about by illuminating power as a property of gas being now almost a negligible quantity, by the consumption economies of the inverted incandescent burner, and by the fact that mantle costs have been considerably reduced by the form, and character of suspension, of the inverted mantle. Is it not better to look at the facts fairly and squarely in the face than to descend to such feeble commonplaces of electrical literature as "Gas is undoubtedly fighting a losing battle, but it is dying hard?" And, again ("Meteor's" thoughts at this critical time wander back to his nursery days), "We have roused the giant out of sleep; and though Jack the Giant Killer will win in the end, it is still a giant we have to deal with—a giant moreover who is as artful as he is bulky." And as to what succeeds the peculiarly poverty-stricken introduction, it would be waste of time attempting to reply to the points seriatim, when London streets supply the irrefragable answer to the whole of them.

But there are two or three matters upon which a few words may here be said. What is regarded by our contemporary as the masterpiece of the whole production is a census of shop window and frontage lighting. The area selected is Oxford Street (from Marble Arch to Tottenham Court Road), New Oxford Street, High Holborn and Holborn Viaduct, Cheapside and Poultry, Queen Victoria Street, Ludgate Hill and St. Paul's Churchyard, Fleet Street, Strand, Piccadilly, and Regent Street. Travel the world over, and one would not find a run of streets where it was more likely that electric lighting for shop window illumination

would be generally the fashion. Such a combination of streets lined with rich retail trading establishments is not to be found elsewhere. The census shows that in these streets 2270 shops are electrically lighted, 165 gas lighted, and 79 partly electric and partly gas. This is a unique condition of things. The wealthy tradesmen started the putting in of electricity; and then it was a game of follow my leader. And fortunate it was for the electric supply companies and authorities in the area that the tradesmen did so; otherwise the condition of these suppliers would have been parlous indeed. It is a district that has a character peculiarly its own, and is not a representative one; and yet within that area the Gaslight and Coke Company (we seem to recollect hearing the Governor say) are selling as much gas now as before the electric light was introduced. But we see nothing in the reference to shop lighting in the special issue as to the troubles that are occasioned by the sudden extinction of electric light, nor is there any allusion to the Clapham and Accrington catastrophes.

Our friends—narrow-minded and stunted in their knowledge of actualities—think this census return (please read with considerable emphasis) is "a crushing revelation of gas retrogression," and yet twenty or more pages are devoted to showing how alive the gas industry is, but how dead, on old and not disinterested electrical testimony, it ought to be. We see from the last-issued Board of Trade returns that this gas "retrogression" is marked by an ascent in the year's gas business of statutory gas undertakings of 1,068,248,000 cubic feet, to a total of 173,957,395,000 cubic feet. We also see in regard to street lighting, that in the areas of the 790 statutory gas undertakings of the kingdom with which the returns deal, there were at the date of the returns 700,696 street gas-lamps—an increase on the previous year of 10,432, notwithstanding all the recent operations of Marylebone, Hampstead, Shoreditch, and several other places. This reminds, too, that when the first General Electricity Supply Act was passed, there were in the country 500 (large, medium, and small) statutory gas undertakings, with a total of 361,311 public lamps, or an average of 723. The 790 concerns in the last returns had 700,696 public lamps, or an average of 887. What is the meaning applied by "Meteor" to the term "retrogression"? It is submitted as a significant fact by our friends that during the last eighteen months 13,340 electric lamps have been added to the "large number already lighting the streets of our towns." We see nothing remarkable in this, when it is remembered what the three London boroughs—the Councils being the electricity suppliers—already referred to have done. Bearing on this point, we may appropriately reproduce a statement that was published in "Electricity Supply Memoranda" for Sept. 20:

> The number of street lamps under supply by the three London Gas Companies at June last was 77,349; while the County Council returns for 1908-9 show that the total number of electric arc street lamps in use in the administrative area (which is not, being somewhat larger, coterminous with the areas of the three London Gas Companies) was then 6574, and other varieties of electric lamps numbered 2641—a total of only 9215, against the 77,349 gas-lamps. Of the totals for electricity, 4859 arcs and 2429 of the incandescent type were in the municipal electricity supply areas! The figures for the electric lamps require some amendment, owing to the conversions from gas to electricity during the past year in Marylebone, Hampstead, and Shoreditch. But the figures for gas are absolutely correct up to June 30 last.

With reference to the arc lamps that are still being retained in Westminster, the "Electrical Times" fails to tell the story of the Hanover Square contract, or to tell its readers what Alderman Everitt said about it recently in the Westminster City Council. The matter is alluded to in our "Electricity Supply Memoranda" elsewhere this week.

There is in the number a great deal upon relative costs; and those that are not based on the old conditions of gas lighting are drawn purely from imagination. Though the claims in this regard of gas suppliers are described as being "hoary legions" and "dead bodies," it is confessed elsewhere in almost the same breath that "we know what electric lighting costs, but we do not take the trouble to find out what gas lighting costs." On what ground, therefore, are the postulations in respect of gas costs based by the "Electrical Times?" If "Meteor" knows all about these claims of gas, where is the sense in counselling a course of research in order to find the truth of the matter? There is want of coherence between assertion and advice, as there is between what appears in our contemporary's special number and what actually obtains in London north of the Thames, and has its confirmation in what is being done, and was being done long before this controversy arose over Westminster, in South London and elsewhere in association with the adoption of the inverted gas-burner in street lighting.

And as to lighting efficiencies. What is the good of quoting Mr. Bradley's old tests, that cannot possibly apply to the new inverted lamps under the new conditions, or what is the good of quoting in the latter part of 1910 Professor Morris's tests of 1908, or where is the profit of quoting tests made of lamps tested by unknown "experts," in unknown places, lamps of unknown type, and in unknown circumstances? Would anyone but an electrician accept evidence of the kind? We cannot congratulate our contemporary on the photographs it publishes. They are excellent studies in black and white; and the contrasts are remarkably sharp. Our friends find uniform illumination a very tender point to deal with, and advise that the value of intensity must not by any means be abandoned. We are not surprised at this in view of the photographic records of public electric lighting now published, and "faked" records too! for we read: "Here are busy night scenes, all the theatres are illuminated, the cab rank is full of vehicles, everything is in full swing. Yet never a soul is to be seen moving along the pavements, no omnibuses or motor cars move along the roads. Of course, they are all there; but they would not keep still, so the photographer refused to take them." Nevertheless, the photographs make good advertisements for gas, as they distinctly show how public lighting should not be done. The "Electrical Times" is thanked by the gas industry for its efforts on behalf of public lighting by gas.

EXHIBITIONS AND GAS.

Illuminated Advertising Signs and Incandescent Lighting.

There were last week, in different parts of London, two exhibitions organized with the view of displaying the latest and best ideas and goods of particular kinds. The first of these, which was held at Olympia, in the West, was the Business Exhibition; and there one saw numerous typewriters, calculating machines, and other modern office and shop requisites, as well as the newest suggestions for effective advertising. The other took place at the Agricultural Hall, in the North, and was the thirty-second of a series of annual Brewers' Exhibitions, the object of which is sufficiently explained by the title.

On turning to the right when entering the Business Exhibition, the visitor immediately came upon a large stand which, if he happened to be a purveyor of gas or any other commodity, must have had some interest for him. This was the display of gas-advertising signs by Mr. C. W. Freeman, who carries on business as an advertising specialist at No. 107, Cannon Street, E.C. Some twelve months since, when a similar exhibition was held, Mr. Freeman also had a stand, which secured a considerable amount of attention at the hands of those connected with the gas industry, and was the subject of a notice in the "Journal" at the time. Calling on Mr. Freeman again last week, in the course of a stroll round the exhibition, he was found to be no less enthusiastic than before with regard to the field that is open to gas as a medium for advertising purposes. In fact, his own experience has already proved to his complete satisfaction that gas has a great future in this connection, if only its possibilities are properly cultivated. So great is his faith, that he has given up the whole of his electricity business, in order to concentrate his energies in the direction of popularizing the use of gas for illuminated advertisements—for which purpose, as for many others, it is, of course, remarkably efficient, extremely cheap, and absolutely reliable. It may not be in Mr. Freeman's power to command success; but, at any rate, he is doing his best to deserve it. During the run of the exhibition the number of inquiries and appreciative remarks with regard to advertising by gas showed conclusively that the subject is attracting careful attention in many quarters; but if these illuminated signs are to really take the position in connection with advertising which they are, on all counts, so admirably qualified to fill, it must be by means of the cordial cooperation of the suppliers of gas throughout the country. Such an extensive campaign as might be inaugurated, it is beyond Mr. Freeman's capacity to conduct altogether by himself. He believes, and he wishes the administrators of gas undertakings to believe with him, that an enormous business in these gas consuming devices could be built up, if companies and local authorities would join with him in opening central show-rooms, at which retailers could be invited to call and inspect all the "taking" novelties in advertising signs which are at their disposal. Meanwhile, all that can be done by a pushing man with a good article to sell, Mr. Freeman is accomplishing, and, we feel sure, will continue to accomplish.

As to the signs themselves, to give anything like a detailed description would be impossible here. And, besides, it is unnecessary; for anyone who should feel tempted to seriously consider them as being a means of increasing the consumption of gas could immediately put himself in possession of full particulars by applying to Mr. Freeman. The movable signs are mostly actuated by the heat of the gas which is used to light them; and they are thus extremely unlikely to get out of order. In fact, Mr. Freeman has devised a flasher, worked entirely by gas, which he guarantees for a period of twelve months. With some of the signs shown, it is possible to arrange for as many as twelve changes of pictures or matter; while there are colour changing devices that can hardly fail to catch the eye, and which can be operated by an expenditure of a very few pence weekly on gas. By a special process, pictures can be made transparent; and when mounted, with incandescent gas-burners behind, they are exceedingly effective. Facias similarly illuminated, and made of two kinds of glass, in accordance with a patent of Mr. Freeman's, look very pretty. An electric arc lamp fixed in the passage-way only a few feet from the stand, in no way dimmed the beauty of a facia of this character which was over the stall. White transparent letters, outlined with gilt edges, on a rich green background, formed about as handsome a name-plate as one could possibly desire. To show what can be done, it may be mentioned that one simple sign in the form of an outside lamp has recently been purchased in very large quantities by a firm of wholesale chemists, who are sending them out to their customers; and in regard to at least three-fourths of them, the illuminant employed is gas. In another

direction, there is a new (provisionally protected) cab signal sign actuated by gas, for hotels, theatres, restaurants, clubs, &c. It is controlled from inside the building; and can be used to call any particular description of cab—by lighting up one portion or another of the sign as required. In addition to this, a hooter calls the desired cab. This appliance has met with the approval of Scotland Yard. In addition to cheapness and reliability, gas has an advantage over electricity for advertising signs in that the light is better diffused.

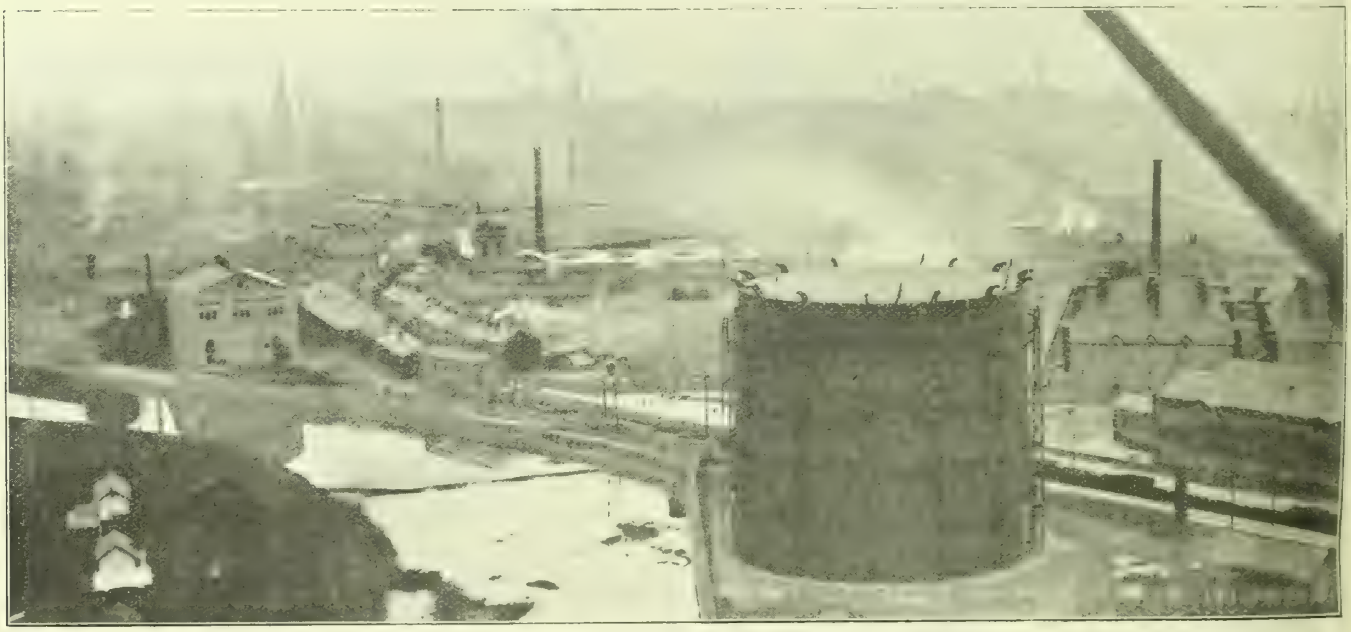
One other stand which attracted attention at the Business Exhibition was that at which the "Coverton" patent burner and mantle were displayed by Mr. W. Coventry, of Langworthy Road, Pendleton, Manchester. This is an invention which it is urged is suitable for use in the lighting of large areas, such as railway stations, goods depôts, public thoroughfares, and "in all cases where the maximum amount of light is required, combined with the minimum consumption of gas." The object in view is said to be to obtain as much light as possible from one point, instead of having in a single lamp several burners and mantles. The special form of the "Coverton" mantle—a ring without any bottom part—is stated to give it a stability which it is impossible for any other mantle to possess; while the burner is so constructed as to produce the correct flame required to convert the mantle to the highest degree of incandescence. There is also a special form of mantle holder or ring, which allows of the easy removal of the mantle without any danger of breakage, and the replacing of same should this become necessary. The maker claims that the "Coverton" mantle produces a very large volume of light, while the consumption of gas in comparison is remarkably small. This low consumption, it is stated, "is guaranteed by the fact that the flame is distributed over an annular surface, and is not supplied to the mantle in the form of a bulb, so that only the minimum quantity of gas required is allowed to pass into the mantle."

Time was when gas was responsible for quite a number of stands at the Brewers' Exhibition; but that is not the case now. While, however, the number of stalls devoted to goods of particular interest to our industry is a diminishing one, the same remark does not by any means apply to the quality of the gas apparatus that is shown. At last week's show, for instance, Messrs. A. E. Podmore and Co., of Charles Street, Hatton Garden, had a notably brilliant display of inverted incandescent gas lighting. A special feature was made of the firm's conversion fittings, which were described and illustrated in the "JOURNAL" for Sept. 13 last (p. 718); and there were also a number of lamps lit up. So effective were these latter, that it was not at all unnecessary to explain that they were working at low pressure. The mantles used in these lamps were the firm's special make, 54 mm. in length, which are found to be particularly efficient. The "Bourne" all-copper lamp was on view, as being an ideal one for brewery premises of any description. It is substantial, and is specially made for dusty and draughty positions and open sheds. There were also lights particularly adapted for saloon bars, smoke rooms, or lounges. In fact, with such an excellent all-round show, it was not surprising to learn from the representatives in attendance that "good business" was being done at Messrs. Podmore's stand.

The only other gas exhibit at the Agricultural Hall was by Messrs. Bilbie, Hobson, and Co., of Queen Victoria Street, who showed in operation one of the latest type "Hornsby-Stockport" gas-engines; and the Thorp and Marsh "B. S. T." system of high-pressure inverted gas lighting, for which they are the sole agents in the South of England. There was a patent compressor supplying numerous lamps. It is pointed out that this system is specially suitable for factories, workshops, large public buildings, open spaces, &c.; and that it furnishes a brilliant light with great economy in gas consumption.

THE NEW BURTON-UPON-TRENT HOLDER AS SEEN FROM AN AEROPLANE.

The accompanying photograph, which we have received from Mr. R. S. Ramsden, was taken from an aeroplane during the Burton-upon-Trent aviation week, which was held at the end of September. It furnishes a unique view of the new holder constructed by Messrs. Clayton, Son, and Co. at the gas-works in the town, which was fully described by Mr. Ramsden in his recent Presidential Address to the Midland Junior Gas Engineering Association, and illustrated in the "JOURNAL" for the 11th inst., pp. 127-129. On the left of the photo. is seen the gable-end of the new retort-house, which was also dealt with.



London and Southern District Junior Association.

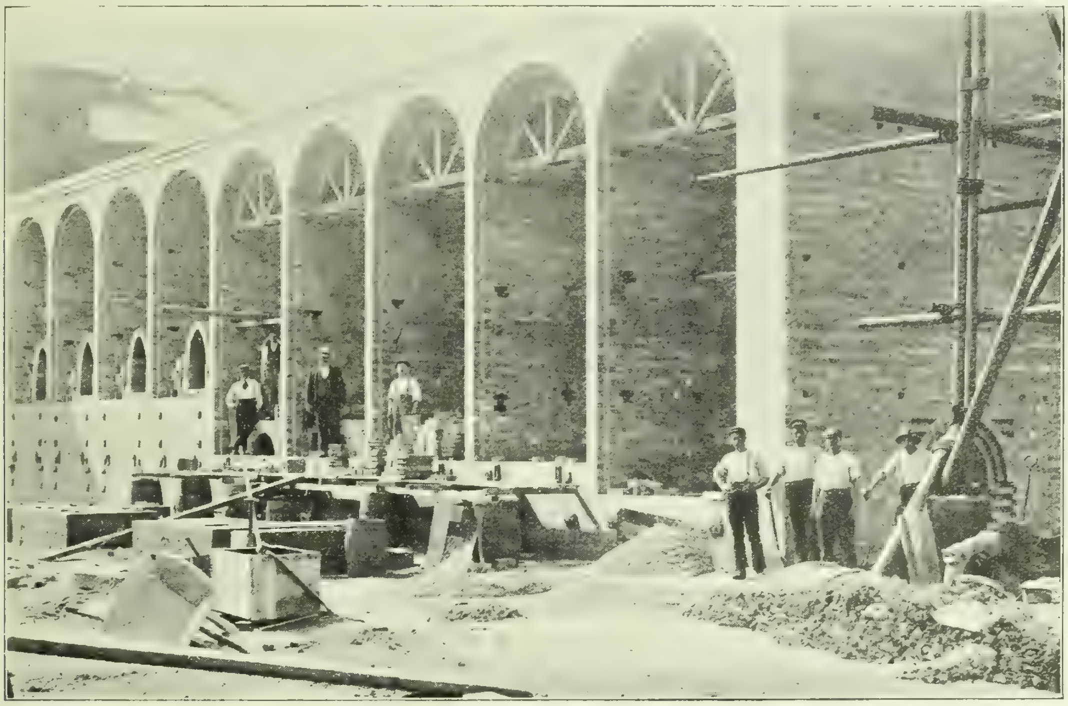
The Association are to make a promising start with the session 1910-11, the opening meeting of which is fixed for next Saturday, at the Westminster Technical Institute, Vincent Square, S.W. There will be a conversazione and exhibition of gas appliances and scientific apparatus in connection with the gas industry; and during the evening Mr. Stanley H. Jones (the Engineer and General Manager of the Commercial Gas Company) will deliver an address. The exhibition will open at 3 o'clock; and the afternoon will be occupied by various practical demonstrations which should prove of great interest to the members. Light refreshments will be available. The President of the Association is Mr. L. F. Tooth, of the Commercial Gas Company; and the organizers of the highly attractive opening meeting are Messrs. H. Rothwell and P. J. Smithers. The subsequent arrangements for the session are as follows: Nov. 12—Visit to the Brentford Gas-Works. Nov. 25—Afternoon visit to Messrs. Sugg and Co., Westminster; lecture by Dr. Harold G. Colman, on "Some Applications of Gaseous Combustion." Dec. 3—Visit to the Fulham Station of the Gaslight and Coke Company. Dec. 16—Address by the President (Mr. L. F. Tooth) on "The Industrial Aspect of Gas;" this address will be preceded by a coffee meeting. Jan. 14—Afternoon visit to the Westminster Compressing Station of the Gaslight and Coke Company; evening visit to Lloyd's Newspaper Printing Works. Jan. 27—Paper by Mr. E. W. Browning, on "Gas-Fires and Chimney-Flues." Feb. 11—Visit to the Stepney Station of the Commercial Gas Company. Feb. 24—Paper by Mr. J. G. Clark, on "Some Phenomena of the Electric Current;" this paper will be preceded by a coffee meeting. March 4—Annual dinner. March 9—Visit to the Gillingham Gas-Works and the Chatham Dockyard. March 2[illegible]—Paper by Mr. Walter Upton. April 8—Visit to the Neasden Generating Station of the Metropolitan Railway. April 28—Paper by Mr. F. Thorpe, of Manchester, on "The Mixing of Gas and Air for Industrial Purposes." May 11—Visit to Messrs. Willey and Co.'s works, Exeter. May 12—Short paper by Mr. F. C. Briggs, on "Carburetted Water Gas;" and a short paper by Mr. N. B. Hodgkin, on "The Distribution Department." May 26—Annual general business meeting. The programme altogether is one on which the Council of the Association are to be heartily congratulated.

GAS MAKING AT GUILDFORD.

A New Retort-House.

INCREASING consumption, and the great likelihood of still further demands being made upon their resources in the future, led the Directors of the Guildford Gas Company some little time back to adopt a scheme which embraced the erection of a new retort-house, provided with modern coal-conveying plant and apparatus for charging and discharging the retorts; and last Tuesday afternoon, in the presence of a small party of interested persons, the machinery was started at work, and the process of gas manufacturing under the altered conditions was commenced. Thus will the Company be enabled to deal with their steadily increasing output for some time to come. The need for extension schemes of this character is always matter for congratulation of the undertaking concerned, as such works constitute a visible sign of the progress which is so much desired and, in connection with the gas industry, so frequently experienced. The competition of an Electric Light Company has in no wise disconcerted the distribution department of the Guildford Gas Company (which is under the charge of the Secretary, Mr. William Titley); and the Corporation, one notices, have had the good judgment to retain gas as the illuminant for the public lamps, the whole of which are fitted up on the incandescent system.

The new retort-house, which is the subject of this article, is a steel-framed structure 56 ft. 6 in. in width inside the walls and

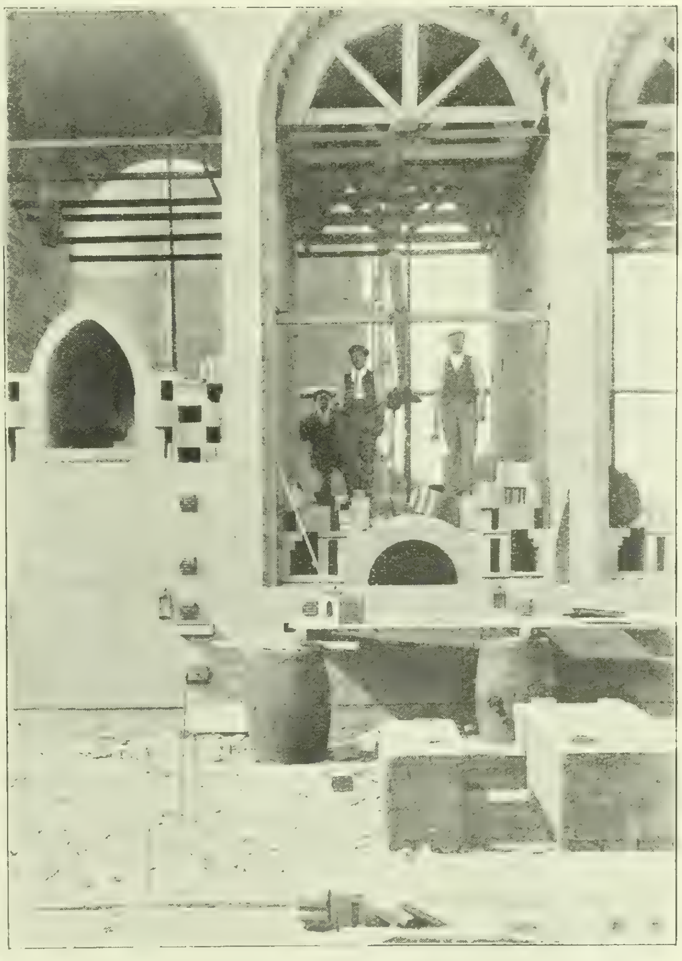


Arches of the Settings under Construction.

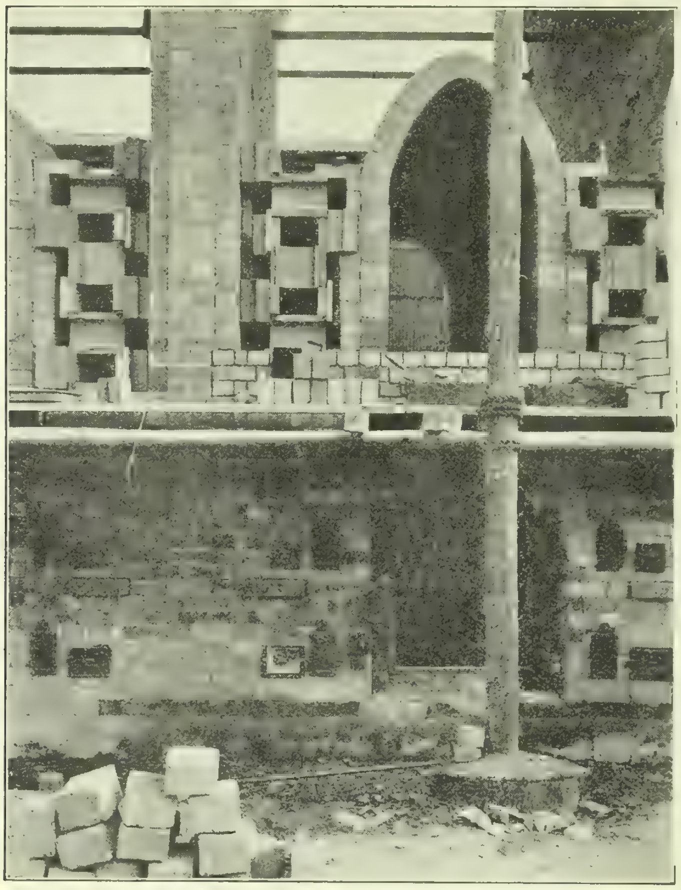
108 ft. 6 in. in length; the height being 42 feet from basement to eaves. There was on the site an old house, which was working until as recently as Feb. 1, so that no time has been lost in the work either of pulling down or building up. The old foundations, stiffened as needful, were partly used; and now they consist of a solid mass of concrete, with a minimum thickness of 3 feet—the site being a water-logged one. The house contains nine beds of eight 20-feet through retorts, five of which were under fire at the time of last week's ceremony. In each of these five benches, it may be remarked, is a different make of retort, so that data may be obtained as to which is the most suitable for future use. Messrs. Drakes Limited, of Halifax, were responsible for the iron-work of the benches and the steel framing of the building—the filling in of which was entrusted to Alderman A. Johnson, a local builder. The stage floor is of reinforced concrete; Tozer's lock-woven mesh being employed for the purpose.

The charging and discharging is performed by a Fiddes-Aldridge combined machine, the contract for which, as well as for the coal elevating and conveying apparatus, was given to Messrs. Aldridge and Ranken, of Victoria Street, S.W., who sub-let the contract for the coal-handling plant to Messrs. Cutler and Sons, of Millwall. The works are situated near the railway, from which the coal is carted; and as the charge for this cartage is only moderate, it is not thought likely that any other method, even if it was practicable, would prove more economical. Under the new scheme, the coal is fed from the store into the boot of an elevator (which, owing to the water-logged condition of the site already referred to, has been placed on the ground level), and is then taken to the top of the breaker, from which it drops down into the boot of the elevator. At the head of the elevator is a longitudinal conveyor, which feeds at any desired point the continuous hopper holding about 150 tons of coal that runs along the whole length of the retort-house. The capacity of this hopper being equal to from one-and-a-half to two days' supply of coal, it will be possible to avoid filling up on Sundays. A new coal-store is later on to be put up; and the question of dealing with the hot coke will also be taken in hand in due time. For the present, the coke is dropped through shoots under each row of retorts down into the cellar, and is then wheeled in barrows out to the yard, and there quenched.

The electricity for the stoking and elevating and conveying machinery is generated by means of two 35-H.P. gas-engines driving two dynamos. This is really a duplicate plant; as one engine and one dynamo are equal to doing more than the whole of the work that is required. No other room being available, the engine-house has been arranged under the stage-floor on the



Filling-in the Arches.

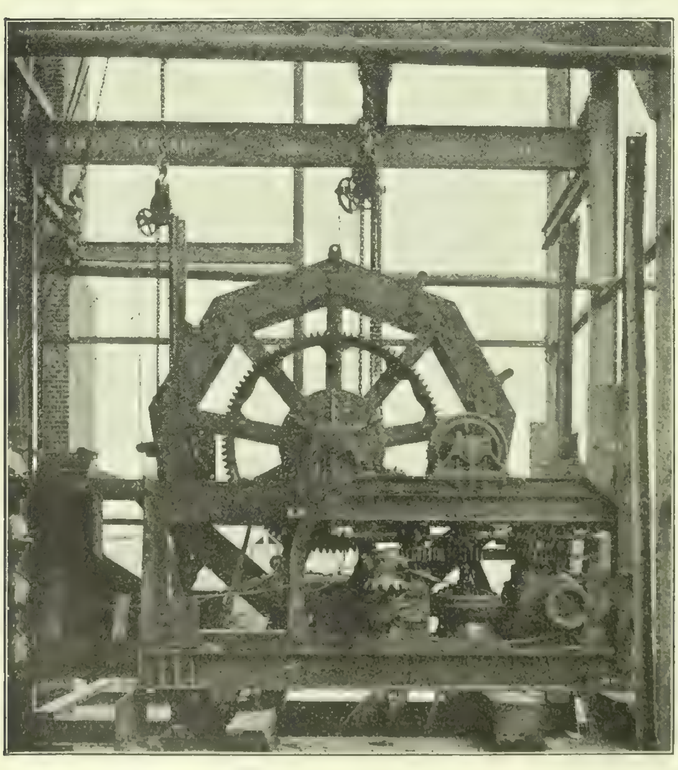


A Further Stage in the Construction of the Settings.

charging side of the retort-house—a separate back wall having been built to keep it cool. The remaining space in the basement of this side of the house there is some thought of dividing up into a workshop and a workmen's mess-room.

The contract for the whole of the brickwork of the settings and the retort-house chimney was given to Messrs. Timmis and Co., of Stourbridge. For the furnaces, the firm's improved Klönne system of regeneration has been adopted; and the doors are Timmis's patent, the object of the inventor of which was to prevent warping, by applying the closing pressure at the side. For the building of the main arches, there were used specially moulded blocks, 18 in. by 9 in. by 6 in. thick; and the furnace-charging doors are bolted up to brick blocks, so as to make them flush with the setting. The foundations were only handed over to the firm on Easter Monday; and their portion of the work was completed by the end of July—that is to say, in about four months.

The ceremony of inaugurating the new retort-house which has been here described was preceded by an excellent luncheon,



The Fiddes-Aldridge Machine before Mounting in Framework.

to which a party of about twenty-five sat down, at the famous Lion Hotel. There was no formal speech-making; but before leaving the table, the Chairman of the Company (Mr. F. F. Smallpeice, J.P.), who presided, proposed the Loyal Toast, and subsequently "Success to those firms who have been doing such excellent work for the Company." He remarked that one and all had taken a great deal of trouble. Mr. J. G. W. Aldridge, Mr. J. A. Drake, J.P., Mr. W. D. Jones (of Messrs. Timmis and Co.), and Alderman Johnson all returned thanks. Mr. Aldridge remarked that the carrying out of the contract had been a pleasure to his firm, as every courtesy had been shown them; and Mr. Drake said that, without desiring to enter into any controversy, he thought the Company had provided themselves with a plant which in years to come would enable them to carry on their work on economical lines, and perhaps result in the lowering of the price of gas.

Assembling at the works after the luncheon, the visitors saw the Fiddes-Aldridge machine discharge and charge some of the retorts; and the evenness of the charges was remarked upon. Interest was aroused by the automatic filling arrangement, by which the hopper on the machine, at each operation, takes in a charge for one retort. The amount of this charge it is, of course, possible to regulate as desired. A beginning was made with 8 cwt. charges; but in all probability the amount will be increased to 10 cwt., which may be found the best for eight-hour charges with these retorts. During the inspection of the retort-house, it was pointed out that it has been provided with a continuous hydraulic main, with sections for each bench of retorts; and that the ascension-pipes are on the charging side of the retorts only. Two retort-house governors are to be installed.

When fully at work, the output of the retort-house will be from 1 to 1½ million cubic feet of gas per day; whereas with the existing old house, which it is hoped now to entirely dispense with, it is only possible to make about 400,000 cubic feet of gas. There is, however, in addition, a Humphreys and Glasgow water-gas plant, the capacity of which (originally 350,000 cubic feet per day) was increased to 550,000 cubic feet by enlarging the generator. The house that has been demolished was altogether out of date, while the one that is now to be shut down is practically worn out. So that, apart from the advantages of concentrating the carbonizing plant, it was necessary to renew. Everything in connection with the extensions has been planned by the Engineer, Mr. P. C. Cleasby. In fact, as one of the members of the Board remarked at the opening ceremony: "The Directors have had such confidence in him that they have not thought it necessary to appeal for any outside assistance." The cost of the whole scheme (exclusive of foundations) will be about £12,000; and it constitutes the first portion of a scheme for re-organizing the works which Mr. Cleasby submitted to his Directors, and which was provisionally approved.

GAS COMPRESSORS OR BOOSTERS, AND BLOW-PIPES, FOR USE WITH HIGH-PRESSURE GAS.

The greatly increased use to which gas under pressure is bein[g] put has induced Messrs. Alldays and Onions, Limited, of Birming[ham], ham, to arrange their "Empire" pressure blowers for exhaustin[g] and compressing gas for lighting, heating, and furnace work.

The compressor is of the rotary type; and a bye-pass is fitte[d] connecting the discharge pipe with the suction pipe. This bye pass is fitted with a valve that is adjustable to suit any require[d] pressure up to 5 lbs. per square inch—an adjustment that can b[e] done while the compressor is at work, by simply turning a screw The machines may be either belt-driven or coupled direct to a[n] electric motor; and they are made in all sizes, ranging betwee[n] 300 and 40,000 cubic feet per hour.

The firm have also introduced a newly-designed blowpipe fo[r] use with compressed gas. This is a very light and handy littl[e] tool, weighing only 14 oz., and should prove a great boon to thos[e] who are using a blowpipe all day. The flame from the burner is much more intense than that of the old method; and, there fore, brazing or heating is very much quicker and a considerabl[e] saving of gas effected—said to be at least 10 to 15 per cent. A simple lever gripped by the hand when using the blowpipe govern[s] the size of the flame at the will of the operator. The gas suppl[y] is controlled by a needle-valve at the nozzle; and no matter wha[t] amount of gas is passing, the pressure remains the same. Thi[s] is an important feature.

The flexibility of control may be seen from the following figures supplied by the Birmingham Gas Department. The pressure c[of] gas in the main was 60 inches water-gauge.

Consumption of Gas in Cub. Ft. per Hour.	Length of Flame in Inches.	Diameter of Flame in Inches.
25	8	1¼
50	10	1¾
75	14	2½
100	16	3

In each test, the gas consumption was taken on a continuous ru[n] of one hour; but in actual practice the consumption for eac[h] size of flame would be much less, as obviously the operator woul[d] loose his hold several times during the period, and the flam[e] would go out, leaving only the very small pilot light.

GAS-WORKS FOR MALTBY.

The Opening Ceremony.

As was briefly announced last week, works which have been erected for the Maltby and Bramley Gas Company, Limited, at Hellaby Bridge, were formally opened on Wednesday, the 12th inst., by Lady Mabel Smith, and that night some 500 houses in the district were illuminated by gas. Mr. John H. Brearley, of Longwood, is Consulting Engineer to the Company.

The land on which the works are erected is freehold, and has an area of an acre. The site at Hellaby Bridge was selected because of its proximity to the railway, and the advantage thereby obtained in getting supplies inwards and outwards. As soon as the volume of business warrants it, steps will be taken to secure a siding into the works. Situated as the works are midway between Maltby and Bramley, they are excellently adapted to supply the two townships.

The retort-house is 45 feet long by 32 feet wide, and has been so designed as to be suitable for coal unloading when the Company obtain a siding. The iron roof consists of five principals of suitable strength, with a ventilator 2 feet wide and 32 feet long at the apex; the remainder being covered with Welsh slates and blue Staffordshire ridge tiles. The retort-bench consists of three arches; but only two are filled at present—the third being left for future extension. The two which are completed each contain six retorts 22 in. by 16 in. by 10 ft. long, and capable of producing about 90,000 cubic feet of gas per day. The chimney rises 37 ft. 6 in. above the retort-house floor-level. The furnaces are heated by patent regenerative settings to the Engineer's own design.

The condensers are two in number, each 25 feet high, and 3 ft. 3 in. diameter. The exhauster is steam-driven, and is capable of driving forward 7500 cubic feet of gas per hour, at a speed of 90 revolutions per minute, against a gas pressure of 20 inches. It is fitted complete with bye-pass, hydraulic-regulator, and gas-governor. The steam-boiler is of the Cornish type, 12 ft. by 5 ft. The Livesey washer has a capacity of 250,000 cubic feet of gas per day. The tower scrubber is 40 feet high by 5 feet diameter, fitted with a water-distributor with revolving spreader, intermediate liquor distributor, and ladder. In the interior are boards each ⅜-inch thick, with ½-inch spaces. The purifiers are each 12 feet square, of cast iron, and are covered by luteless lids—suitable lifting gear being provided. The valves are so designed as to allow either two, three, or four purifiers to be working at the same time. The purifiers are fitted with horizontal grids. The station-meter has a capacity of 10,000 cubic feet per hour. The gasholder is of the Gadd and Mason spiral-guided type. It consists of two telescopic lifts; the outer being 62 feet and the inner 60 feet diameter, and each 20 feet deep. The tank is constructed of steel, and is 64 feet diameter. The capacity of the holder is 110,000 cubic feet. The 6 inch governor is of the compensator type. Overhead storage tanks of ample capacity are provided for tar, ammoniacal liquor, and water.

All the works mains are 9 inches in diameter; and where the district mains branch to Maltby and Bramley, the size is reduced to 6 inches. This size is carried right to the two townships named; and the subsidiary streets are supplied through 4-inch and 3-inch mains respectively. The Company have fitted up all the houses right to the point of combustion; the meters being principally of the prepayment type. At the works are provided suitable offices and workshop; and shortly the Company will arrange a show-room. The principal contracts were not let until the first days of May; and on the 8th inst. gas making was commenced. Thus within five months the Company have succeeded in erecting works, laying over 5 miles of mains, and fitting up more than 500 houses ready for using gas. The works will, with slight further expense, be capable of supplying 30 million cubic feet of gas per annum; and they are expected to satisfy the anticipated rapid development of the district for the next ten years.

The following were the Contractors: Buildings, Messrs. Gray and Sons, Tinsley; retort-bench, Messrs. John Walsh and Sons, Halifax; condensers, retort-house roof, scrubber, and purifiers, Messrs. Newton, Chambers, and Co., Sheffield; exhauster, the Bryan Donkin Company, Chesterfield; Livesey washer, Messrs. Tattersall and Sons, Elland; gasholder, Messrs. Robert Dempster and Sons, Elland; governor, Messrs. Bruce Peebles and Co., Edinburgh; works and district mains, Sheepbridge Coal and Iron Company, near Chesterfield; weighbridge, Messrs. Ashforth, Son, and Co., Dewsbury; meters, Messrs. Alder and Mackay, Edinburgh; boiler, pumps, and storage tanks, Messrs. Ellison and Cordingley, Cleckheaton.

At the opening ceremony, Councillor Ellis, a Director of the Gas Company, presided, and gave some interesting particulars in regard to the past history and present position of the gas industry. He remarked that, although they were over a century behind the times in starting a gas supply, they had at least the advantage of beginning at the point which other gas makers had got to. They were assured that their plant was thoroughly up-to-date, and would produce gas economically and of good quality. The works were designed to supply a much larger quantity than would be needed at present; but they had provided for the great developments which were expected. With the support of the householders, they expected the output to grow at such a rate as would enable them to share the benefits with the consumers. The greater the quantity used in proportion to the plant involved, the less the working expenses. Facilities would be given to all consumers to obtain cooking and heating appliances on reasonable terms.

A description of the works and plant was then given by Mr. Brearley, who went on to speak of the special facilities which will be afforded the consumers. The Company, he said, had fitted up free of charge 95 per cent. of the houses in Bramley and Maltby, and would continue to do so for a period of six months. If the Parish Councils desired to adopt the Lighting Act, the Company would spread the payment over a term of five or six years, and provide lanterns, pillars, &c., so that the ratepayers need not fear a heavy increase in the rates. This practice had been followed in other places with advantage to the public, who were thus enabled to have a system of public lighting without any undue call upon the rates. Referring to the Manager (Mr. Wilkinson), he said he knew from personal knowledge that the Company had in him a man whose services would be a benefit both to the undertaking and to the consumers.

A silver key with which to open the door of the governor-house was then presented to Lady Mabel Smith by Mr. E. J. King, of Elland, who remarked that, as the representative of one of the Contractors, he wished to congratulate the Directors of the Company on having brought to a satisfactory conclusion the construction of the work. The time occupied had been a record for shortness; and great credit was due to the EnginGeer for having brought the numerous Contractors so well into line, and getting the works completed in so satisfactory a manner. Lady Mabel Smith then made a short speech, and carried out the opening ceremony—for which she was heartily thanked.

After tea, the visitors inspected the works.

PADIHAM'S NEW GAS-WORKS.

Inauguration Ceremony.

The formal inauguration on Wednesday last of the new gas-works of the Padiham Urban District Council (which were described and illustrated in our last issue—pp. 187-191) was made the occasion of several interesting little ceremonies. Gas engineers from different parts of Lancashire and adjacent counties were present; and though the proceedings extended from about noon until after six in the evening, time did not hang heavy on the hands of any member of the party. There was much to see and interest the visitors about the old works and the new during the early part of the afternoon, while the gathering at the Co-operative Hall, which followed, was a very pleasant one. At noon, Mr. Thomas Riding, J.P., the Chairman of the Gas Committee, held a reception at the Council Chambers, and was supported by Mr. James Horne, J.P., the Chairman of the Council. Mr. T. H. Thompson, J.P., Vice-Chairman, Mr. J. C. Waddington, Clerk, and many members of the Council, together with Mr. A. J. Harrison, the Gas Engineer.

On leaving the Council Chambers, the party first proceeded to the old gas-works; and the inspection proved conclusively that the Council had not started a day too soon with the construction of their new works. In fact, it was a marvel to most of the party how the Gas Engineer, with such a plant, had managed to supply the town and district with gas, particularly in the winter months. It was incidentally mentioned that the site of the old works is likely to be used for public purposes; and as the value set upon it is about £6000, this will help to relieve the Gas Department of part of the cost of the new undertaking.

When the party reached the new works, Mr. Harrison presented the Chairman of the Council with a gold key, as a memento of the occasion; and Mr. Horne, before opening the main gate leading into the works, delivered a short speech. Having acknowledged the presentation, and referred to the part he took in forwarding the scheme for the new gas-works, he said he thought that the visitors at the close of their inspection would come to the conclusion that the works were ideal. Some people might say that the system of carbonization which they had adopted was not up-to-date; but he fully believed they had acted wisely in awaiting the results of the experiments which were being made with verticals in larger towns and cities than Padiham. They in Padiham had been hampered for a long time as to their gas supply; and the new works had not been erected too early, as the old premises were not only dilapidated, but were almost tumbling down in some places.

On entering the new works, the party proceeded at once to the boiler and exhauster houses, where Mr. Harrison asked Mr. Thompson's acceptance of a gold souvenir key. Mr. Thompson, in declaring the buildings open, said he could lay claim to a close connection with the gas undertaking of the town. His father was the first Chairman of the old Padiham Local Board, while he (the speaker), by a remarkable coincidence, happened to be the last. During the time his father was a member of the old Local Board, he was greatly instrumental in bringing about the purchase of the gas-works from the private Company, and the creation of annuities which made possible the acquirement of the undertaking. It was strange that the father should do this, and that the son should be one of those instrumental in getting a clause inserted in the Padiham Urban District Council Act of 1908 which enabled the authority to redeem the gas annuities by compulsory purchase. In his opinion, Padiham had taken the right course in having this clause inserted in the Bill; but it would not have been possible to have acquired the works without the annuities in 1876. In

opening the door of the exhauster-house, he said he wished the new works every success, and did not think the people of Padiham would have cause to blame the Council for the action they had taken. Inside the exhauster-house, a marble tablet built in one of the walls was unveiled. This tablet has inscribed on it the date of the opening of the new works, together with the names of the Chairman of the Council, the Chairman, Vice-Chairman, and members of the Gas Committee, and of the Gas Engineer.

An adjournment was next made to the retort-house, where Mr. Riding set the machinery in motion, and was presented with a handsome silver rose-bowl as a souvenir of the occasion—this being handed to him by Mr. J. Armitage Drake, J.P.

Mr. Riding, who was described as the "Father" of the Council, being the oldest member, expressed the hope that the new works would be successful and become a profitable undertaking for the benefit of the ratepayers of Padiham.

Following this ceremony, considerable time was spent by the party inspecting the plant, under the guidance of the Engineer. Not the least interesting part was to see the carbonizing installation at work, and also the coal and coke-handling plant in operation. Each member of the party had presented to him a souvenir booklet, containing a reprint from last week's "JOURNAL" of the description of the new works and plant. The extent of the land available for gas-works purposes is some 16,560 square yards, adjoining the Lancashire and Yorkshire Railway; and there is ample room for extensions. The works are designed to produce a million cubic feet of gas per day; but only half this quantity is at present aimed at. The works will supply gas, in addition to Padiham, to the towns of Sabden, Read, and Simonstone.

At the conclusion of the inspection of the works, the party adjourned to the Co-operative Hall, where a banquet had been arranged for by the Council. Mr. RIDING presided.

Mr. A. T. HARRIS (Market Harborough), in proposing the toast of "The Urban District Council of Padiham," said at the outset that he did not agree with the statement made by some of his friends that the engineer in the employ of a private company was more fortunate than the one engaged under a public body. In his opinion, the position of a gas engineer was very much what he made it. By the exercise of tact and discretion, he could smooth over many difficulties and create a better feeling between himself and those employing him. This was particularly so with public bodies upon which they had progressive men, such as was evidently the case at Padiham. Looking at the history of the gas undertaking in Padiham, it seemed to him that they had progressive men on the old Local Board when, in 1876, they decided to acquire the works from a private Company; and it was apparent from what they had seen that day there were progressive men on the Urban District Council now. He ventured to say that the erection of new works could not have been delayed much longer. Probably they had been putting off the evil day as long as they could, until at last they felt the time had come when the old works could no longer meet the requirements of the town and district. To those who had inspected the old works that day, it was patent that the putting down of new plant had become absolutely necessary, if gas was to be produced cheaply and efficiently. This he believed would be accomplished in the new works. In considering the question of plant for gas manufacture, those at Padiham had naturally given a great deal of thought to the method of carbonization to be adopted. At present the important matter of the carbonization of coal was in a state of transition. Padiham, however, were in the position of having to put all their eggs into one basket; and he ventured to say, from experience, that they had, under the circumstances, been wise in adopting the system they had. Padiham had a system which had been proved to be efficient, and they could look forward to the future with confidence, having room on the new site for putting down, as the consumption of gas increased, a more efficient plant, if it was proved there was a more efficient plant for their purpose. The Council and ratepayers were to be congratulated on the new works; and he hoped they would prove to be as successful as was expected.

Mr. JAMES HORNE, responding, claimed that Padiham, in regard to its public undertakings, held a position that few other towns of the same size occupied. Not only had they their own water-works and gas supply under their control, but also a sewage works.

Mr. J. C. WADDINGTON, Clerk to the Council, also responded. In the course of his remarks, he said that the Council recognized, in regard to the new gas-works, that Mr. Harrison, their Engineer, had a good scheme, and they gave him every opportunity of carrying it out. They hoped the works would be a great success in years to come, and save the rates to some extent, by reason of the profits made out of the gas manufactured and sold. The gas undertaking had always been profitable; and now that they had got new works, they were looking forward to its being more profitable still. He thought it was something to boast about that they carried their Bill for the new works, and other matters, through Parliament with comparatively slight alteration. The important clauses as affecting the gas undertaking were agreed to practically as drafted; and no greater testimony could be given to the Committee of the Council who had the matter in hand. Very few public bodies promoting Bills in Parliament obtained all they asked for; but Padiham did.

Mr. S. R. OGDEN (Blackburn) had charge of the next toast—of "Success to the New Gas-Works." He said they had seen that day the new gas-works as an accomplished fact; but how many of them realized the great amount of time, trouble, and anxiety that had been entailed in bringing the works to their present stage? No one could tell except the man who had been on the scene all the time. Having a knowledge of the difficulties with which Mr. Harrison had had to contend, it was with great pleasure that he congratulated him upon the excellent way he had carried out the work; and he was satisfied that what had been done would be of advantage to Padiham. He (Mr. Ogden) was quite of the opinion that the system of carbonization which Mr. Harrison had decided upon was the best for Padiham. With the toast the names of Mr. Riding and Mr. A. J. Harrison were coupled.

Mr. RIDING, in replying, traced the history of the gas undertaking from its inception to the present day, recapitulating a good deal of the information given in the "JOURNAL" last week. Before he concluded, he paid a high compliment to the Engineer, Mr. Harrison, for the way he had managed the undertaking since his appointment, and for the work he had done in connection with the new venture.

Mr. A. J. HARRISON, on rising to respond, was received with loud applause. He considered himself fortunate, he said, in having an entirely new site upon which to construct the works. It fell to the lot of very few men to have such a chance—and at his age, too—of constructing an entirely new works. The task was not undertaken without much thought and consideration; and he was pleased to say that all through he had had the complete confidence of his Council. He desired to place it on record that no engineer in the country to-day could have a better understanding with his directors or council than he had; and he was perfectly satisfied with the treatment his Council had meted out to him during the six years he had been at Padiham. His first acquaintance with the old gas-works was not exactly promising. He arrived to find that part of the governor-house had been blown out; and looking at the wreck, he almost wished he was back again at Brigg. Anyhow, he got the place straight in course of time; but he was soon convinced as to the impossibility of producing gas cheaply and satisfactorily in the old works, and with plant that was entirely out of date. Then there was the ground-rent going on for the site required for new works, with nothing upon it but a gasholder; and so he made up his mind that there was nothing better to be done than to push forward the scheme for a new works. The scheme was not presented to the Council without a large amount of consideration. Many an anxious night did he have while the scheme was being thought out. It was quite a fact that outsiders had no idea of the amount of work involved in preparing such a scheme as this. But now that the works were practically completed, he was satisfied that they had done the right thing for Padiham; and he was pleased to acknowledge the help he had had, not only from the Contractors, but from Mr. Ogden, to whom he was greatly indebted for advice. Mr. Ogden had not told them that he was called in by the Council to report upon his (Mr. Harrison's) scheme; and the assistance that gentleman had given him from time to time had been of the greatest possible help to him. Not only that, but he had had the help of his uncle (Mr. A. H. Harris) in the carrying out of the scheme. It was a very interesting fact that eight members of his family were connected with the gas industry—seven of them being at present in charge of gas undertakings in different parts of the country. He thought this was rather unique in the gas profession. It was too early yet to speak as to the new plant and its capabilities; but after a week's work, he was perfectly satisfied that the new works would be beneficial to the town and ratepayers of Padiham. They had a compact little works, and had provided for the future.

Mr. H. E. JACKSON, the Chairman of the Finance Committee of the Council, proposed the health of the Contractors. He considered they had been fortunate in the selection of their Contractors; and as far as he could see, the Council had full value for their money.

Messrs. J. A. DRAKE and J. W. SCOTT responded on behalf of their respective firms. The former observed that the works and plant had been put down on proved lines, which they might be sure would be of great benefit to the ratepayers of Padiham. The latter said it was worthy of note that works which in 1907 were estimated to cost £27,000 had been put down for less than that sum in 1910. They had seen that day, added Mr. Scott, one of the finest little gas-works for a Council like Padiham to have.

Mr. W. WOLSTENHOLME proposed the toast of "The Visitors," coupling with it the names of Mr. T. Duxbury, of Oldham, and Mr. A. H. Harris, of Wigston.

Mr. T. DUXBURY, responding, said that, having had an opportunity of inspecting the old works, he wondered how Mr. Harrison had managed to make gas to supply a town like Padiham with the plant at his disposal there. Only Mr. Harrison knew how it had been done. He was sure the Gas Committee could not have had any idea as to the responsibilities Mr. Harrison must have had, and the difficulties he must have had to contend with, to keep the town supplied with gas, especially in winter time. As to the new works, he could assure the Gas Committee that they were fully justified in putting in inclined retorts. He said this speaking from a long experience of inclined retorts—he was one of the pioneers in the use of them—and taking into account the requirements of a town of the size of Padiham. In his opinion, Mr. Harrison and his Committee had been wise in putting down the plant they had; and he could congratulate them upon having a very fine installation. He was pleased to hear that Mr. Ogden had given Mr. Harrison every assistance in the carrying out of his scheme. They all knew Mr. Ogden as an Engineer with great experience in the use of inclined retorts; and he was sure if it was upon this gentleman's advice they had acted, Padiham certainly would not be very far wrong. He was particularly delighted to see that at the new works they had made provision for the comfort of the stokers in the way of a mess-room, bath-room, and lavatory, because he did feel that the men got through their work much better if the gas engineer and his committee looked after them and made their lot more comfortable. Padiham had now as complete and compact a little gas-works as he had seen anywhere. The works were well arranged, and the plant such as would enable them to manufacture gas at a very low cost; and he was sure the ratepayers would have no cause to regret the expenditure incurred.

Mr. A. H. HARRIS also responded. He said he was pleased to hear that the Padiham Council had confidence in their Gas Engineer, and in the carrying out of the new works had given him the free hand they had done.

This concluded the toast list and the day's proceedings.

Official returns show that the world's consumption of nitrate of soda during the past year amounted to 43,996,966 quintals—an increase of 8,000,000 quintals as compared with the previous twelve months.

EXHIBITION BY THE SUTTON GAS COMPANY.

There has lately been held in the Public Hall, Sutton, a very attractive exhibition of gas appliances under the auspices of the Sutton Gas Company.

Taking the stands in their numerical order, the first consisted of a beautiful cosy model dining-room, designed by Messrs. Godfrey Giles and Co., and installed with the Gas Company's fittings with the view of illustrating the decorative effect produced by using inverted gas-burners. The room attracted much favourable attention; the papering, panelling and medallion work being of fine quality. At the third stand was shown the apparatus employed for testing the illuminating power of gas, provided by Messrs. William Sugg and Co., Limited, who had on view some of their well-known inverted incandescent gas-burners, lamps, and fittings, including their "Regent" and "Windsor" lamps. Their exhibit included an enamelled water-boiler, water-heaters for bath use, and gas cooking and heating appliances of all descriptions. At the next stall, the New Inverted Incandescent Gas-Lamp Company, Limited, showed their "Nico-Radio" and "Nico-Vibra" burners; and close by the Bland Light Syndicate, Limited, had on view their new type of inverted burner.

Some well-designed hand-beaten metal work inverted fittings, finished in oxidized copper, formed an attractive feature of the stand of Messrs. George Hands and Co., who also showed some of their powerful lamps for outside lighting.

Turning to the exhibits of cooking and heating appliances, Messrs. Fletcher, Russell, and Co., Limited, had an excellent display of their latest patterns of gas-fires, fitted with air and gas adjusters and with their patent non-lighting-back burners, all removable for cleaning purposes. The other appliances to be seen included water-heaters and geysers; and a small, but interesting, exhibit was a furnace for melting silversmiths' and jewellers' scrap. The character of their stand will be seen from the photograph. Messrs. John Wright and Co., Limited, and the Davis Gas Stove Company, Limited, presented a fine assortment of gas-fires, cooking-stoves, water and greenhouse heaters, washing-boilers, &c. At the stall of Messrs. Arden Hill and Co., the "Acme" gas-fires attracted much attention on account of their "Thermo" front with a single row of fuel, and having nothing before the fire to prevent perfect radiation. The firm's "Mars" radiators were also among their exhibits. In order to demonstrate the advantages of some of the latest and best appliances, a model kitchen and bath-room were fitted up, in which these were tested; the process proving very interesting to many who attended the exhibition. The fittings for the kitchen were provided by Messrs. Wilsons and Mathiesons, Limited, of Leeds, and Mr. G. S. Webb, of Sutton; and the latter, in conjunction with Messrs. Ewart and Sons and Messrs. Fletcher, Russell, and Co., fitted up the bath-room.

The Gas Company's stand, of which we give a view, was a very interesting feature of the exhibition. They showed models of gas-works plant, including the De Brouwer conveyor, wet and dry gas-meters, lighting, cooking, and heating appliances, apparatus for testing gas, and a collection of the products resulting from its manufacture.

It only remains to say that the whole of the arrangements in connection with the exhibition were carried out by Mr. G. Mead-Robins, the Company's Engineer and Secretary; and that it was opened by the Chairman, Mr. F. Budgen. Each day, Mrs. A. M. Collins gave lectures and demonstrations in cookery, which were well patronized. In the evening, when all the lamps were alight, the effect was very striking. These were of all sizes, ranging from the 500-candle power lamps exhibited by Messrs. Sugg and Co. to the smallest kind needed in the home. The gas-switches used for lighting them were supplied by the Telephos Company and the Pneumatic Distance Lighting Company.

Coke-Handling Plant for the St. Josse-ten-Noode (Brussels) Gas Company.—We learn that the St. Josse-ten-Noode Gas Company have ordered for their works at Jette-St. Pierre, of which a description was given in the "JOURNAL" for the 28th of June last, a large installation of coke-handling plant from the firm of Ad. Bleichert and Co., of London and Leipzig. It consists of a man-trolley for grab or bucket working, which runs over the storage-ground on a travelling loading bridge with a span of about 137 feet, and serves to discharge and rehandle the coke. The electrically driven trolley can also leave the bridge at any point, and pass over a slide switch on to the fixed track, the extremity of which lies over the railway line.

DISCHARGER FOR HORIZONTAL RETORTS.

There has recently been published the specification of a French patent taken out by the firm of Carl Francke for a retort-discharging machine in which the operation is performed by a series of rakes on the discharger, and by a movable plate attached to the end of it. The appliance is shown in the accompanying illustrations, fig. 1 of which is a side view of the general arrangement of the system; fig. 2, a view of the discharger, showing the position of the rakes when in action; fig. 3, a view showing their position when the bar is inserted in the retort; and fig. 4, a plan of the bar showing the construction of the rakes.

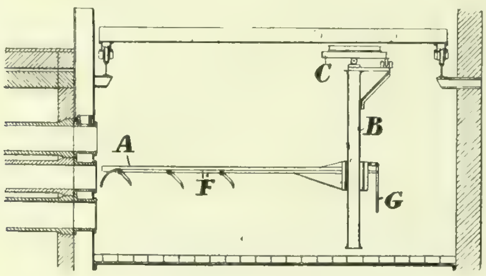


Fig. 1.

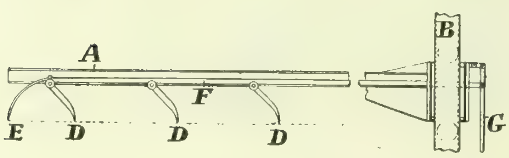


Fig. 2.

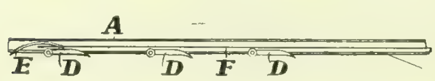


Fig. 3.

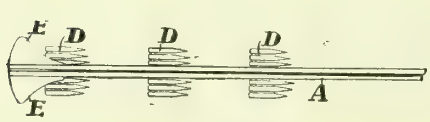


Fig. 4.

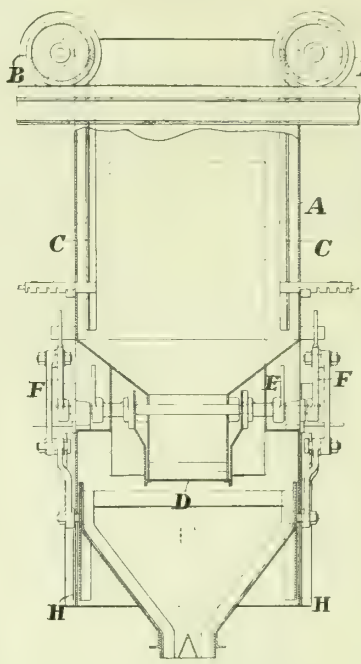
The bar A is attached to a carriage mounted on a column B in such a manner that it can be raised and lowered. The column turns upon a carriage C affixed to a travelling crane, which passes in front of the retorts, so that the discharger can be introduced into any one of them. As will be seen, the discharger is furnished with several rakes D, and at its free end is a plate E. The former are made of several rods or pieces of sheet iron, and are mounted upon the bar in such a manner as to be movable independently of each other. Consequently, during the introduction of the discharger into the retort they move back and slide flat over the glowing coke. When the bar is withdrawn, the rakes penetrate into the mass. The plate E is actuated by a rod F, extending the length of the bar, and worked by hand, either directly or by means of the lever G. In this way, the plate may be raised into the position shown in fig. 3 when the discharger is introduced into the retort, and lowered as shown in fig. 2 before the charge is drawn, so as to draw out the back coke. As the mass is gripped at several points at once, it remains in a block while being withdrawn. The end plate serves solely to bring out the fragments of coke which may have become detached from the mass.

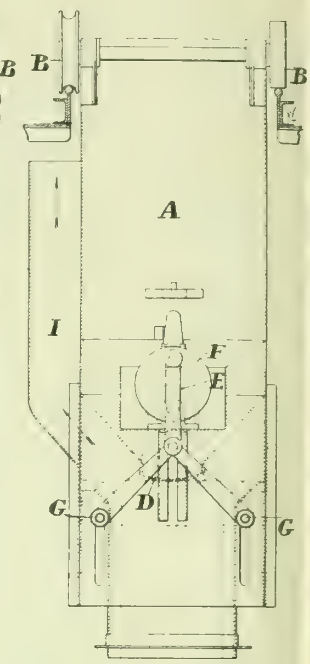
SAFETY CHARGER FOR VERTICAL RETORTS.

The specification has lately been published of a French patent, taken out by the Compagnie Générale de Construction de Fours for an improved machine for charging vertical retorts. It is pointed out in the introduction that the mechanical appliances at present in use do not protect the men operating them from the flames and smoke which issue from the upper part of the retort during the process of charging; the consequence being that they cannot do their work so comfortably or so safely as is desirable.

The arrangement patented by the Company has been devised to remedy this defect. It is shown in the accompanying illustrations; fig. 1 being a front vertical section and fig. 2 a cross sectional view of the machine.

The machine consists of a movable framework carrying a hopper A, suspended by chains B from an overhead railway, which enables it to be brought over any retort in the series. The capacity of the hopper may be regulated as desired by means





of partitions C, furnished with rackwork as shown. The lower outlet of the hopper is closed by an oscillating circular flap D, which may be moved from the outside by means of the handle E. Below the hopper A there is another, suspended as shown in fig. 2, and moving vertically. Motion upwards or downwards is given to it by the winch F. During these movements of the hopper, the crank-pins G (fig. 2), which keep it suspended, slide through channels arranged on the sides of the chest—which is furnished on one side with a chimney I (fig. 2), starting from the space between the two hoppers, and extending vertically to the height of the upper one.

The action of the machine is as follows: After the lid of the retort to be charged has been removed, the carriage is brought over the opening. The stoker then turns one of the winches F so as to let down the bottom hopper far enough to allow of its lower opening fitting into that of the retort. In this position, the workman is able to open the flap D and allow the coal in the hopper A to descend. As long as the bottom of the lower hopper remains in the mouth of the retort, the flames, smoke, and other products of combustion can only escape by way of the hopper, and subsequently by the chimney. The result is that the men operating the charger are protected from the possibility of accidents due to the emanations referred to.

The specification contains an illustrated description of an auxiliary hopper arranged for charging vertical retorts with other material than coal.

Income-Tax Allowance for Depreciation.

Three Irish Gas Companies—viz., the Armagh, Lurgan, and Portadown—having appealed on the question of an allowance from their assessments, under Schedule D, for depreciation of plant, the cases were recently heard by the Special Commissioners sitting at Armagh. The Companies were represented by Mr. W. A. Schultz, Chartered Accountant, of 50, Cannon Street, E.C. In all three cases, depreciation had been allowed for many years, and it had now been disallowed by the Surveyor, acting on the instructions contained in the circular from the Board of Inland Revenue to which reference has already been made in the "Journal." After hearing the arguments, the Commissioners decided that they had no option but to allow depreciation in accordance with the Customs and Inland Revenue Act, 1878 (39 & 40 Vic., cap. 16), and the Finance Act, 1907 (7 Edw. VII., cap. 13). The question of the amount of allowance was deferred, to enable the Companies to bring forward evidence as to the cost and probable life of the various classes of plant and machinery.

Manchester District Institution of Gas Engineers.—The 159th general meeting of the Institution will be held at Stretford next Saturday. According to the programme issued by the Hon. Secretary (Mr. W. Whatmough, of Heywood), the members will meet at the gas-works, which they will inspect under the guidance of the President, Mr. H. Kendrick, the Engineer and Manager of the Stretford Gas Company. After the inspection, a move will be made to Manchester, and luncheon partaken of in the Grand Hotel, where the meeting will be held later in the afternoon. The business will include the presentation of a report respecting the lectures at the Manchester University and the Royal Technical Institute, Salford, a description of the Stretford Gas-Works by the President, and a discussion on his Inaugural Address at the annual meeting in February. The Office-Bearers and Committee for the ensuing year will be elected; and at the close of the business the members will take tea together.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The members of the Western District of the Scottish Junior Gas Association, to the number of more than sixty, paid a visit on Saturday afternoon last to the Atlas Locomotive Works at Springburn, Glasgow, belonging to the North British Locomotive Company, Limited. The visitors were received by Mr. T. Marshall, the Electrical Engineer, by whom and his staff they were shown over the works—the inspection lasting for two-and-a-half hours. There was much to be seen in the line of mechanical engineering, and many fine tools (unfortunately not at work), but there was very little indeed of direct interest to gas engineers. Gas is not used for heating, except for the one purpose of putting the tyres upon locomotive wheels. In this process a ring of bunsen flame is made to play on the tyre, which in a few minutes is sufficiently heated for placing upon the wheel. It is then allowed to cool down, and in cooling shrinks till the tyre grips with a force which no power that has yet been applied has been found capable of dislodging. In the works, there are several gas-engines of 60-H.P. downwards. They are of the single-cylinder type, and were stated to give great satisfaction in working.

At the conclusion of the visit, the President—Mr. J. Frazer, of Provan—proposed a vote of thanks to the Company for their kindness in allowing the members of the Association to visit the works, and to Mr. Marshall and his staff for showing them round. The vote was heartily accorded, and was acknowledged by Mr. Marshall, who expressed the pleasure they had all had in receiving the Association.

PHYSICAL PRODUCTION OF LIGHT.

At a Meeting of the Physics and Chemistry Section of the Franklin Institute early in the year, a paper on "The Physical Production of Light" was read by Mr. E. P. Hyde.

The author considered briefly certain questions in physiological optics which determine the light-giving properties of radiant energy, and then discussed the laws of radiation and the radiating properties of metals. He paid particular attention to various new methods for determining selective radiation; and data obtained by them were presented. The full text of the paper has lately been given in the "Journal of the Institute," from which the following abstract has been prepared; and though somewhat outside the range of subjects ordinarily treated of in our pages, it will be read with interest in view of the statement made at its close. "The limitation to the experimental methods as described thus far is found in the restriction to the study of substances which can be heated in a vacuum by the passage of an electric current. By the use of a surface bolometer to measure directly the radiant energy, rather than depend upon the electrical power supplied, substantially the same general method may be employed in a more general way. It is hoped thus, with some modifications, to extend the measurements to a study of flames, gas-mantles, and other forms of luminous sources."

Beginning with physiological optics, the author considers first artificial and natural causes of light and then visible and total spectra. He points out, at the very commencement, that light is a "sensation." If there were no eye to see, there would be no light, however many sources of radiant energy might be present. Conversely, if the eye were entirely shielded from the action of radiant energy, the sensation of light might still be experienced under certain conditions, as, for instance, by a shock to the eye caused by a violent blow on the back of the head. In contrast to this sensation of light produced artificially is the natural production of the sensation of light when radiant energy within proper limits of wave-length, of sufficient intensity and duration, falls upon the retina. The author explains, however, that his paper will be confined to a consideration of the production of the sensation of light by natural means, and moreover will have to do rather with the physical properties of radiating bodies than with the physiology and psychology of the sensation proper. Before proceeding to a discussion of his main subject, he outlines briefly the qualitative and quantitative effects produced when the retina is subjected to energy of various wave-lengths and intensities. The conclusion arrived at is that if a luminous source is to have the highest efficiency, not only should all the energy delivered to the source be emitted in the form of radiant energy of wave-lengths lying within range of the visible spectrum, but should be emitted in radiation of wave-lengths corresponding to the position of maximum luminosity in the visible spectrum.

The author next discusses the laws of radiation. He explains that there are two kinds of radiation to be distinguished. If a body does not undergo any change in its nature during the process of radiation, it would continue to radiate in the same way if, through the constant addition of heat, its temperature were held constant. This is commonly known as "pure temperature radiation." If, on the other hand, the body undergoes change, it would not continue indefinitely to emit radiation, even though the temperature were held constant. To this kind of radiation has been given the name of "luminescence." The cause of the radiation in this case is not to be found in the temperature of the system, but in some other source of energy. The author's purpose, however, is to deal with pure temperature radiation, since this is by far the commoner and more important form met with in most of our practical sources of light. He first reviews briefly the various properties of the theoretical black body—*i.e.*, a body that will neither reflect nor transmit any of the energy incident on it—and then cites in succession the laws of Kirchhoff, Stefan-Boltzmann, Wien, and Planck in regard thereto.

Having summarized the properties and laws of the theoretical black body, Mr. Hyde proceeds to consider the ways in which the pure temperature radiation from a material substance may differ from the radiation from a black body. A material body may differ from a black body in that it emits at a given temperature one-half, one-third, or one-fourth of the energy of every wave-length of that emitted by the black body at the same temperature. Such a body is sometimes called a "grey" body. But it can differ in another way, as shown in the following extract from the paper:

Not only may the quantity of energy emitted be dffierent from that of a black body, but the quality may also be different. Thus, if a body emitted one-fourth as much red and one-third as much green and one-half as much blue as a black body at the same temperature, it would not correspond to a grey body, but would radiate in a way which we will define as "selective"—that is, it would radiate relatively more energy in one wave-length than in another compared with a black body at the same temperature. This type of selectivity is to be distinguished, at least in degree, from that kind of selective radiation exhibited in the bright line spectra of luminous gases. Now, the question which immediately presents itself on considering the radiation from the various types of incandescent filaments and mantles is this: "Is the high efficiency of the metal filament lamps and the rare earth mantles to be ascribed to a higher working temperature of the luminous substance, or to a selectivity in its radiation such that, at a relatively low temperature, a preponderance of energy is emitted in the visible spectrum as compared with the radiation from a black body at the same temperature?"

The author goes on to explain that this high efficiency of which he has been speaking may be obtained by one of three possible ways or by a combination of them. If the radiation is what has been defined as "luminescence," the radiated energy might lie principally in the visible spectrum. If this were the case, as is probable in the radiation from the firefly, the efficiency would be very high. Secondly, high efficiency might be obtained by an excessively high temperature; and the third way is through selective radiation in favour of short wave-lengths. We are told that if the ratio of the energy emitted in the visible spectrum to that emitted in the infra-red spectrum were twice as great for a given substance at a definite temperature as for a black body at the same temperature, the substance would have double the efficiency of the black body as a luminous radiator, provided the distribution of energy in the visible spectrum of the two were the same. But before discussing the methods available for determining whether the high efficiency of metal filament lamps is due to the high temperature at which the filaments operate or to a pronounced selectivity in the radiation of the filaments, the author points out how low is the efficiency of even the most efficient light sources. He says the ratio of the energy in the visible spectrum to the total energy radiated is probably less than 0·2, even for one of the most efficient lamps known—viz., the flame arc; while for incandescent lamps the percentage of energy available for light is still less. In other words, perhaps less than 5 per cent. of the energy put into a tungsten lamp is radiated in the form of light rays; the other 95 per cent. being radiated in the form of heat rays of wave-lengths too long to excite the human retina.

In order to show, however, how rapidly the photometric efficiency would increase with comparatively small increases in temperature, Mr. Hyde shows in the following table the relation between temperature and candle power of polished platinum at various degrees, as given by Lummer and Kurlbaum.

TABLE I.—*Coefficient of Change of Candle Power with Change of Temperature for Platinum.*

T (Absolute) Deg. C.	X.	T (Absolute) Deg. C.	X.	T (Absolute) Deg. C.	X.
900	30	1200	19	1600	15
1000	25	1400	18	1900	14
1100	21				

It will thus be seen that at a temperature of 1900° C. (absolute), or a little below the approximate working temperature of a 3·1-watt carbon lamp, the photometric intensity increases approximately fourteen times as rapidly as the temperature. Thus, a change in temperature of 1 per cent. would cause an increase in candle power of 14 or 15 per cent. Since for 1 per cent. a change of about 5 per cent. in energy would be required, the increase in efficiency corresponding to an increase of 1 per cent. in temperature would be about 9 or 10 per cent. at 1900° C. At lower temperatures, the gain in efficiency would be greater, and at higher temperatures less, than that given for 1900° C.

The author next passes on to consider the different methods of studying selectivity. He says that about two years ago, while he was at the Bureau of Standards, he developed two photometric methods for giving a positive qualitative criterion as to the relative selectivity of two radiating substances, and applied these methods to a preliminary study of the various incandescent electric lamps then in use. Owing to the enforced interruption of the work consequent upon leaving the Bureau, the investigation

was not completed. Most of the essential features of the methods and the preliminary results obtained were, however, described before the American Physical Society, and later presented before the Illuminating Engineering Society. To the best of his knowledge, the application of these methods to the various carbon, tantalum, tungsten, and osmium lamps gave the first definite data as to the relative selectivity of these filaments. In the paper under notice, these photometric methods are discussed in more detail than heretofore, and, in addition, further experimental data are presented, particularly with reference to the black body and platinum as studied by the same methods as those used with the other radiating substances. In both methods, the starting-point consisted in bringing the two filaments to the same distribution of energy in the visible spectrum by means of spectro-photometric measurements. The author desired to compare the radiating properties of the filaments at different temperatures; but in order to avoid at the beginning of the investigation any direct-temperature measurements, he selected as his arbitrary temperatures those which a particular carbon filament had at three definite voltages over a considerable range. Thus, he compared the radiating properties of the various filaments when they were at a colour match with the standard lamp at 75 volts, when they matched it at 100 volts, and when they matched it at 125 volts. The standard lamp used was a treated carbon filament of about 3·5 watts per candle at 110 volts. The method, therefore, was to determine for each lamp the voltage at which it matched in colour the standard lamp at 75 volts, 100 volts, and 125 volts successively; then burning these lamps at the determined voltages to measure the coefficient of change in candle power corresponding to 1 per cent. change in watts, and to measure the lumens per watt for each lamp. The results are given in Tables II. to IV.; and they include measurements on lamps of untreated, flashed, and metallized carbon, tantalum, tungsten, osmium, platinum, and "helion" filaments, and also on the electrically heated black body. The author makes the following remarks on the tables.

Table II.—*Standard Lamp at 75 Volts (Black Body at 1689° C. Absolute).*

Substances Investigated.	k* (Absolute Values).	k (Relative Values).	Lumens per Watt (Absolute Values).	Lumens per Watt (Relative Values).
Black body { Observed	3·50	1·00	..	..
Black body { Computed	3·60	1·04	..	..
Untreated carbon	3·45	1·00	0·39	1·00
"Helion" lamp	3·45	1·00	0·38	0·95
Flashed carbon	3·35	0·97	0·41	1·05
Metallized carbon	3·40	0·98	0·41	1·05
Platinum	3·10	0·89	..	..
Tantalum	3·00	0·86	0·50	1·30
Tungsten	2·85	0·82	0·59	1·50
Osmium	2·85	0·82	0·72	1·85

* k is in each table the percentage change in candle power corresponding to a change of 1 per cent. in watts. The relative values are in terms of $k = 1$ for untreated carbon.

Table III.—*Standard Lamp at 100 Volts (Black Body at 1886° C. Absolute).*

Substances Investigated.	k* (Absolute Values).	k (Relative Values).	Lumens per Watt (Absolute Values).	Lumens per Watt (Relative Values).
Black body { Observed	..	..	..	..
Black body { Computed	3·25	1·06	..	..
Untreated carbon	3·05	1·00	1·50	1·00
"Helion" lamp	3·00	0·99	1·50	1·00
Flashed carbon	3·00	0·98	1·60	1·10
Metallized carbon	3·00	0·99	1·55	1·05
Platinum	2·75	0·90	..	..
Tantalum	2·60	0·86	1·70	1·15
Tungsten	2·55	0·84	2·00	1·35
Osmium	2·50	0·83	2·35	1·55

Table IV.—*Standard Lamp at 125 Volts (Black Body at 2058° C. Absolute).*

Substances Investigated.	k* (Absolute Values).	k (Relative Values).	Lumens per Watt (Absolute Values).	Lumens per Watt (Relative Values).
Black body { Observed	..	..	..	..
Black body { Computed	3·05	1·11	..	..
Untreated carbon	2·75	1·00	3·5	1·00
"Helion" lamp	2·70	0·98	3·6	1·00
Flashed carbon	2·65	0·98	3·7	1·05
Metallized carbon	2·75	1·00	3·7	1·05
Platinum	..	..	..	..
Tantalum	2·35	0·86	3·9	1·10
Tungsten	2·40	0·88	4·4	1·25
Osmium	2·40	0·87	4·9	1·40

In the first column of Table II., which contains the results obtained at a colour match with the standard lamp at 75 volts, are given the various substances investigated; the second column contains the ratios (k) of the percentage change in candle power to the percentage change in the total energy radiated (taken as equivalent to the watts supplied); and the third column, the relative values of k expressed in terms of the value of k for untreated carbon as unity. By expressing the results in this way, the relative differences among the different types of lamps are more readily seen. In the fourth column are given the lumens per watt, on the basis of the international candle; and in the fifth column, the same quantities expressed in terms of the value for the untreated carbon lamp taken as unity. Tables III. and IV. contain similar data at the higher temperatures corresponding to a colour match with the standard carbon lamp at 100 volts and 125 volts respectively.

The results are quite interesting. Thus it will be noticed (*vide* Table II.) that when these various substances have the same distribution of energy in the visible spectrum, the lumens per watt range from 0·39 to 0·72 in absolute value, or from 1 to 1·85 relatively. If there were no relative selectivity, the lumens per watt would be the same for every type. There is marked evidence, therefore, that there is considerable selectivity among the different types of filaments; and it is interesting to note the order in which the filaments arrange themselves. A higher value of lumens per watt—as, for example, the value 1·85 for the osmium lamp as compared with 1 for the untreated carbon filament—indicates that when the osmium filament has the same distribution of energy in the visible spectrum as the untreated carbon filament, the spectral energy curve of the osmium filament drops off considerably in the infra-red as compared with the energy curve of the untreated carbon. In other words, the osmium will radiate selectively in favour of shorter wave-lengths—that is, in favour of the visible spectrum—and is therefore a more efficient luminous radiator than an untreated carbon filament. It would appear from the table that the "Helion" lamp is, if anything, less selective in favour of shorter wave-lengths than the untreated carbon. The small difference shown, however, between 1 and 0·97, may be accounted for by experimental error; so that we might say that the "Helion" filament behaves much like the untreated carbon filament. It should be explained, however, that the "Helion" filaments which were used in this investigation were quite old, and it is barely possible that the deposit of silicon had entirely disappeared, and that we were simply studying the properties of the base carbon, which would readily explain the results obtained. The treated carbon and the gem filaments are more selective than the untreated carbon; the tantalum considerably more selective; the tungsten still more so; and, finally, the osmium most selective of all.

The results obtained at the higher temperatures (Tables III. and IV.) are quite similar to those found at the lower point. By both methods the filaments arrange themselves in the same order as was found at 75 volts; but the numerical differences are in some cases considerably smaller. Thus at 75 volts the number of lumens per watt of the osmium lamp is almost twice that of the untreated carbon lamp; whereas at 125 volts it is less than $1\frac{1}{2}$ times that of the untreated carbon lamp. In interpreting the results given in the tables, it may be stated that there is relative selectivity among the filaments beyond any doubt; but to what extent the high efficiencies of the metallic lamps are to be ascribed to selectivity, and to what extent to the high temperatures at which the filaments operate, is not by any means immediately apparent from the data given. In order to arrive at any definite conclusion in regard to the amount of the selectivity, one must know under what conditions of operation the filaments are at the same true temperature; and at present there are no ready means available for making this determination.

It will be noted, from the data given in Table II., that when the untreated carbon and osmium filaments are at the same colour the lumens per watt of the osmium filament are 1·85 times those of the untreated carbon filament. This means that, relatively, more of the energy emitted by the osmium filament lies in the visible spectrum than with the untreated carbon filament, and that therefore the osmium filament is most probably radiating selectively in favour of the shorter wave-lengths. The numerical value of the effect depends, however, on the relative temperatures of the two filaments. If they are at the same temperature, the osmium is almost twice as efficient as the carbon lamp when they are both at the same low temperature corresponding to a colour match with the standard carbon lamp when operated at 75 volts. If, on the other hand, the temperature of the osmium filament is higher than that of the carbon filament, then one cannot tell whether the increased efficiency of the osmium lamp is due to its selective emission, or to the slightly higher temperature at which it is operating. Our knowledge of platinum radiation would lead one to expect, however, that the temperature difference is in the opposite direction. If we imagine a radiating body which tends to exaggerate in its emission the energy of the shorter wave-lengths—that is, a body which emits a larger proportion of its total radiant energy in the visible spectrum as compared with a black body at the same true temperature—it is probable this property of selective emission would obtain in the visible spectrum also; so that the emission in the blue would be relatively larger than the emission in the red as compared with the emission from the black body at the same temperature. If this assumption, which would seem to be true for platinum, is true for tantalum, tungsten, and osmium, then the values recorded in the tables give, in every case, the lower limit of the effect of the selectivity on the efficiency of the filaments.

It is possible that the difference between the working temperatures when the filaments are at the same colour becomes more pronounced as the absolute temperature is increased, and that

this may account for the smaller differences in lumens per watt at the higher voltages as compared with the results obtained at 75 volts. At all events, one can see from Tables III. and IV. that if the assumption contained in the previous paragraph is true, an osmium lamp at the same true temperature as that at which an anchored oval treated carbon filament operates when consuming about 3·1 watts per mean horizontal candle—colour match with a standard carbon lamp at about 115 or 120 volts—would show an efficiency higher than that of the carbon lamp by more than 35 or 40 per cent. One cannot estimate how much higher the efficiency would be without a knowledge of the temperature difference which exists between the osmium and treated carbon filaments when at a colour match.

From the data given in the tables for tantalum and tungsten, it is evident that for these also, as well as for osmium, the selectivity would seem to play an important part in causing the high efficiency, particularly in the case of tungsten. It cannot be emphasized too greatly, however, that all the deductions in regard to the effect of selectivity in partly explaining the high efficiency of the metallic filament lamps are based upon the single assumption that if a black body and a metal are at such temperatures as to show the same distribution of energy in the visible spectrum (colour match), the temperature of the black body is at least as high as, or higher than, the temperature of the metal. This is true for platinum—the only metal that has been investigated; but the writer cannot say positively that it is true for other metals.

SUMMARY.

The author closes his paper with the following *résumé* of the new photometric methods and results.

In summarizing the two photometric methods which have been discussed, there are two features to be emphasized: (1) The view-point which constituted the basis of the measurements; and (2) the extreme simplicity of the methods employed. The view-point consisted in comparing the radiating properties of various substances when brought to the same distribution of energy in the visible region of the spectrum. The method employed to secure this condition consisted merely in bringing the two sources to a match in colour by the use of an ordinary Lummer-Brodhun contrast photometer. The two methods used in the study of the radiating properties under this condition consisted merely in determining the lumens per watt, and the ratio of the percentage change in watts. Except, therefore, for the work on the electrically heated black body as a reference-point, and for the check measurements made with the spectro-photometer and the infra-red spectrometer, the investigation could be carried out with an ordinary photometer and adequate ammeters and volt-meters.

The view-point lying at the basis of the measurements is at the same time quite old and yet distinctly new. One of the oldest methods of pyrometry depended upon the colour of the light as determined by eye observations, without reference, however, to any standard. But this old method could lay claim neither to any high degree of accuracy, nor to any theoretical application to the study of the radiating properties of matter. It is true that the black body temperature, as determined in the ordinary way with the customary optical pyrometers, is lower than the true temperature of the body; but the equation of absolute emissivity does not enter when the method of comparison is solely by colour match. In fact, the true temperature of the selective body is quite probably lower rather than higher than the temperature of the black body when at a colour match; in this way affording an upper limit of temperature, just as the ordinary methods of optical pyrometry afford a lower limit of the true temperature.

The results obtained by the application of the photometric methods show very interesting facts. All the metals studied are selective, and, as would seem probable from the results, selective in the same way—*i.e.*, in favour of the shorter wave-lengths. All three of the metals, tantalum, tungsten, and osmium, appear to be more selective than platinum—the osmium deviating farthest. On the basis of one assumption, which, though probable, is not necessarily true, the conclusion results that, when at the same true temperature, osmium is at least 40 or 50 per cent. more efficient as a luminous radiator than untreated carbon.

Determination of Sulphur in Coal Gas.—This subject was dealt with by Mr. H. J. M. Creighton before the Nova Scotian Institute of Science. The paper has appeared in the "Transactions;" and the following abstract was recently given in the "Journal of the Society of Chemical Industry." In the determination of sulphur in coal gas by burning a known volume of the gas in a special burner surrounded with lumps of ammonium carbonate, and passing the combustion gases into a glass tower filled with glass balls, the alkaline liquid collected in a beaker below the tower was occasionally observed to contain a precipitate of aluminium hydroxide. This was derived from the glass balls, some of which were greatly corroded. The corrosion could not have been due to the ammonium carbonate, as the white precipitate was observed only in the case of gas made from coals high in sulphur (largely in organic combination). Experiments as to the effect of aluminium compounds on the determination of the sulphur as barium sulphate showed that in a solution containing 0·5 gramme of ammonium sulphate and 0·025 gramme of aluminium, there would be an error of about 1 per cent. in the sulphur determination. To avoid this error, it is necessary to use glass balls free from aluminium when determining sulphur in gas by the method described.

MEASURING AIR OR GAS SUPPLY TO ENGINES.

In the "JOURNAL" for the 13th ult. (p. 721), we gave the official abstract of a paper read by Mr. W. E. DALBY, M.A., M.Inst.C.E., before the Engineering Section of the British Association, "On the Direct Measurement of the Air Supply to a Gas-Engine by Means of an Orifice, and the Calibration of the Orifice." The following is the full text of the communication.

INTRODUCTION.

It is always desirable when experimenting with a gas-engine to know the proportion of air to gas in the charge. The measurement is usually made by an indirect method. The exhaust gas from the engine is analyzed; and this, together with an analysis of the gas supplied, furnishes data from which the air supply may be computed. In general, the method is not very accurate, and probably the errors may amount to 10 per cent. even in engines running with no hit-and-miss governor.

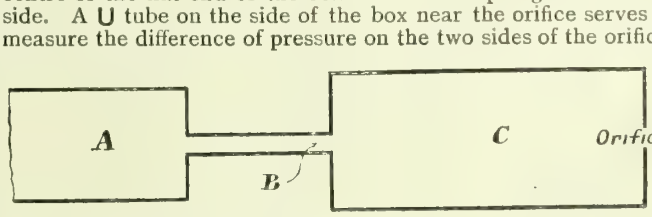
At the Ashton trials of the Committee of the Institution of Civil Engineers,* following a suggestion of Professor Unwin, an endeavour was made to measure the air supply directly by means of an anemometer placed opposite an orifice in an air-box; the box forming an enlarged continuation of the air suction-pipe of the engine. The anemometer readings were subsequently calibrated by the device of driving the engine as a pump, and deducing from the indicator diagrams of the pumping the weight of air drawn through the orifice corresponding to a definite reading on the anemometer.

Professor Ashcroft, in a paper contributed to the Institution of Civil Engineers, on "Experiments on a Method of Measuring the Air or Gas Supply to Engines and Furnaces," described a method of measuring the air supply to an oil-engine forming part of the equipment of the Engineering Laboratory of the Central Technical College. An air-box was placed on a continuation of the air suction-pipe provided with an orifice at one end, a part of one side of the box being closed with an india-rubber sheet to act as a pressure-equalizer at the moment the engine drew in a charge. The peculiarity of the method was that the orifice was almost as large in diameter as the suction-pipe of the engine; consequently the difference of pressure on the two sides of the orifice was extremely small. This small pressure was measured by a specially designed and sensitive indicator, and the quantity of air flowing through the orifice was inferred from the small difference of pressure measured by the instrument. The orifice was calibrated, as in the Ashton trials—viz., by running the oil-engine as a pump, and from the corresponding indicator diagram deducing the weight of air flowing through the orifice for a difference of pressure measured by the sensitive indicator placed on the air-box.

In the method about to be described, an orifice is used, but it is made small enough, in relation to the quantity of air flowing, to require a difference of pressure on the two sides of the orifice large enough to be conveniently observed by means of a U-tube. The special feature of the experiments is the method of calibrating the orifice. There are difficulties in deducing the weight of air from a P V diagram alone, but no difficulty if the temperature can be measured directly at various points on the diagram, where the pressure and volume are accurately known. The novelty of the method consists in the direct measurement of the temperature of the air at certain points in the cycle when the engine is used as a pump.

GENERAL DESCRIPTION OF THE APPARATUS.

The gas-engine with which the apparatus is connected is one of 10-H.P., made by Crossley. The cylinder is 7 inches diameter and 14-inch stroke. The air suction-pipe is prolonged, and is finally enlarged into a box 2·66 square feet cross-sectional area. A sharp-edged orifice bored out of a brass plate is placed in the centre of the flat end of the box with the sharp edge on the outside. A U tube on the side of the box near the orifice serves to measure the difference of pressure on the two sides of the orifice.



A. Engine cylinder, 395 cubic feet, including clearance. B. Connecting pipe and passages, 28 cubic feet. C. Air-box, 19·7 cubic feet capacity; cross sectional area, 2·66 square feet. Total capacity between orifice and admission valve, 47·7 cubic feet.

Fig. 1.

A feature in the experiment is the use of oil in the U tube. It damps out oscillations, and does not evaporate, and enables a steady reading to be obtained. The accompanying diagrammatic sketch (fig. 1) shows the arrangement. The volume of the apparatus between the admission valve on the engine and the orifice in the box is 47·7 cubic feet. A is the engine cylinder, the capacity of which is 0·395 cubic foot, including clearance; B is the connecting-pipe and passages, 28 cubic feet; and C is the air-box,

* See "JOURNAL," Vol. XCV., p. 635.

of 19·7 cubic feet capacity (or a cross-sectional area of 2·66 square feet).

Method of Calibration.

The engine is coupled direct to a dynamo, which, for the purpose of these experiments, is used as a motor to drive the engine as a pump. The air drawn in passes through the Otto cycle, with the difference that there is no explosion; so that the expansion curve corresponds very nearly, but is slightly below, the compression curve. We are not concerned, however, with the greater part of the diagram. All that is necessary is to measure the pressure, volume, and temperature directly at two points—viz., at the end of the exhaust stroke, and at a point in the compression stroke just after the admission-valve is closed. From the first measurement the air in the clearance space is found, and from the second measurement the total air in the cylinder is computed. The difference is the air drawn in through the orifice per cycle, providing the valves of the engines are suitably set.

Let P V T be the absolute pressure, the volume, and the absolute temperature measured at the end of the exhaust stroke. Then

$$P\ V = 0{\cdot}665\ w\ T,$$

in which P is the pounds per square inch absolute,
V is the volume in cubic feet,
T is the absolute temperature in degrees C.,
w is the weight of air in pounds.

Then the weight of air shut in the clearance space is

$$w = \frac{P\ V}{0{\cdot}665\ T}\ \text{lb.}$$

Similarly, if $P_1\ V_1\ T_1$ are the corresponding measurements at a point just after the admission-valve is closed,

$$w_1 = \frac{P_1\ V_1}{0{\cdot}665\ T_1}\ \text{lb.}$$

Hence the air drawn into the cylinder per cycle is

$$(w_1 - w)\ \text{lb.} = \frac{1}{0{\cdot}665}\left\{\frac{P_1\ V_1}{T_1} - \frac{P\ V}{T}\right\}$$

If the engine-shaft makes N revolutions per minute, and the air passing through the orifice per second is W lb.,

$$W = \frac{N}{120}(w_1 - w) \quad (1)$$

Again, along a stream-line passing through the orifice

$$\frac{v^2}{2g} + \frac{p}{D}\ \text{is sensibly constant,}$$

where
v = the velocity in feet per second,
p = the difference of pressure on the two sides of the orifice,
D = the density of the air.

The discharge through the orifice in pounds per second is given by

$$W = a\ D\ A\ v = a\ D\ A\sqrt{\frac{2gp}{D}}$$

The coefficient of discharge a is introduced to allow for the variation of the component velocity over the area of the orifice, and for frictional losses.

The difference of pressure p is measured by a difference of level h in a U-tube containing liquid of a specific gravity s. Therefore p may be replaced by

$$p = s \times 62{\cdot}5 \times h.$$

Putting $s = 0{\cdot}9$, the expression reduces to

$$W\ \text{lbs. per second} = 0{\cdot}418\ a\ A\sqrt{hD} \quad (2)$$

The area A of the orifice is in square inches; the height h is in feet; the density of the air D is in pounds per cubic foot.

The coefficient of discharge a can be computed from

$$a = \frac{W}{0{\cdot}418\ A\sqrt{hD}}$$

W is found from (1) by means of the direct observations taken of pressure, volume, and temperature. The height h is observed directly on the U-tube at the side of the box, and D is calculated from P ÷ 0·665 T, where T and P are respectively the air temperature at the entry to the orifice in absolute degrees Centigrade, and P the barometric pressure in pounds per square inch.

Measurement of the Pressure and Volume.

Diagrams were taken with an optical indicator of the author's design, stopped-down so that the lower part of the diagram is obtained to an enlarged pressure scale. A feature of the indicator is that each diagram is calibrated for pressure by a dead-weight apparatus *in situ*, immediately after the diagram is taken, and without stopping the engine. The taking of the diagram and its calibration occupy less than a minute.

Three diagrams are shown in figs. 2, 3, and 4, corresponding to the trials on an orifice ⅝ inch nominal diameter at the three speeds 52, 140, and 240 revolutions per minute. Each diagram was calibrated *in situ* for intervals of pressure of 5 lbs. per square inch. All the pressure lines shown on the diagrams were put on optically by means of the apparatus mentioned at the time the diagram was taken. In each diagram the stop comes into action when the pressure has reached about 15 lbs. per square inch.

The vertical lines correspond to crank positions of 200° and 220° reckoned from the dead-point most remote from the crank-shaft, or of 20° and 40° reckoned from the nearest dead-point. They are drawn optically at the time of taking the diagram. The diagrams shown in the figures are just as they left the indicator; nothing having been added to them by hand except the lettering.

Measurement of the Temperature.

The engine is fitted with the apparatus described in a paper on "The Measurement of Temperatures in the Cylinder of a Gas-Engine," communicated by Messrs. Callendar and Dalby to the Royal Society in 1907,* by means of which a direct observation of the temperature can be made at any assigned crank-angle with a Callendar platinum thermometer. Briefly, the platinum thermometer is introduced into the cylinder through the stem of the admission-valve, which is bored out to receive it. A percussion contact of novel design is placed on the cam-shaft, so that the thermometer circuit is momentarily closed at any crank-angle desired. The duration of contact was in the present case limited to 10° of crank-angle. The temperature measured is therefore the average temperature over the interval that corresponds to 10° of crank-angle; the crank-angle corresponding to the middle of this interval being the particular angle held to correspond with the temperature observed. The temperature is measured at 0°, 200°, and 220°, reckoning from the dead-centre remote from the crank-shaft. The temperature used for computing W is that measured at 200°, because there the actual temperature is not greatly different from the incoming air in which the thermometer is immersed during the suction stroke, and the rate of change of the temperature is small, and also—what is equally as important—the gas temperature is approximately the same as the wall temperature.

Valve-Setting.

To obtain an accurate calibration of the orifice, it is obvious that all the air entering the cylinder when the engine is driven as a pump must pass through the orifice. With the ordinary setting of the valves, and at slow speeds especially, a small amount of air is likely to be drawn in through the exhaust-pipe, since the exhaust-valve is usually set so that it does not close till a certain fraction of the suction stroke has been performed. Also the admission-valve is set ordinarily so as to open before the exhaust stroke has finished. There is therefore, with the normal valve-setting, a period during which the admission-valve and the exhaust-valve are open together, and the piston passes through the dead-point remote from the crank-shaft during this period. In order to secure that there shall be a definite weight of air in the clearance space when the piston passes the dead-point, and also that all the air coming into the cylinder comes through the admission valve, and therefore through the orifice, the admission valve was reset so that it closed when the crank was 5° over the dead-centre, and the exhaust-valve was reset so that it closed 5° before the dead-centre. It follows from this that the small amount of air in the cylinder when the exhaust-valve is closed is slightly compressed in the clearance space, and that it expands again until the admission valve is open. This small compression and expansion is shown on all the diagrams at the point A. The point A therefore corresponds to a definite weight of air w, which is calculated from the P V and T observed at the point.

The setting of the admission-valve carries with it the consequence that it closes when the crank is about 25° from the end of the suction stroke. Consequently a small expansion of the air in the cylinder takes place, until the piston arrives at the dead-point, on the turn of which compression begins. This expansion towards the end of the suction line can be seen on all the diagrams. The setting therefore ensures that the measurement of the pressure, volume, and temperature takes place well after the closing of the admission-valve, and therefore corresponds to a definite weight of air in the cylinder.

Experiments on an Orifice ⅝-Inch Nominal Diameter.

The indicator cards from which the measurements of pressure were made are shown in figs. 2, 3, and 4; and particulars of the measurements are given in Table I. The measurement is made direct from the negative by means of a Zeiss glass rule. The pressures given in the table are those corresponding to the 0° and 200° crank-angle position. Full particulars are given in Table I. as to the way in which W is computed, and in Table II. of the

* See "Journal," Vol. CI., p. 34.

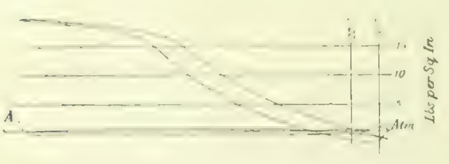


Fig. 2—52 Revolutions per Minute.

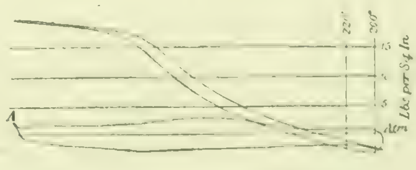


Fig. 3—140 Revolutions per Minute.

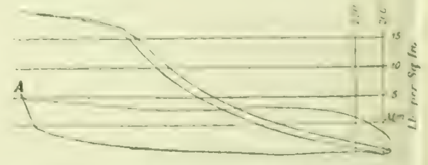


Fig. 4—240 Revolutions per Minute.

calculations for the coefficient α. It will be noticed from the latter table that α remains practically constant for the three speeds at nearly 0·6.

TABLE I.—*Details of the Observations from which* W *of Equation* 1 *is Calculated.*

N, Speed. Revolutions per Minute.	Crank Angle. Degrees.	Pressure Measured from Diagram. Pounds per Square Inch.	Calculated Volume. Cubic Feet.	Temperature Measured Directly Deg. C. Absolute.	$\frac{PV}{0.665\,T}$ Weight of Air in Pounds.	$\{w_1 - w\}$ Weight of Air Drawn into Cylinder through Orifice per Cycle.	W of Equation 1. $\frac{N}{120}\{w_1 - w\}$ lb. of Air Flowing through Orifice per Second.
52	0	15·40	·0824	287·8	·00663 = w		
	200	13·72	·3872	293·8	·02719 = w_1	0·2056	·00891
140	0	16·75	·0824	306·9	·00676 = w		
	200	11·97	·3872	294·6	·02366 = w_1	·01690	·01972
240	0	20·23	·0824	329·2	·00762 = w		
	200	10·27	·3872	296·4	·0202 = w_1	·01258	·02516

TABLE II.—*Details of the Observation from which* α *is Found.*

Speed. Revolutions per Minute.	Barometric Pressure. Pounds per Square Inch.	Temperature of Laboratory Measured near Entry to Orifice. Deg. C. Absolute.	D, Density of Air. Pounds per Cubic Foot.	h, Head in Feet.	A, Area of Orifice. Square Inches.	α
52	14·67	292·5	·0755	0·180	·306	·597
140	14·67	292·5	·0755	0·885	·306	·596
240	14·67	293·5	·0752	1·505	·306	·584

TABLE III.—*Summary of Experiments on Orifices* 1-*inch and* ⅝-*inch Nominal Diameters.*

Actual Diameter of Orifice in Inches.	A, Area in Square Inches.	N, Speed. Revolutions per Minute.	h, Head in Feet.	Coefficient α.
1·014	0·807	132	0·160	0·590
1·014	0·807	200	0·230	0·620
1·014	0·807	240	0·285	0·610
0·624	0·306	52	0·180	0·597
0·624	0·306	140	0·885	0·596
0·624	0·306	240	1·505	0·584

CONCLUSION.

It is remarkable that the coefficient remains practically constant over a wide range of speed and over a range of head from 0·18 to 1·5. It would seem, therefore, that if an orifice is so chosen that at normal speed the head in the U-tube is about 1 foot, the air supply can be calculated without serious error by using a coefficient of which the value is 0·6. The weight of air (W) in pounds per second would then be given by the expression

$$W = \tfrac{1}{4} A \sqrt{s h D},$$

where A is the area of the orifice in square inches,
s is the specific gravity of the liquid in the U-tube,
h is the difference of level in the U-tube measured in feet,
D is the density of air entering the orifice in pounds per cubic foot.

D is to be calculated from P ÷ 0·665 T, where P is the barometric pressure in pounds per square inch, and T is the absolute temperature in degrees C. of the air at the entry to the orifice.

From this it would appear that the rate at which gas is supplied to the engine could be measured in the same way with probably greater accuracy than is possible with the ordinary wet meter. The chamber, relatively large, could be arranged on the side of the gas-bag remote from the engine, divided into two parts by a diaphragm, in the centre of which is an orifice of such diameter that the difference of head between the two sides of the diaphragm would correspond to about 1 foot of water. I may say that I am making one of these, and will give some particulars of the results in a future communication. With the large difference of level in the U-tubes adopted, very small variations in the supply can be detected; and the difference of level may be almost used for a speed indicator.

Finally, I think that this method may be used in any case in which the air supply is to be measured directly, since the above experiments show that, with proper precautions, the coefficient α may be regarded as sensibly constant over a wide range of speed and head.

Copper sulphate to prevent algæ was used in four of the reservoirs at the Albany (U.S.A.) Water-Works last year, before the commencement of warm weather. Two of the basins were treated four times during the season, another three times, and another twice. The maximum amount of sulphate used during any one application was 0·32 part per million, and the minimum quantity 0·1 part per million. The early start made with this treatment and the constant watching for the development of aquatic growths are the reasons given by Mr. H. J. Deutschbein, of the Bureau of Water, to account for the fact that no complaints regarding algæ were received during the year. The reservoirs are supplied with filtered water from the Hudson River.

REGISTER OF PATENTS.

APPLICATIONS FOR LETTERS PATENT.

23,348.—HART, J. A., "Compression of gas." Oct. 8.

23,355.—PINCHING, E. L., and WALTON, W. H., "Illumination devices." Oct. 8.

23,369.—SCHWABACHER, H., "Lamplighters' torches." Oct. 8.

23,376.—MOORE, W. G., "Treatment of carbonaceous materials and their bye-products. Oct. 10.

23 406.—BOURNE, J. J., "Pneumatic operator for gas-taps." Oct. 10.

23,448.—GUNNING, J., "Lighting and extinguishing gas-burners at predetermined hours." A communication from Couaillet Frères. Oct. 10.

23,476.—CANNON, D. W., "Incandescent burners." Oct. 10.

23,488.—SOUTHEY, A. W., "Generation of gas." Oct. 11.

23,492.—BURSTALL, F. W., "Washing and scrubbing gases." Oct. 11.

23,495.—M'FARLANE, A. & A., "Magnifier of gaslight." Oct. 11.

23,521.—MACLAGGAN, R., "Galleries for globes." Oct. 11.

23,549.—HUTCHINS, T. W. S., "Gas-producers." Oct. 11.

23,550.—AARTS, J. G., "Retorts." Oct. 11.

23,559.—FRÄMBS, H., and BENDER AND FRÄMBS, G.M.B.H., "Gas-producers." Oct. 11.

23,589.—HALL, E. J., and STEVENSON, H., AND SONS, LTD., "Boxes for inverted mantles." Oct. 12.

23 598.—HENNESSY, J. J., and SPENCE, R., "Air-gas apparatus." Oct. 12.

23,666-7 8.—FLAVEL, P. W., "Atmospheric burners." Oct. 12.

23,696.—RUSSELL, W. J., "Gas-stoves." Oct. 12.

23,697.—HASSALL, W., and LINES, A., "Inverted burners." Oct. 13.

23,705.—YARROW AND CO. (BOLTON), LTD., and YARROW, M., "Joints of pipes and mains." Oct. 13.

23,719.—DETMOLD, E., "Inverted mantle." Oct. 13.

23,722.—DEUTSCHE GASGLÜHLICHT AKT.-GES. (AUERGES.), "Incandescent burner." Oct. 13.

23,779.—CHALLIS, J., and STEPHENS, K., "Incandescent burners." Oct. 14.

23,794.—PEARSON, J. S., and WELDING, T. C., "Generating air-gas." Oct. 14.

23,822.—GIORGI, A., "Gas-regulators." Oct. 14.

23,856.—ACETYLENE ILLUMINATING COMPANY, LTD., "Acetylene containers." A communication from Acetylène Dissous et Applications de l'Acetylène." Oct. 14.

23 916.—YATES, H. J., "Thermostats." Oct. 15.

23,926.—DEUTSCHE GASGLÜHLICHT AKT.-GES. (AUERGES.), "Incandescent burners." Oct. 15.

23,929.—ANDERSON, D., "Gas-lamps." Oct. 15.

23,930.—ANDERSON, D., "Gas-controllers." Oct. 15.

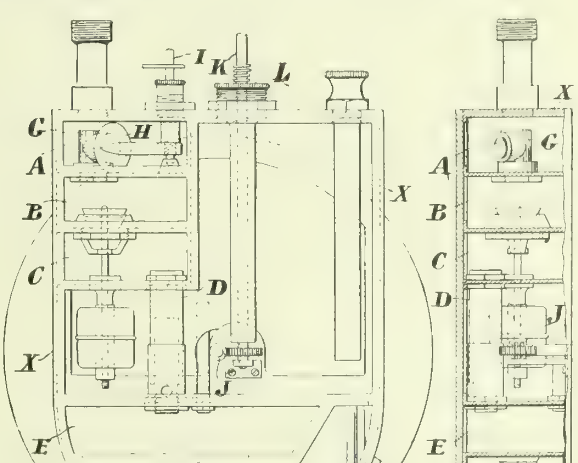
23,948.—STOLTE, A., "Gas-washer." Oct. 15.

Coin-Freed Wet Gas-Meters.

SUTHERLAND, J. C., of Erdington.

No. 22,050; Sept. 28, 1909.

A feature of the present invention is to form all the necessary small chambers integral with the larger chamber casting, so as to be accessible by the simple removal of the front plate. Further, separate chambers are provided for the automatic valve and the float valve; these chambers having beneath them an additional chamber forming a gas-way from the float valve chamber to the overflow chamber.



Sutherland's Coin-Freed Wet Meter.

In the elevation with front plate removed and side elevation with part broken away to show the various chambers in section, the automatic valve chamber A is immediately over the float valve chamber B, below which is an additional chamber C with outlet tube D leading to a compartment E below the shelf, and which compartment communicates with the measuring drum M and with the waste-water box F, which is fitted with a transverse vertical partition to prevent unregistered gas being withdrawn from the syphon overflow.

The chambers A, B, C are cast in one piece with the chamber casting X, and so formed that when the front plate is removed the chambers

are completely accessible, as are also the compartment E and the waste-water box F.

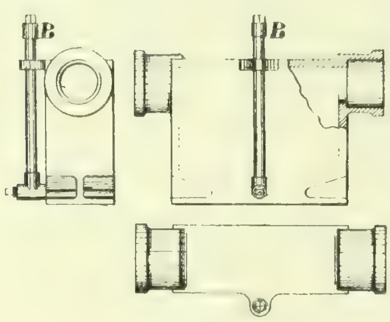
Screwed into the floor of the chamber A is an elbow pipe G, in the horizontal branch of which is the seating for the automatic cut-off valve H. This valve is operated by the vertical shaft I extending upwards through a stuffing box in the casting, and working in conjunction with the compound screw (not shown) usual in prepayment attachments to set the valve for the consumption of a definite quantity of gas on the insertion of a given coin in the prepayment mechanism. On rotation of the measuring drum M of the meter, the worm J on the drum shaft actuating the index-shaft K restores the valve to its initial position by means of suitable gearing, and thereby cuts off the supply of gas from the measuring drum. The index-shaft K passes through a stuffing box L, provided with packing leathers "which effectively prevent leakage of gas, even at very considerable pressures."

Syphons for Collecting and Removing Liquid in Gas-Mains.

Layton, A. E., of Redditch.

No. 22,965; Oct. 8, 1909.

This invention relates to syphons or catch boxes in the form of a rectangular casting; the base of the well being inclined so that the liquid flows to the lowest point, where the pump pipe enters at right angles, and passes down to the junction outside the syphon. At the bottom of the syphon (communicating with the lowest part of the well) is an inverted T-piece; the pump tube entering its vertical limb. The inner horizontal limb communicates with the well; while the outer one has a screw plug, by removing which the syphon may be flushed for the removal of dirt or sediment.



Layton's Pipe Syphon.

As illustrated, the syphon has a depending well part; and the interior is inclined so as to cause the liquid to flow to one part. There are two inclines shown, meeting at the centre, at which point the pump tube enters; but, if desired, there may be a single incline falling to one end of the well, or the well may be inclined transversely or so arranged that the liquid will flow down to a lowest point.

The pump tube B is arranged outside the syphon; being held at the top by a lug and at the bottom by an inverted T-piece, one limb of which enters the well at its lowest point. After removing the plug, the pump may be attached and the liquid pumped out in the usual way; while the plug enables the syphon to be flushed for the removal of dirt or sediment.

Discharging and Charging Machine for Gas-Retorts.

West, J., of Southport.

No. 22,471; Oct. 2, 1909.

This gas-retort discharging and charging machine is in general description, and the object to be achieved, similar to that described in patent No. 9673 of 1908; and it has for its object "to discharge the coke from the gas-retorts by pushing the coke through the retort by means of a ram constructed in the form of a scoop and operated by a chain, whereby the coke is discharged from the retort, and the coal fed into the retort at the same time—the coal being deposited and left in the retort when the scoop is withdrawn from the retort."

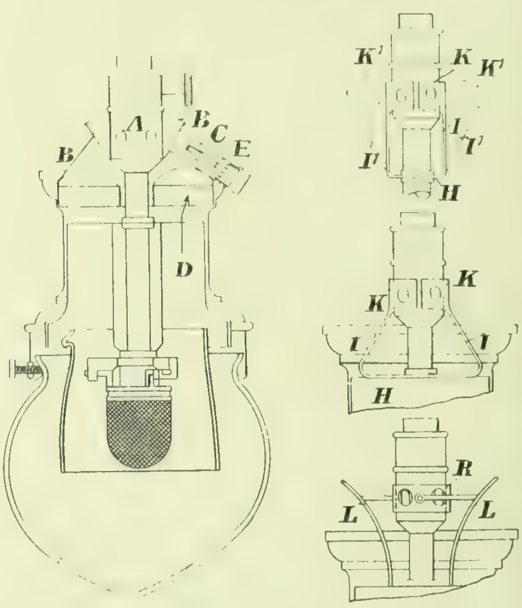
An illustrated description of the arrangement appeared in the "Journal" for April 5 last (pp. 24-26), and little need now be added, except to reproduce a side and end elevation of the machine (from the drawings accompanying the patent specification), so as to show the modification made since the earlier arrangement referred to above. For an illustrated abstract of the 1908 patent, see "Journal" for May 18, 1909, pp. 450-51.

Bunsen Burner with Automatic Air Regulation.

Gesellschaft für Verwertung Chemischer Produkte mit Beschränkter Haftung, of Berlin.

No. 27,344; Nov. 24, 1909. Date claimed under International Convention, Feb. 2, 1909.

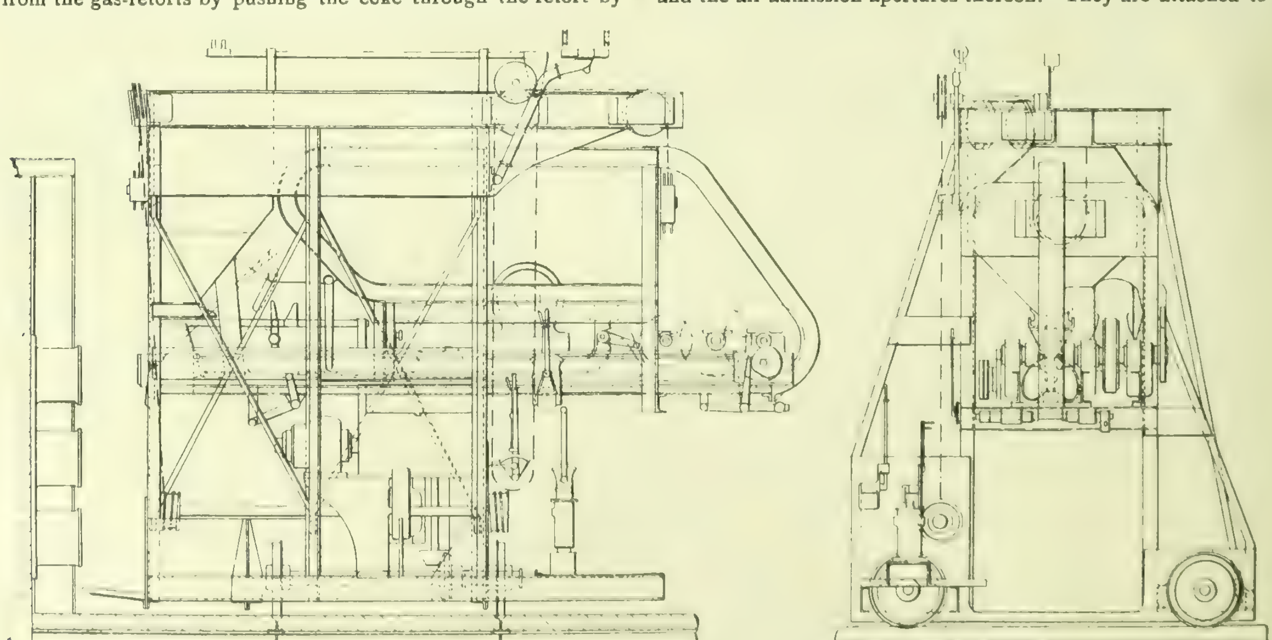
This invention relates to a bunsen burner in which the air supply is automatically regulated by means of one or more thermostatic bodies—being characterized by the attachment of the expanding body or bodies outside the reach of the suction-chamber, so that when the burner is cold the air apertures of the suction chamber are closed, and the explosion flame produced when the lamp is lit cannot strike into it.



A German Burner with Automatic Air Regulation.

In the inverted burner shown complete, the suction-chamber A is surrounded by a chamber B, from which air supply pipes C lead outwards. These pipes are exposed to the products of combustion flowing from below (in the direction of the arrows) and coursing from the chimney D. Within they are fitted with a piece E, consisting of two plates of metal of different co-efficient of expansion—say, brass and iron—closely united by rolling. When cold, this regulating piece in its upper part forms a cone consisting of several tongues. When the burner is lit, the rising products of combustion heat the tube C and the thermostat therein; and the shape of the latter is so altered that the several tongues bend away from one another and free the transverse section of the pipe for the primary air of the burner.

In the first modification, the valves K surround the suction-chamber and the air admission apertures thereon. They are attached to strips



West's Discharging and Charging Machine for Gas-Retorts.

of sheet-metal connected with one another by a bridge-piece H—made of thermostatic metals. It is essential that the expanding material is not mounted on the suction-chamber but on the lower part of the burner-tube, which is always more strongly heated than the suction-chamber, so that it may be exposed to sufficient heat. When the lamp is lit, the valves K move (by reason of the expansion parts I and H being heated) and assume the positions K[1]; while when the lamp is extinguished, the valves resume their former position in which they close the air-apertures.

The other modification differs in that the bridge-piece H is made wider, so as to obtain a better surface for contact with the lamp casing and better transmission of heat to the thermostat.

In the third construction shown, the conducting pieces L are so constructed as to be expanding, and are suitably coupled with the annular slide R. As the ascending products of combustion pass the conducting pieces, the latter alter their shape and produce the requisite movement of the slide.

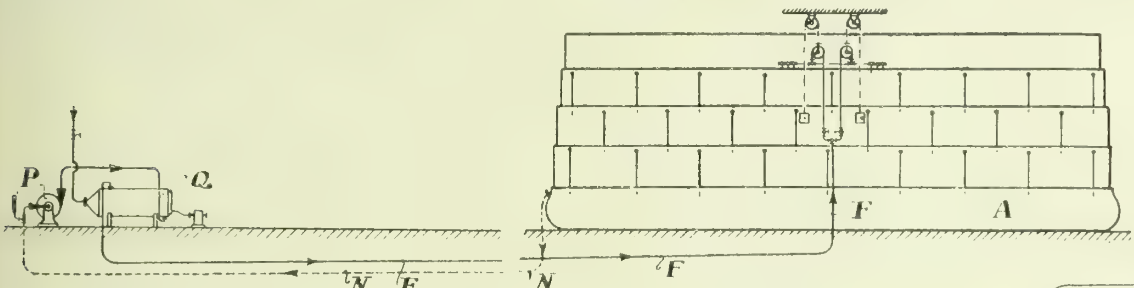
Heating Apparatus for Gasholders.

Knorr, L., of Nürnberg, Germany.

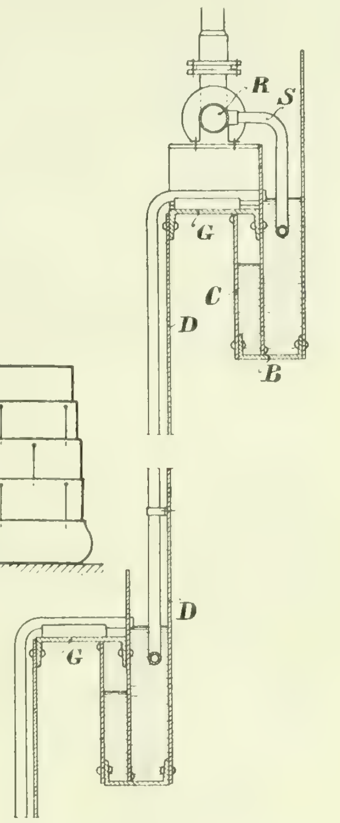
No. 6008; March 10, 1910. Date claimed under International Convention, March 20, 1909.

This invention relates to the heating of gasholders for the purpose of preventing the liquid in the sealing troughs freezing.

In devices hitherto proposed for this purpose, the patentee points out that the sealing liquid in each trough was heated; each trough having a special heating device, or being supplied with steam or hot water by means of a regulating device. The present invention, however, consists in supplying the heating liquid only to the topmost sealing trough, and



Knorr's Gasholder Lift Heater.



in providing overflow pipes by which it overflows in succession into the lower troughs, and finally into the lowest one or into the gasholder tank. From the latter, the liquid may be returned to the heating device, and thence be pumped back into the topmost trough. The whole of the liquid is thus caused to circulate in a closed cycle in which the heating device is included.

The gasholder shown comprises the bottom trough A and four telescoping annular sections above—the latter carrying the roof (not shown) of the holder. The heating liquid is supplied by the pipe F. To this pipe are connected two flexible pipes led over pulleys into the topmost sealing trough that connects the two upper gasholder sections. The pulleys are suspended from tensile members which pass over pulleys attached to the gasholder framing (not shown), and which carry weights at their other ends, so that the flexible pipes are kept taut. The excess of the sealing liquid overflows from the topmost sealing trough by an overflow pipe into the next lower sealing trough, and thence similarly through overflow pipes until it reaches the bottom trough A. From A, the liquid is drawn through the pipe N by the pump P, and forced thence, through the heating device Q and the pipe F, back to the topmost trough.

In the sectional drawing, the side of the topmost telescoping section of the holder is formed by an annular U-member B riveted to the side and by the ring C. The next lower telescoping section D carries at its upper end an annular U-member G, to which a ring is riveted that dips into the sealing liquid. R is a circular pipe to receive the heating liquid from a flexible pipe above and deliver it, through a number of pipes S distributed over the entire circumference of the sealing trough, into the latter. If the sealing liquid rises beyond a determined level, it overflows through pipes into the next lower sealing trough, whence it will be conveyed, through further overflow pipes, into the next lower sealing trough, and so on.

Separating Tar from Hot Gas Produced in the Destructive Distillation of Coal.

Wagener, E., of Dahlhausen a.d. Ruhr, Germany.

No. 6282; March 12, 1910. Date claimed under International Convention, March 29, 1909.

This invention "consists in subjecting the gas to centrifugal action while the tar or mixture of tar and ammoniacal liquor, separated from gas in a previous operation, is injected in large proportion into the gas, or in mixing the gas with tar or a mixture of tar and ammoniacal liquor before it is subjected to the centrifugal action."

The patentee states that he founds his invention on the following considerations: Tar has been removed from the hot gas produced in the destructive distillation of coal by subjecting the gas to a spray of tar forced through an injector; the tar used as a scrubbing agent being kept at a temperature not exceeding 80° C. It has also been proposed to remove the tar from the hot gas by passing it in a vertical direction through a horizontally distributed fine spray of tar already separated or in the act of being separated. It has also been proposed to subject the hot gas to centrifugal action for separating the tar, at a temperature which prevents the condensation of the steam contained in it. Of these methods, the first has proved very valuable, because, by the use of a sufficient proportion of the scrubbing agent, an intimate intermixture of gas and agent is obtained; and only in this manner can the fine tar drops be completely absorbed. The fact that in gas-works the rotary exhauster used for moving the gases separates tar even from cool (almost tar-free) gas, shows that centrifugal appliances are suitable for separating tar. For removing the large proportion of tar in crude gas, the tar as it separates does not suffice; but a larger quantity of previously separated tar must be introduced into the scrubbing apparatus in order that removal of tar may be complete.

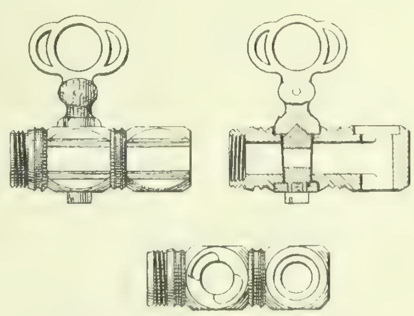
He has found that, even when a tar spray is used, it is advantageous to inject tar into the gas before it arrives at the tar spray (as is shown in patent No. 12,809 of 1908), because there is produced an intimate mixture of the gas and tar before they pass together through the injector. The use of a large proportion of the scrubbing agent offers the further advantage that, in order to cool the crude gas to the suitable scrubbing temperature, no separate cooling agent is required. The scrubbing agent itself effects the cooling; since, owing to its high specific heat, an increase of its temperature by only a few degrees means a considerable reduction of the temperature of the crude gas—especially since at these temperatures there is no condensation of steam to water; the gas being still superheated.

Taps or Cocks for Gas.

Sperryn, G., and Wood, W. H., of Birmingham.

No. 6950; March 19, 1910.

This invention refers more particularly to taps or cocks used for regulating and controlling the supply of gas to burners; the object being to provide a positive "stop" or "nighting" "possessing none of the defects of the hitherto known methods of providing stops on taps."



Sperryn and Wood's Gas-Tap.

The inventors form the thumb-piece or fan separate from the plug, and provide projections at the bottom of it. The thumb-piece is secured in a slot or bifurcation in the plug, so that the projections are presented from the sides of the slot; and stops engage these projections or horns by cutting away the top of the tap body. The thumb-piece is preferably stamped from sheet metal with a bottom part wider than the top of the plug, which is slotted to receive it. The bottom part of the thumb-piece thus projects on each side of the top of the tap-plug and forms the horns or projections.

The invention will be understood by referring to the illustration.

Recovering Valuable Products from Iron Pickling Liquor and Gas Liquor.

FALDING, F. J., of New York, and CATHCART, W. R., of New Jersey, U.S.A.

No. 11,364; May 7, 1910.

This invention relates to a process for making sulphate and chloride of ammonia, or other salts of ammonia, and recovering the valuable products from the waste pickling liquor resulting from the washing of iron and steel in a weak acid solution, and from the gas liquor resulting from the washing or scrubbing with water of gas produced by the distillation of coal and other organic matter.

The process consists in mixing the pickling liquor with the gas liquor to form an ammonium salt—such as ammonium sulphate in solution and iron hydrate, subjecting the mixture to the action of an oxidizing agent to convert the soluble iron hydrate into iron hydrate (which is insoluble in the presence of the ammonium salt) and thereby causing all the iron to precipitate, and preferably separating the precipitate from the solution and recovering the ammonium salt from the solution.

Describing the invention more in detail, the patentees say: Supposing the waste pickling liquor employed to be in the sulphate form. If ammonia (NH_3) is added to a solution of ferrous sulphate, the following reaction will take place:

(1) $2NH_4OH$ (or $2NH_3 + 2H_2O$) $+ FeSO_4 = (NH_4)_2SO_4 + Fe(OH)_2$.

The ammonium sulphate will remain in solution and the ferrous hydrate will be only partly precipitated—it being soluble in the presence of the ammonium salt. If the solution is subjected to the action of an oxidizing agent, as by passing a current of air through it while heated, the ferrous hydrate will be converted into ferric hydrate or some intermediate oxidation product or a mixture of such products, for example—

(2) $2Fe(OH)_2 + H_2O + O = Fe_2(OH)_6$ and
$3Fe(OH)_2 + O = Fe_3O_2(OH)_4 + H_2O$.

These ferric and ferroso-ferric hydrates are insoluble in the presence of ammonium salts, and therefore precipitate completely.

The gas liquor is preferably given a preliminary treatment in order to free it from sulphides. For this purpose there is added to a given volume of gas liquor sufficient of the pickling liquor to produce enough ferric or ferrous hydroxide to precipitate the sulphur as iron sulphide and free sulphur. Instead of the pickling liquor, ferrous hydroxide (or preferably ferric hydroxide, previously obtained by this process or otherwise) may be used for this purpose. This step of the process may be carried out either with or without heat and oxidation as may be necessary, and according to the solution of iron salt employed. The precipitate will carry down some of the tarry matters of the gas liquor, and the cyanogen and chlorine compounds contained in the gas liquor will be precipitated. The precipitate may be further treated for recovering the sulphur and cyanogen and chlorine values, together with iron hydroxide.

To the volume of gas liquor now freed from sulphides, cyanide, and chlorides, a corresponding volume of the waste pickling liquor containing the necessary equivalent of sulphuric acid to combine with the ammonia contained in the gas liquor is added; and the mixed solution is preferably oxidized by heating it and passing a current of air through it, or in any other suitable manner. There will thus be produced ammonium sulphate in solution, which can be recovered in the usual way, and a precipitate of insoluble iron hydroxide, which will be practically free from sulphur, as also from cyanide and chloride, which may be washed and filter-pressed and prepared for use as an iron ore or otherwise.

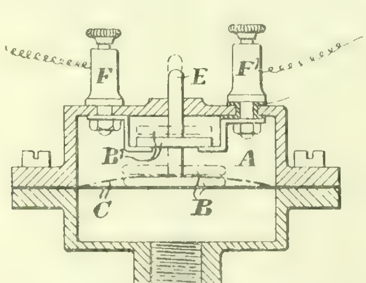
In order that all of the iron may be precipitated as hydrate, it will be evident that the solution should at all times be slightly alkaline, a slight excess of gas liquor being used for this purpose. The patentees add: The foregoing process can be used to advantage where the gas liquor and pickling liquor are produced in plants situated some distance from each other.

Gas-Pressure Alarm Apparatus.

TRIMLETT, H. J., of Wandsworth Road, S.W.

No. 17,712; July 26, 1910.

This device, to be used for the purpose of giving an alarm when the pressure of gas in a pipe falls below a predetermined point (especially intended for use with incubators), consists of a casing dividing into two chambers by a thin diaphragm of indiarubber or like material; the lower chamber having a tapped boss by which it is secured to the gas-pipe.



Trimlett's Gas-Pressure Alarum.

As shown, the upper chamber A receives the movable contact maker consisting of the rod E, which passes loosely through a hole in the top of the casing, the disc B resting a little distance above the diaphragm C. The two terminals F and F[1] are connected to the alarm circuit and carry internal contact pieces at their inner ends. The terminal F[1] is insulated from the casing by an insulating thimble, so that the circuit is not completed unless the contact disc B[1] drops upon the contacts as shown in full lines. The whole device is secured upon the gas-pipe by the tapped boss of the lower chamber so that the under side of the diaphragm C is subjected to the gas pressure, which normally pushes it up, as shown in chain lines, raising the contact maker clear of the contacts.

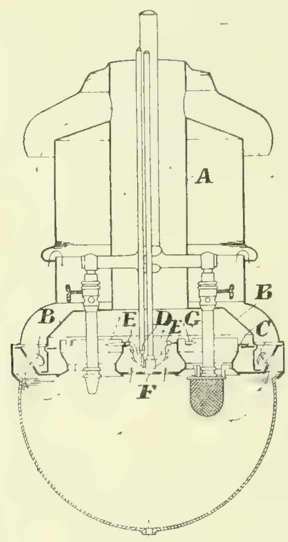
This device may be used in greenhouses warmed by gas, or for house supply through a slot meter, to call attention immediately the pressure of the gas begins to decrease.

Ignition Device for Inverted Incandescent Gas-Lamps.

JULIUS PINTSCH, AKTIENGESELLSCHAFT, of Berlin.

No. 14,492; June 15, 1910. Date claimed under International Convention, June 16, 1909.

In inverted gas-lamps of this kind, in which the combustion gases are not led off through a central chimney, the patentees point out that no difficulty exists in arranging the ignition device outside the area of the combustion gases, "since in these lamps generally a cover is provided over the main flame, above which the ignition device can be arranged." In inverted gas-lamps with central chimney, however, the ignition device has hitherto always been arranged in the chimney itself, or, at least, in such a manner that the combustion gases, when flowing to the chimney, traversed or passed the ignition device—in consequence of which, not only a deposit of soot, but also the destruction of the ignition device by the hot combustion gases resulted.



Pintsch's Ignition Device for Incandescent Gas-Burners.

According to this invention, the ignition flame device is within a space formed by the mantle-holders and perfectly closed off from the combustion gases. The space can thus receive fresh air from below, and the ignition flames pass through holes provided in the mantle-holders into the area of the gases issuing from the main burners.

The chimney A has at its lower part a chamber B common to the burners, in which a supporting ring for the mantle-holders is fixed. The combustion gases of the main burners are led through the mantle-holder C into the chimney, and flow into the atmosphere in the direction of the dotted arrows, whereas the path of the fresh air is illustrated by arrows drawn in full lines. The burners for the pilot flame D and the travelling flames E are arranged within the chamber B, in such manner that they lie below the upper edges of the mantle-holders, and are protected against the combustion gases by the suction action of the chimney carrying the gases upwardly. In order to increase this suction action, small holes F are arranged within the reflector below the pilot burners, which allow of the entrance of the fresh air to the pilot flames. In order to effect ignition by the travelling flames, the pipes of the traveller are constructed so that the flames pass through openings G of the mantle-holder into the interior of the holders. In this manner the pilot flame and travelling flame are arranged outside of the space filled with the combustion gases, and are "protected against an undue influence of the heat."

Bristol Electricity Undertaking.

Speaking at a Bristol ward meeting, Councillor Featherstone Witty devoted a considerable part of his address to criticism of the Corporation electrical undertaking. Referring to a statement that the competition of the electric light had caused reductions in the price of gas, he said that the capital expenditure on the undertaking was £821,000; and if the municipal traders were content with having a reduction in the price of gas for this sum, then all he could say was that £821,000 was a big price to pay for what would no doubt have come about even if such an undertaking had never existed. The statements of the municipal traders meant that the lower the price of electricity was brought, the lower would be the price of gas. On this principle, how much they would benefit the consumers of gas if the Corporation were to provide electricity free! He urged, however, that the reduction in the cost of gas had been brought about by questions quite apart from the electricity undertaking. The price for the electric light had never been low enough to come into such sharp competition with gas as to cause a reduction in the price. What he wanted to emphasize was the new doctrine on which the municipal traders were falling back—that the electrical concern was not run for the benefit of the ratepayers as a whole, but for the benefit of consumers of gas, and in order that these might have their gas bills reduced. If his opponents could show conclusively to the ratepayers of the city that his contentions had no foundation on fact in regard to the sinking fund being insufficient of itself, without something added to it every year, for the depreciation of the assets of the electrical concern, and that it did not wipe off a penny of real debt—if they could prove that his statements were entirely and absolutely erroneous, he would give a hundred guineas to the General Hospital and the Royal Infirmary, on condition that if he was right, and they were wrong, they would act in a similar manner.

We are informed that Messrs. R. & A. Main, Limited, have appointed the following additional representatives: Mr. David Gibb, North of England; Mr. S. F. Chamberlain, Eastern Counties; and Mr. C. G. Clark, Eastern Central Division of England.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mansfield's Inverted Burners.

Sir,—In the current issue of the "Journal" appears a reference to some proposals for improvements in inverted incandescent burners, which form the subject of a patent granted to Mr. Alfred Mansfield, bearing the date of Aug. 31, 1910.

The patent not being at present in print, I have to rely upon the abstract of it appearing in the "Journal." But from this it seems that the methods proposed by Mr. Mansfield bear a very strong likeness to those used in the burners which were adopted for street lighting by the Beckenham Borough Council in competition with their own electric lighting. The size of these burners was carefully proportioned to suit the South Suburban Company's gas; and there is no method of adjustment either with the air or the gas—both are predetermined, and beyond the power of the lamplighter to alter. The system was the same one as that previously applied to the South Metropolitan Company's area, where some thousands of the burners, also specially proportioned, are in successful use. We have also applied the same methods in burners used for indoor lighting, of which considerable numbers have been made.

I believe Mr. Mansfield is on the right lines in his endeavours to construct a burner which relies upon fixed dimensions for efficient working; but I do not think he can claim originality in this. We have had burners in use for more than twelve months, with consumptions commencing at $1\frac{1}{4}$ cubic feet per hour, constructed with fixed dimensions; and they have proved themselves, and are in my opinion, a great improvement over the various variable types.

Charles Carpenter.

South Metropolitan Gas Company,
Oct. 20, 1910.

The Testing of Gas-Fires.

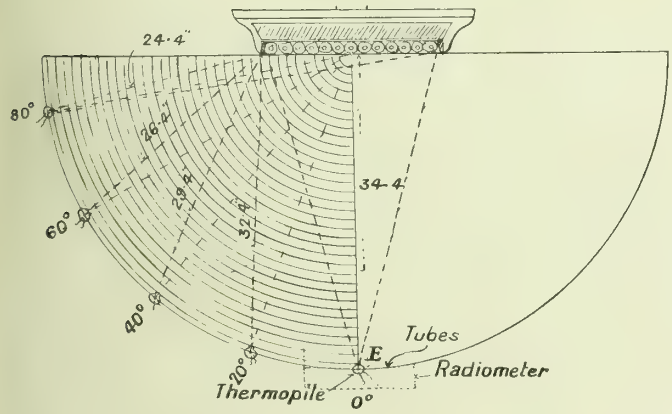
Sir,—I was pleased to see Mr. Clark's letter in your issue of the 18th inst., referring to mine of the 11th inst. It does not, however, dispose of my contention that the thermopile and galvanometer, as at present operated, lead to considerable error in the ascertainment of the radiation efficiency of gas-fires, especially very wide ones.

Perhaps it will be as well, before entering into the subject, to dispose of the points given by your correspondent as being those most likely to cause the error to which I refer. They are:

(1) Error due to the conical hood of the thermopile.
(2) The true centre of the thermopile.
(3) The elimination of error due to the conduction of heat into the radiometer from the warm surrounding air.

The conical hood I disposed of nearly three years ago, as I found (in repeating experiments with all conditions constant) that the total galvanometer readings differed considerably (these tests were comparative only). Without the hood, I got lower but much more consistent readings. Latterly, I have employed means that enable me to set the thermopile facing central in each position on the hemisphere; so that in two or three consecutive tests the total readings agree to within 2 per cent.

I take the centre of the thermopile as being the true centre; and at the distance of 34·4 inches (being *minus* hood), practically no rays are obstructed. There is further the advantage of obtaining lower readings on the galvanometer by the removal of the hood, inasmuch as owing to the torsion of the hair-springs on which the needle of the galvanometer is pivoted increasing the further the needle moves up the scale, a greater current of electricity is necessary to move the needle through (say) from 50 to 60 than from 1 to 10. Therefore, by keeping the deflections of the needle as low as possible, one is more likely to get readings in proportion to the intensity of the rays. A moment's reflection will, I think, make this quite clear to the reader, without any elaboration on my part.



The last point—viz., "Error of conduction of heat, &c."—I allow for as follows: The radiometer is placed so that its front is facing away from the fire; the tubes or face proper being left exposed to the air of the laboratory. A light cloth is thrown over the side exposed to the radiations of the fire. The water is then set running; the fire lighted; and the whole left to reach the maximum. By regulating the ventilation, the laboratory is maintained at almost constant temperature; so that after noting the difference in the levels of the thermometers due to the warm air of the laboratory (and which is deducted from the total rise), the radiometer is placed into position and the whole test carried out under fixed conditions. I could mention other necessary precautions, but think that enough has been said to show that due regard is paid to these measures.

To return, however, to the point in question. I attach herewith a diagram on which I have marked the distance of 34·4 inches from the face of the fire to the thermopile as lines, each line representing an inch. Taking a fire (say) 20 inches wide, and placing the thermopile at E, it is in this position 34·4 inches from the face of the fire. Not so, however, if we place it at 20°; for at this point the source of some of the rays is approximately between 34·4 inches and 32·4 inches; at 40°, between 34·4 inches and 29·4 inches; at 60°, between 34·4 inches and 26·4 inches; and at 80°, between 34·4 inches and as low as 24·4 inches. By extending the width of the fire, this figure would be reduced considerably more, with, of course, a consequent rise of the galvanometer readings. From tests I have made with specially prepared fires, I find that although the reading on the galvanometer when the thermopile is at E equals only 18, yet when it is placed at the 80° mark the reading jumps to as high as 60. These readings, when dealt with in the usual manner, give utterly absurd results. The same objections apply to even the smallest of fires, though, of course, not to such an extent.

I am now engaged upon altering my apparatus to procure if possible the true efficiency of even the widest fires marketable.

Oct. 23, 1910. Experimenter.

Automatic Lighting and Extinguishing Public Lamps.

Sir,—May I once more trespass on your space to reply to the further criticisms of your correspondent who signs himself "Contributor," and at the same time explain that, in so doing, I have no intention of booming any individual lighter, but simply to point out where the criticisms are not valid or correct.

With reference to the difference which exists between the class of pressure apparatus which utilizes the whole of the pressure for operating and the class which relies for the purpose upon the margin over and above the maximum day pressure—admitting that "the difference is only one of degree"—my point was that it was just this degree which destroyed the validity of "Contributor's" first premise that the former class of apparatus is useless with low pressures. This is amply borne out by his further statement that, to work the second class of apparatus with anything like safety, it is necessary to permit it to engage at the maximum working day pressure, and then raise the pressure $1\frac{1}{2}$ inches to operate it—*i.e.*, 1 inch for the range and $\frac{1}{2}$ inch for the safety margin—so that only in the case of a gas-works having an abundant reserve of pressure can the ordinary pressure lighter be used with any degree of reliability.

Dealing with what may be termed the "whole pressure" type of apparatus, "Contributor" gives us a very nice equation. He says: If x equals the pressure necessary to raise the bell, and l equals the pressure required to turn the tap with a margin of safety, therefore $x\ l$ is the pressure below which this class of apparatus will not work. This is undoubtedly true. But he is still leaving $x\ l$ an unknown quantity; and while this force remains unknown, it is merely playing with words to state that there are plenty of gas-works in this country and on the Continent that work with pressures below $x\ l$.

One cannot argue with or against nebulous quantities. The modern tendency of the gas industry is (owing to the almost universal adoption of the incandescent burner) to increase the working pressure; and although in some places low pressures are still the rule, this is only an argument in favour of my contention that the ideal pressure lighter is that which utilizes the whole of the gas pressure, rather than that which relies upon only a portion of it.

To give a concrete case of what is meant. The writer, some years ago, while working on the Continent with a "whole pressure" type of apparatus, obtained perfectly satisfactory results with a total initial pressure (inclusive of the necessary rise given for lighting) of 30 mm.—actually less than the increase over and above the maximum day pressure which, according to "Contributor," has to be given to successfully work the "margin pressure" type of apparatus.

If "Contributor" had followed his own advice, and read my reply carefully, he would no doubt have noticed that, when dealing with the danger of mercury-seal blowing, I did not infer that this never happened, but that there was no chance of it occurring, providing "the apparatus is constructed in a proper manner." And I see no reason to alter this opinion.

There was no misunderstanding on my part, either intentionally or otherwise, *re* the question of mechanically altering the range between the engaging and operating point on the ordinary apparatus, as I had this type also in mind when making the statement that there were methods of achieving the above result. I regret that I cannot share "Contributor's" enthusiasm for the apparatus mentioned by "Eureka," especially as pressure lighters which were able to work at a high pressure and extinguish at a low pressure were tried, condemned, and banished from this country twenty-five years ago. It may be that this type might suit some districts—for instance, towns or villages where the lamps are extinguished at midnight. But they would be absolutely unsuitable for sunrise extinguishing, as this would necessitate the gas company maintaining a comparatively high pressure right through the early hours of the morning—an arrangement entirely opposed to all current practice.

The alternative of extinguishing at a high pressure, which is at the same time lower than that required for lighting, is certainly an improvement; but if this is accomplished by a fixed adjustment, the advantage is exceedingly small compared with what can be, and is being, done in this direction. The only way in which the gas engineer can be provided with an apparatus which will allow him a choice of pressures suitable to the conditions of supply, stock, reserve, pressure, &c., existing at the works (especially as these conditions often vary from day to day) is to completely ignore height of pressure altogether and simply work upon the method of giving same. If an apparatus can be produced which uses the whole of the gas pressure for opening or closing the burner supply, constructed in such a manner that all the working parts are easily accessible and outside the gas supply, and which allows the lighting to be performed at a high pressure and the extinguishing at a second high pressure lower than the first or *vice*

versâ, which will also permit of a drop in pressure and a subsequent sharp return of same, effecting the desired result, I claim a great advance has been made in the question of the lighting of public lamps by automatic means.

This can be done, and is being done to-day, not in an experimental fashion, but over large areas, as all those interested in the question can ascertain for themselves. The above result is achieved by an apparatus which only responds to a sharp increase irrespective of what the initial pressure may be at the time, or how same may vary from day to day; and actual tests have proved that this type of apparatus will respond to a sharp increase of (say) 5-10ths or 6-10ths given at any point between 20-10ths and 62-10ths. The tests were as follows:—

20-10ths to 26-10ths for lighting
26-10ths to 32-10ths for extinguishing
32-10ths to 38-10ths for lighting again
38-10ths to 44-10ths for extinguishing again.

And so on up to the limit mentioned above; and then the pressure was dropped to about three inches, and the cycle was commenced over again.

At the same time a slow rise of three or four inches did not affect the apparatus in any way. This new method of working automatic lighting by pressure gives the widest possible range of pressure under which the apparatus can be relied upon to perform its proper function without the necessity of re-adjusting in any way.

In conclusion, I think the best thanks of the gas industry are due to "Contributor" for raising this very profitable discussion, and also to the "JOURNAL" for throwing open the correspondence columns for this purpose.

Farringdon Avenue, E.C., Oct. 21, 1910. ARTHUR H. FRANCKS.

LEGAL INTELLIGENCE.

GAS COMPANIES AND THE REINSTATEMENT OF ROADS.

Unsuccessful Action against the Rayleigh Gas Company.

In the King's Bench Division of the High Court of Justice last Wednesday, Mr. Justice Bray and a Common Jury had before them the case of *Jarvis and Others v. Rayleigh Gas Company.* It was an action brought, under Lord Campbell's Act, by Mrs. Ellen Jane Jarvis, who, with her six children, sued the Company for damages in consequence of the death of her husband, Walter Jarvis, caused, as alleged, by the negligence of defendants' servants.

The plaintiffs' case was that on Sept. 7, 1909, the deceased was riding a bicycle down the Rayleigh Road where the defendants' workmen had just before dug a trench for laying a main and had filled it up. He came into contact with a flint about the size of a man's hand, and was thrown from his bicycle; sustaining serious injuries, from which he died four days afterwards. The allegation was that the accident was occasioned by the negligence of the defendants' servants in not properly filling in the trench, with the result that the large stone was left upon the road. The defendants admitted that the trench had been filled in by their workmen; but they denied that they or their workmen were guilty of negligence. They also denied that the stone with which the deceased had collided came from the trench, or that it formed any part of the material used by their workmen in filling up the hole—saying it had been employed to scotch the wheel of a cart going uphill. They also alleged contributory negligence on the part of the deceased, inasmuch as he was riding with a parcel so placed that he could not properly guide or control the machine.

Mr. J. Duncan appeared for the plaintiffs; Mr. Marshall Hall, K.C., and Mr. Morton Smith represented the defendants.

Among the witnesses called for the defence were Mr. Worthington Church, the owner of the works, and the Manager (Mr. J. A. Kent); and at the close of the evidence his Lordship left the four following questions to the Jury: (1) Were the defendants guilty of negligence in filling up the trench? (2) Was the stone lying on the road owing to defendants' negligence? (3) Was the stone the cause of the accident? (4) Could the deceased have avoided the accident by the exercise of reasonable care? To the first and second questions the answers were "No;" to the fourth, "Yes;" and to the third, that there was no evidence. Judgment was accordingly entered for the defendants.

RESPONSIBILITY FOR MAINTAINING A WATER-PIPE.

SUPREME COURT OF JUDICATURE—KING'S BENCH DIVISION.

Wednesday, Oct. 19.

(*Before Justices* PHILLIMORE *and* AVORY.)

Parnell v. Portsmouth Water-Works Company.

This was an appeal by the defendants from a decision by his Honour Judge Gye, sitting at the Portsmouth County Court, awarding the plaintiff the sum of 10s. 8d., the cost of repairing a communication pipe which conveyed the supply of water from the Company's main to the house.*

Sir A. CRIPPS, K.C., and Mr. CABABE appeared in support of the appeal; Mr. TINDALE DAVIS represented the respondent.

Sir A. CRIPPS said the pipe in question, which was laid under a public highway, had been in the same position for many years, though there was nothing to show at whose expense it had been laid. In 1907, a leak was discovered, and notice was given to the plaintiff by the Company to repair, under threat of the supply of water being cut off. Plaintiff had the necessary repairs effected, and three years afterwards commenced an action to recover the amount he had paid, on the ground that the repairing should have been done at the cost of the Company. The questions for the Court were: (1) Whether the payment was made under duress; and (2) whether liability to repair was upon the owner or the Company. At the trial in the Court below, evidence was given that the Company had never laid or repaired any communication-pipe; the Corporation having always allowed owners to open the roads to do necessary repairs. The Judge found that, in executing the work, the plaintiff acted under duress and a mistaken view of the law. Having regard to the terms of the Special Act and the decision in the case of *Grand Junction Water-Works Company v. Rodocanachi*,* he submitted that the duty to repair was on the owner or occupier, and that judgment should be entered for the appellant Company.

Mr. Justice AVORY: Is it not clearly sufficient for you to say that the plaintiff has not proved that the communication-pipe was laid by the Company?

Sir A. CRIPPS thought it was.

Mr. TINDALE DAVIS submitted that the County Court Judge was right on both points, which he had decided in favour of the plaintiff. No evidence was given as to who laid the pipe; and the probability was that it existed at the time the Special Act was passed. By that Act, the Company were not compelled to supply water unless the fittings were so constructed as to prevent waste; and they were the only authority having power to open public highways to repair pipes or stopcocks, as was decided in *Chapman v. Fylde Water-Works Company*,† and *Colne Valley Water-Works Company v. Hall.*‡

Mr. Justice PHILLIMORE said he was of opinion that the appeal must be allowed, though he was not at all surprised that the County Court Judge arrived at the conclusion he did, for it had taken them very considerable time and much thought before coming to an opposite conclusion. To whom the communication-pipe belonged, he was quite unable to say. From the Statutes it appeared that owners of houses under £10 were entitled to call upon a water company to put down pipes; while, on the other hand, a company could require the owners to pay a rent. But here no rent was paid, though the house was under £10. The Company required respondent to repair the pipe, threatening to cut off the supply of water if this was not done; and the respondent was able to put the pipe in repair probably because he employed a specially licensed plumber. In the Colne Valley case, it was decided that the water company, who did the repairs, could not recover the cost from the private owner; and in the Grand Junction case, it was held that the company were not bound to repair. Therefore, so long as this case stood unchallenged, it must be taken that in all cases where the Metropolis Water Act applied, a water company were not bound to repair; and in the present case, the language of the section was the same as in that Act. He rested his decision solely upon the fact that the Water Company were not bound to repair.

Mr. Justice AVORY said, there being no finding of fact as to whether the pipe was laid down by the owner or by the Company, the Court had no material for determining the question of ownership. It was sufficient to say that, in order to succeed, the plaintiff, who sought to recover money paid, as he said, under duress, was bound to satisfy the Court that the money was really payable by the Water Company, and not by him. Having utterly failed to discharge this onus, the claim could not succeed.

The appeal was allowed, with costs; and the judgment of the Court below reversed, but (by consent of the appellants) without costs.

USING DOMESTIC WATER FOR TRADE PURPOSES.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, Oct. 14.

(*Before the* LORD CHIEF JUSTICE *and Justices* PICKFORD *and* COLERIDGE.)

Cambridge Water-Works Company v. Hancock.

This was an appeal by the Cambridge Water Company from a decision of local Magistrates, and raised a question under sections 18 and 19 of the Water-Works Clauses Act, 1863.

Sir A. C. CRIPPS, K.C., and Mr. RAIKES appeared for the appellants; Mr. SCHILLER represented the respondent.

Sir A. CRIPPS said the respondent was summoned under section 18 of the Act of 1863 for using water for other than domestic purposes—viz., for the purpose of his business as a dairyman; and he was summoned under section 19 for affixing a pipe to a certain tap which he used in connection with his water supply. It appeared that he kept thirty cows, and at the north end of the dairy there was a tap, 4 ft. 6 in. from the ground, supplied with water by the Company. There was also a cattle-trough which was supplied with water from a pump; and it was agreed that the respondent only had a supply for "domestic purposes." Water from the tap, obtained through a hose-pipe, was used for washing a brick-paved yard and a milk-float; and water was seen running from the hose into the cattle-trough. The Justices held that the use of the water by respondent's servants on four occasions for the above purposes was not a use for other than domestic purposes, and that causing or permitting water to flow into the cattle-trough was merely incidental to the washing of the milk-float. Upon the second summons, the Justices came to the conclusion that a temporary attachment of the hose to the pipe was not an attachment within the meaning of the Act. The learned Counsel submitted, on a mere statement of the above facts, that the Justices had come to a wrong conclusion, and that the case should be remitted to them to convict.

Mr. SCHILLER contended that the purpose for which the water was being used could not be separated from the intention of the person actually using it. If a man filled a pail with water from the tap to be

* See "JOURNAL," Vol. CIX., p. 880.

* *Ibid.*, Vol. LXXXVI., p. 35.
† *Ibid.*, Vol. LXIII., p. 813; and Vol. LXIV., p. 147.
‡ *Ibid.*, Vol. XCVII., p. 291; and Vol. C., p. 576.

used for domestic purposes, and then, finding he had drawn too much, poured the surplus into the trough, he would not commit an offence within the meaning of the section.

The LORD CHIEF JUSTICE remarked that water run into a trough through the hose could not be called a domestic purpose.

Mr. SCHILLER said it appeared from the evidence that the trough had been filled from the pump, and the end of the hose was merely put in to prevent the water running over the yard while the man went and turned off the tap. The Company practically admitted that using water for washing the float was a user for domestic purposes.

Sir A. CRIPPS denied that there had been any such admission.

Mr. SCHILLER urged that washing the yard was clearly a user of water for domestic purposes. The hose simply owed its existence to the fact that the tap was in an inconvenient position in the yard. There was clearly no offence committed by affixing the hose to the tap, as it was merely used as a vessel for carrying water for a purpose for which the respondent was entitled to use it.

The LORD CHIEF JUSTICE said he was clearly of opinion that the Magistrates had gone wrong, having confounded the matters which were most material when they came to consider what they ought to do in the case. He did not say this because they thought there had been a breach of the provisions of the statute they ought of necessity to say it was either a serious or a light offence. In the first case, the respondent had got the Justices to decide that, because the Company in some cases had not made a charge for certain things for which they might have charged, therefore there had been no breach of the law which prohibited a person from using the water for other than a domestic purpose, or for any purposes other than those for which he was entitled to use it. It was perfectly true that the meaning of "domestic purpose" had been extended beyond what the framers of the Act intended; but it had never yet been suggested that that which was in effect a trade purpose could be said to be a domestic purpose because either a company had not charged under some circumstances, or something had happened which would justify the user in saying it was only casual or very small. As to washing the yard, this seemed to be a question of fact, though he could well imagine it to be distinctly a trade purpose, especially in a knacker's yard. Water used for washing a milk-float or for filling a cattle-trough might also be said to be for trade and not domestic purposes. The first case must go back to the Justices to be dealt with by them on the merits. As to the second summons, it appeared that the respondent had affixed a hose temporarily to the pipe; and the Justices found it was not an offence, as it was only a temporary affixing. He thought the case must also go back on the ground that the temporary affixing of a hose to the service-pipe might be as much an offence as if it was a permanent affixing.

Justices PICKFORD and COLERIDGE concurred; and the appeal was allowed, with costs.

Claim Against the South Metropolitan Gas Company.

At the Greenwich County Court, a few days ago, before his Honour Judge Willis, Mrs. Sarah Ann Foord, of Grays, sued the South Metropolitan Gas Company for compensation for the death of her husband, Daniel Foord. Mr. Montgomery, for the plaintiff, stated that on the 25th of February Foord met his death at the defendants' wharf at East Greenwich. He was captain of a barge, and after going on shore fell while descending the ladder from the wharf. The case turned upon the construction of the ladder; and his Honour gave judgment for the defendants.

North Oxfordshire Water Company.

In the Chancery Division of the High Court of Justice last Friday, Mr. Justice Warrington had before him a motion *ex parte* by Mr. Thorpe, in an action by one Campbell against the North Oxfordshire Water Company for the reappointment of the Receiver and Manager. Plaintiff sued on behalf of himself and all other debenture-holders. He held 40 debentures, representing £1000 out of an issue of £15,000. Counsel said the action was commenced on the 3rd of August, and came on the 10th before the Vacation Judge, who appointed Mr. Charles Frederick Bowker as Receiver and Manager till the second motion day in the present sittings, which was the 14th inst. Unfortunately, some dispute arose between the plaintiff and his solicitors, who claimed a lien on the papers; and the new solicitors, who instructed him, were unable to give notice of motion for the 14th to continue the receivership. They had given a notice for Friday, which (there having been no appearance by the defendants in the action) they had filed, but, unfortunately, not in time to be effective for that day. He was therefore obliged to move *ex parte*. The interim Receiver, who was still actually in possession, had made an affidavit to the effect that the property and assets consisted of about an acre of freehold land and pumping-house at Bloxam. There were 38 customers. The total income was between £50 and £60 per annum; while the outgoings were about the same amount. From the date of his appointment, he had received by way of rentals £9 1s. 3d., and a further sum of £19 2s. 4d., the balance to the credit of the Company at the bank. He had made payments for wages, salaries, travelling expenses, &c., to the amount of £7 10s. 6d.; and the balance of £20 13s. 1d. was still in his hands. He estimated the total value of the Company's property and assets to be about £3000. Since the previous Saturday, he had received something under £1, and had paid nothing. There was reason to believe that no appearance would be entered to the action; and it was intended to draw up a statement of claim, and put it down as a short cause on motion for judgment. He asked his Lordship to appoint Mr. Bowker as Receiver and Manager until this could be heard. Mr. Justice Warrington thought the proper thing was to appoint Mr. Bowker *ex parte* over next Friday—to give security forthwith.

Liverpool and the Test-Burner Bill.—At their final meeting for the municipal year, the Parliamentary Committee of the Liverpool Corporation had under consideration the question of further opposition to the Standard Burner Bill. It was decided to continue opposition to the third reading of the Bill.

MISCELLANEOUS NEWS.

GAS & COMMERCIAL SECURITIES CORPORATION, LTD.

A Five Per Cent. Dividend on the First Year's Operations.

The First Ordinary General Meeting of this Company was held last Wednesday, at the Offices, No. 39, Lombard Street, E.C.—Mr. R. S. GARDINER in the chair. The other Directors—Mr. S. R. Clarke and Mr. A. F. Phillips—were also present.

The SECRETARY (Mr. L. Maynard Brown) read the notice convening the meeting, and also the Auditors' report.

The Directors' report and the accounts having been taken as read,

The CHAIRMAN moved their adoption. In doing so, he said he wished to express the gratification of the Directors at the very satisfactory result of the first year's operations of the Company. The Company was registered at the end of May, 1909. The particulars were circulated privately; and the first allotment of shares and debenture stock took place at the end of June. On Aug. 31 last year, the total amount subscribed was £16,800; so they had not had the benefit of the present total issued capital for a full twelve months. Yet a profit of £1669 17s. 5d. had been earned, from which had to be deducted the interest on debenture stock (£397 8s. 10d.), and from which, too, the Directors were writing off half the formation expenses, or £199 13s. 5d. This left an available surplus of £1072 15s. 2d. Now one of the first questions that arose upon the accounts was the values at which the investments were to be taken. He believed it was the practice of some trust companies to write-up securities that had appreciated in value, and to write-down those that had depreciated. The Directors had decided that they would not write-up any of the investments, and that when they had appreciated in value, as several of theirs had done in the course of the year, they would remain in the books at their cost. He felt sure the shareholders would approve this wise and prudent policy, which could but strengthen the future position of the undertaking. The Directors recommended, in pursuance of this policy, that £175 be written off sundry investments—three only in number—that had depreciated to that extent, or (he should say) had done so at the date of the report; for he was glad to mention that, since the report was issued, one of the three had been dealt in on the Stock Exchange at the very figure at which the Company had purchased. He hoped the depreciation in the other two securities might also prove to be equally temporary. The Board recommended the payment of a final dividend of 3 per cent. free of income-tax, making 5 per cent. for the period under review, and leaving to be carried forward £397 15s. 2d. This would have amply sufficed to write-off the balance of the formation expenses. But the Directors thought it was, on the whole, wiser to carry forward a substantial sum to the credit of next year's operations.

So much for the revenue. What, however, was more important was the position of the investments. They comprised twenty-one widely differing securities, or an average investment of £960. They had been selected with great care, and with a view to their being permanently retained. He (the Chairman) had gone through them carefully within the previous day or two; and he could see no reason at present why they should part with any of them. He was pleased to say they could all be realized in the course of a very short time—almost a matter of days—for a total sum exceeding by several hundred pounds the Company's total capital and liabilities. This, he hoped, would be considered a most satisfactory test of their stewardship. The investments included industrial and commercial securities of every sort spread over the world; and no calamity that could befall any one country or industry, or any one commodity, could vitally imperil the Company's position. The Directors had therefore done their part in making advantageous use of the capital entrusted to them. They hoped this would induce the shareholders to make the Company better known, and to make it a little more important than it was at present. The Company had paid all the stamp duty and registration fees on a share capital of £100,000. This was the sum the Directors had in view. They did not intend issuing any circular offering shares or debenture stock; but they would continue to entertain applications for shares and debenture stock to an equal extent until the present maximum of £100,000 of each class of security had been reached. He should mention that the accounts did not include any Directors' fees. When the Company was formed, the Directors unanimously and spontaneously agreed they would not accept any remuneration until the whole of the formation expenses had been written off, and the shareholders had received a 5 per cent. dividend. The latter had been already reached; and the Board hoped next year to take some remuneration for their services. The management of the Company's business had been exceedingly interesting to himself, as well as to his colleagues.

He might add that the creation of this Company represented the fulfilment of an idea he had entertained for at least twenty years, but which pressure of other claims on his time had compelled him to defer realizing until now. During the few years that might yet be spared to him, he should do his best to strengthen the position of the Company, and to promote its enduring prosperity, to the credit of its founders, and to the advantage of the shareholders, and all associated with it. He formally moved the resolution adopting the report and accounts.

Mr. S. R. CLARKE seconded the motion, which was unanimously carried.

Proposed by the CHAIRMAN, and seconded by Mr. A. F. PHILLIPS, a final dividend of 3 per cent.—making 5 per cent. for the period under review—was declared, free of income-tax.

The CHAIRMAN, in moving the re-election of Mr. S. R. Clarke to his seat at the Board, said that, during the year, they had had occasion on the Board to appreciate the care and prudence with which Mr. Clarke examined into the Company's operations. He (the Chairman) was certain that, as long as Mr. Clarke was on the Board, the shareholders might be assured that the Company's purchases would be made with the utmost caution.

Mr. PHILLIPS seconded the motion, which was cordially agreed to.

Mr. CLARKE having acknowledged his re-election,

It was moved by Mr. E. L. BECKINGHAM, and seconded by Mr. HARGROVE, that Messrs. Monkhouse, Goddard, and Co. be re-elected Auditors for the ensuing year, at a remuneration of 20 guineas.

The motion was passed.

Mr. BECKINGHAM proposed a vote of thanks to the Chairman and his colleagues for their valuable services in managing the Company with such care and prosperity. The shareholders hoped the Chairman's expectation as to the remuneration of the Board would be realized next year. They deserved it.

Mr. L. C. FAREBROTHER seconded the motion.

The CHAIRMAN, on behalf of himself and his co-Directors, sincerely thanked the shareholders for their kind appreciation of the services of the Board.

BRUSSELS MUNICIPAL GAS SUPPLY.

Statistics for the Past Year.

The current number of the "Journal des Usines à Gaz" contains the report of the Gas Committee of the Brussels Municipality for the past year, accompanied by the accounts. They furnish the following particulars. There was expended on capital account during the year a sum of 639,446 frs., the bulk of which was for a new holder, of about 2 million cubic feet capacity, brought into use in October. At the close of the year, the total expenditure on works and plant amounted to 33,758,518 frs. (£1,350,341). The total revenue was 7,500,578 frs.; and the expenditure, 5,360,301 frs.—showing a balance of 2,140,277 frs. Allowing 87,678 frs. for the decreased value of the stores, there was left a sum of 2,052,599 frs. (£82,104). The quantity of coal carbonized was 129,513 tons, in addition to which 2908 tons of coal were used for enriching purposes and for providing an auxiliary supply of gas. The total quantity of gas sent from the works was about 1635 million cubic feet, of which some 1423 millions were sold and 120 millions used for public lighting; the rest being burnt in the offices or unaccounted for. The quantity of gas sold per inhabitant was about 7310 cubic feet; the average price being 2s. 9d. per 1000 cubic feet. The number of meters in use at the close of the year was 45,125, or 1288 more than at the corresponding period of 1908. There were installed during the twelve months 597 prepayment meters; bringing up the total number to 5866. Altogether, 28,392 cooking, heating, and other gas-appliances and 351 gas-engines were in use at the end of the year. The mains were increased by about 9500 yards; making the total length 224,550 yards. For the public lighting 7562 lamps were employed, containing 7420 upright and 1393 inverted burners. After midnight, 1179 burners were extinguished.

PROGRESS OF VIENNA MUNICIPAL GAS UNDERTAKING.

The report of the Administration of the Vienna Municipal Gas Undertaking for 1909 is the tenth issued since the establishment of the Municipal gas-works; and the "Zeitschrift des Vereines der Gas- und Wasserfachmänner in Oesterreich-Ungarn" takes the opportunity to quote figures from it, and promises in succeeding articles to discuss the progress which has been made by the undertaking in the decade. A few figures from the exhaustive summary given in the pages of our Austrian contemporary may be reproduced.

Last year the City Council of Vienna decided to abolish the triple management of the undertaking which had hitherto prevailed, and, instead of having separate administration, works, and accounts managers, to place the whole undertaking under one manager. Considerable simplification of business resulted from the change. The gas made in the year 1909 amounted to 4,026,785,000 cubic feet, of which 3,329,440,000 cubic feet were coal gas, and the remainder, amounting to 17·3 per cent. of the total make, water gas. The output of gas was 5·07 per cent. more than in 1908. It is believed that this output would have been greater but for the exceptionally mild weather experienced in the second half of the year. The average make of gas per ton of coal carbonized was 10,992 cubic feet. The maximum number of retort-settings in use at any time was 170, and at the same time five settings of inclined large carbonizing chambers were in use. The average weight of a charge per retort was 381 lbs., and per carbonizing chamber 18,298 lbs. The raw materials used in the production of water gas amounted to 54·1 lbs. of coke used in the generators, 17·2 lbs. of coke used as boiler fuel, and 15·4 lbs. of gas oil, per 1000 cubic feet of water gas made. The tar produced in the water-gas plant amounted to 16·2 per cent. of the oil gasified. The production of coal tar amounted to 5·01 per cent., and of ammonia to 0·2523 per cent., of the weight of coal carbonized. The specific gravity of the gas distributed averaged ·459. The mean gross calorific power of the gas was 593 B.Th.U. per cubic foot.

The installation of inclined carbonizing chambers was extended during the year—the number of chambers being increased from 15 to 34; so that the productive capacity of the installation now amounts to about 2,825,000 cubic feet of gas per diem. Separate exhausting, tar-extracting, and purifying plant were provided for the water-gas installation, thereby liberating the portion of the coal-gas apparatus which had hitherto been used for the water gas. This was done in preparation for the extension of the carbonizing plant on the works to a productive capacity of 23 million cubic feet per diem. The erection of a gasholder of 5,300,000 cubic feet capacity, which was started in 1908, was completed, and the holder was brought into use last autumn. The holder stands in the open, whereas the earlier ones on the works are in houses; and it has a steel tank with bulged or arched sides. Additional transformers were added to the electrical plant on the works for transforming the alternating current of 5000 volts taken from the adjacent Municipal electricity works to direct current of 220 volts.

The gas made was accounted for as follows: Supplied to consumers through ordinary meters, 85·05 per cent.; through prepayment meters, 3·01 per cent.; to the corporation, 1·69 per cent.; for public lighting, 6·54 per cent.; for works' use, 0·54 per cent.; and unaccounted for, 3·17 per cent. Excluding gas used for public lighting, the consumption per head of the population amounted to 2892 cubic feet. The length of mains in the distributing system was, at the end of the year, 438½ miles, and the average diameter of the mains was 12½ inches. The number of ordinary meters in use at the end of the year was 113,783, and of prepayment meters 16,098. The number of prepayment meters had increased in the course of the year by 34·4 per cent. The number of street-lamps supplied with gas in the municipal area was 20,790, of which number 21 were equipped with single inverted burners and 1101 with two inverted burners. The rest had upturned burners. About half the street-lamps were kept alight all night and half only during the evening hours. The employees (including officers) of the gas undertaking at the end of the year numbered 1911. The surplus realized on the year's working amounted to 4,311,805·78 kronen (about £179,658), which is about £33,751 more than the surplus realized in 1908. After making allowance for insurance, depreciation, and interest, a net profit of 3,911,830·12 kronen (about £162,976) has been transferred to the municipal chest.

The progress which these figures for the past year represent in the working of the municipal gas undertaking since its inception ten years ago is to be discussed in the next article of the series in the Austrian Journal; and this will be dealt with in due course in our columns.

THE EXTENSIONS AT THE ILKESTON GAS-WORKS.

Official Inspection.

In the last number of the "JOURNAL," a description, with illustrations, was given of the extensions which have been carried out at the gas-works of the Ilkeston Corporation, from the plans and under the supervision of the Gas Engineer, Mr. F. C. Humphrys. An official inspection of the works was recently made by members of the Town Council, on the invitations of the Chairman and Vice-Chairman of the Gas Committee (Alderman F. Beardsley and Mr. W. Tatham). The party were conducted round the works by Mr. Humphrys, who fully explained the operation of the machinery. After the inspection, the company partook of tea.

At the close of the repast, Alderman Beardsley said he hoped, after what the visitors had seen, they would be satisfied that the money which had been laid out had not been spent foolishly. The extensions had been a big job; but the Corporation had as their Gas Engineer a good man, who never seemed to fail in anything that he had taken in hand. Mr. Tatham having offered a few remarks to the same effect, Mr. Humphrys said it might seem rather strange to have an official inspection of plant twelve months after it had been in operation; but it seemed to him that this had its compensations, because it proved that the plant had passed the experimental stage. The reason for there having been a certain amount of delay was because they had not been engaged in building entirely new works, but in remodelling old ones on a new plan. They were consequently handicapped in many ways. In some cases they had had to pull down work before they could even think of letting the next contract. The undertaking had comprised no less than twelve principal contracts; and it had not been possible to have more than three or four of them going at the same time. One important feature of the work completed was that it had not necessitated dispensing with the services of a single workman on the permanent staff. He made up his mind that the old hands should have the first opportunity of learning how to work the new machinery, and, if possible, to do so permanently; and the result was that the men they had seen working were those who fourteen months ago were employed using the shovel. The Mayor (Alderman C. A. Sudbury) said that, after seeing the result of all the money that had been spent, he thought they could congratulate themselves that they had obtained very good value indeed for it. Not only were they satisfied that they had this, and that therefore they would have in the gas-works an increasingly valuable asset, but they were also very pleased to hear from the Engineer that the labour had to a certain extent been "de-casualized," and that the conditions of working for the men had improved as well as the condition of the works. He concluded by proposing the health of the Chairman of the Gas Committee; and with Alderman Beardsley's brief response the proceedings closed.

Improved Public Lighting for Brentford.—At the last meeting of the Brentford District Council, a proposal was considered from the Gas Company in regard to street lighting. The Company offered to provide each lamp with a clockwork lighter and extinguisher, and to either alter the present lanterns or to fix new ones with inverted incandescent burners, without cost to the Council, provided the Council would enter into an agreement for ten years, based on the conditions of the one at present in operation. It was decided that the Company should be informed that the Council were prepared to determine their existing agreement, and to enter into a fresh one for five years, provided the Company carried out the work.

Lighting Display at Exeter.—During the "shopping week" in St. Sidwell Street, Exeter, which commenced last Thursday, a large part of the illumination was undertaken by the Exeter Gas Company; and Mr. S. Herbert, speaking as Chairman of the St. Sidwell's Tradesmen's Association, thanked the Company for the assistance they had rendered in the matter of lighting. Mr. Westlake, the Manager and Secretary, in reply, said the Company desired to co-operate with the traders in the "shopping week." The Company have erected a high-pressure gas installation at No. 29, in the above-named street, which, it is claimed, gives three times the light of the ordinary low-pressure burners for the same consumption of gas. There are six 500-candle power lamps outside the building, and they cost only ½d. each per hour for gas. The display is a very fine one.

IMPROVED PUBLIC LIGHTING IN MANCHESTER.

Important Installation of the Keith System.

Last Tuesday evening, there was brought into use for the first time an installation of high-pressure gas lighting in an important section of Manchester. With the view of being abreast of the times in the provision of improved lighting in the city, the Gas Committee some time ago arranged for the erection in the streets round the old Royal Infirmary site of 21 lamps fitted with Keith's high-pressure inverted burners. One of the lamps is suspended in a U-shaped bracket at the corner of Piccadilly and George Street; and the remainder, in harp-shaped brackets 6 ft. by 4 ft. 6 in., fixed on special pillars 12 feet high, have been set up in George Street, Parker Street, and a portion of Portland Street. Each of these 20 lamps, with bye-pass, consumes 25½ cubic feet of gas per hour, and gives a light of 1500-candle power. This is a considerable gain; but it falls far behind the light-giving power of the lamp at the corner of Piccadilly and George Street. In this case, a light equal to 3000 candles for a consumption of 51 cubic feet of gas per hour, including bye-passes, is given. Thus for a total consumption of 561 cubic feet per hour, the city has illumination equal to 33,000 candles. At twelve o'clock each night the high-pressure lamps are extinguished, and 21 low-pressure inverted lamps, which are suspended from swan-neck brackets fixed at the top of each pillar, will be lighted. Each of these lamps consumes 5 cubic feet of gas per hour, and gives a light of 100-candle power. The high-pressure lamps supersede 21 low-pressure ones which contained 55 upright burners, each consuming 5 cubic feet of gas per hour and giving a light of 80 candles. The new low-pressure lamps are 25 per cent. better than those hitherto in use. With regard to the high-pressure lamps, the public get from 561 cubic feet of gas per hour a light of 33,000 candles, compared with a light of 4400 candles with a consumption of 275 cubic feet per hour. The citizens get seven-and-a-half times more light for a trifle more than twice the expenditure of gas. The gas is compressed to 54 inches water pressure by a Keith rotary compressor coupled direct to an electric motor.

The new lighting was formally inaugurated by Alderman Gibson, the Chairman of the Gas Committee of the Corporation, in the presence of the members and chief officials, including the Superintendent (Mr. F. A. Price) and the Engineer (Mr. J. G. Newbigging, M.Inst.C.E.). At the close of the ceremony, the company returned to the Town Hall, where, under the presidency of Alderman Bowes, the senior member, Alderman Gibson was entertained at dinner, in commemoration of his services as Chairman of the Committee for seventeen years, and also in recognition of his personal qualities.

Prior to the dinner, a special meeting of the Committee was held—the Lord Mayor (Mr. Charles Behrens) in the chair—at which the following resolution was unanimously adopted: "That the hearty and sincere thanks of the members of this Committee be tendered to Alderman Robert Gibson, Justice of the Peace for the City of Manchester, for the able and valuable services he has rendered as Chairman of the Manchester gas undertaking for the long period of seventeen years, and to assure him of the high esteem and regard in which he is, and always has been, held by his colleagues on the Committee. The time that Alderman Gibson has unstintedly devoted to the interests of the gas consumers and ratepayers of the city has not been equalled in the history of the undertaking by any of his predecessors in the chair. When presiding over a meeting, he has ever been distinguished by his courtesy and fairness; and while showing every consideration for the opinion of those who differed from him, he has invariably succeeded, by tact and ability, in securing harmony in the deliberations of the Committee, and guiding the members to a right and just decision on questions of policy. While congratulating him on the continued prosperity of the Manchester Gas Department and on its present strong financial position, the members are proud to know that Alderman Gibson is regarded throughout the gas industry of Great Britain as an ideal chairman of a large undertaking. Every member of this Committee desires to express the hope that Alderman Gibson may, in the providence of God, be spared for many years to enjoy the confidence of his colleagues and of the gas consumers of the city of Manchester generally."

PUBLIC LIGHTING OF PADDINGTON.

The Question of Gas or Electricity.

At the Meeting of the Paddington Borough Council last Tuesday, the subject of the public lighting was again under consideration. It will probably be remembered that, at the meeting of the Council on the 4th inst., a report from the Works Committee, recommending improved gas lighting for the streets of the borough, was referred back for further consideration, with special reference to the prices charged by the Gaslight and Coke Company to the Hampstead Borough Council in their new contract, and with a view to getting a shorter contract [see *ante*, p. 143]. The Committee again reported in favour of lighting the streets by gas; and the Finance Committee likewise again reported favourably upon the question. The Works Committee stated in their amended report that they had acted upon the references of the Council by interviewing the Controller of the Sales Department of the Gaslight and Coke Company (Mr. F. W. Goodenough), and had obtained from the Company satisfactory assurances that the terms they offered to Paddington were even better than those quoted to Hampstead. They said the difference in the prices was more than accounted for by the following: (1) The extra cost of installing new lamps at Paddington, as against the conversion only of the old lamps in Hampstead; (2) higher candle power per lamp in Paddington than in Hampstead, involving extra consumption of gas; (3) the Company undertaking all responsibility for knocked-down lamps; and (4) the Company undertaking to light the lamps on foggy days, without extra cost. The Committee ascertained that the Company's offer was absolutely their lowest price; but that they might be disposed to consider the possibility of reducing the minimum contract period of five years to three, though five years was regarded as a very common period for such contracts. The Committee added that the Metropolitan Electric Supply Company, Limited, had written stating that they would be pleased to submit a tender for street lighting by electricity, on the understanding that their tender and that of the Gas Company were sealed, and considered by the Committee at the same meeting. In an interview which the Borough Surveyor previously had with the Electric Supply Company's Engineer, it was ascertained that the Company were not at present prepared to offer terms for the lighting of the whole of the borough with electricity, as it would be necessary to lay new mains for a further 25 miles, which would cost between £20,000 and £30,000 for mains only. The Engineer stated that his Company could offer a scheme for electrically lighting only about 35 miles of streets where mains already exist. The Committee gave instructions for the Company to be informed that they were unable to recommend the Council to pledge themselves in this manner, or to divide the borough for the purposes of lighting it partly by electricity and partly by gas. They concluded by recommending that, subject to the consent of the London County Council being obtained to the loan, the Council should enter into an agreement with the Gaslight and Coke Company for lighting the borough in accordance with the conditions mentioned in their letters of the 5th, 13th, and 25th of July, 1910, the two provisoes contained in the report of the Finance Committee [*ante*, p. 144], and the arrangements made by the Borough Surveyor with the Company's representative.

Mr. E. C. Elgood, the Chairman of the Works Committee, in submitting the report, explained that the difference in the price for the single-burner lamps in Hampstead and Paddington—viz., £2 12s. 6d. and £2 5s. respectively—was accounted for by the fact that new all-copper lanterns were to be provided by the Gas Company in Paddington, while in Hampstead the Company were going to convert the existing lanterns, adapting them to take the new inverted fitting. With regard to the proposal of the Metropolitan Electric Supply Company that any tender they might send in should be sealed, and dealt with at the same meeting as the offer of the Gas Company, he considered it a most unfair and unbusinesslike suggestion to make, and one which he could not recommend should be considered, seeing that the terms of the Gas Company had been made public.

Mr. Henwood opposed the recommendation, stating that, in his opinion, the reasons given by the Gas Company for the difference in the price for single-burner lamps in Hampstead and Paddington was only the half-truth. It was not necessary for the lanterns in the side streets to be "scrapped," as they were capable of taking the single inverted incandescent burners. He should like to ask the Chairman of the Works Committee if it was impossible to adapt the existing lanterns for the single burners.

Mr. Elgood said it was not impossible, but it was inadvisable.

Mr. Henwood then suggested that the matter should be referred back to the Works Committee to obtain prices from the Electric Supply Company for publicly lighting the portion of the borough where they have their mains laid.

Mr. E. S. M. Perowne, the Chairman of the General Purposes Committee, pointed out that, under the Standing Orders, the reference should have been sent to his Committee as well as to the Works and Finance Committees; and he claimed the right of having the report sent to his Committee. He thought the Electric Supply Company should have a chance, and that the Council should do their best for the ratepayers.

The report was eventually referred back to the Works Committee, with instructions to obtain estimates from the Metropolitan Electric Supply Company. It was also decided to send it to the General Purposes Committee.

PUBLIC LIGHTING OF WAKEFIELD.

Some discussion took place at the last meeting of the Wakefield City Council, in connection with the minutes of the Street Lighting Committee, which contained a recommendation that a number of new lamps should be erected in different parts of the city.

Alderman Atkinson, who asked if any of the proposed lamps were on the route of the electric cable, expressed the opinion that, in the case of lamps in new streets, &c., they should use electricity for lighting as far as possible. It would, he pointed out, be a hardship on the Gas Company to get them to erect a number of new lamps, and then in a year or two throw them on the Company's hands. He was certainly not in favour of abolishing gas-lamps wholesale. He noticed a statement had been made to the effect that the Gas Company received something like £4000 a year for public lighting in the city of Wakefield. He had inquired into this, and found the actual sum paid by the Corporation was something less than £3000. They should remember that the Gas Company paid the Corporation £3159 in rates; and a private firm would be chary of insulting such a customer. The Company also paid a large amount in wages, 75 per cent. of which found its way into the coffers of the Wakefield tradesmen.

Mr. Stonehouse said he was asked recently how much the Corporation paid for public lighting; and he replied that he thought the sum was about £4000, of which the Electric Lighting Department received £900. He believed the accounts would bear out this statement. He did not wish the Corporation to deal harshly with the Gas Company; and he did not advocate abolishing all gas-lamps straightaway, and substituting electric light in their place. But seeing that the electric light undertaking belonged to the Corporation, it ought to receive more support from them than it had done in the past. Alderman Atkinson had alluded to the rates the Gas Company paid. One might get the idea that the Company was a philanthropic undertaking, run for the benefit of the ratepayers of Wakefield. This heavy contribution to the rates of Wakefield was the result of the building up of a huge monopoly, at the expense of the Wakefield ratepayers. The Company had supplied a commodity that was wanted; and they had made a good profit on it. Let them not talk about their obligations to the Gas Company, for it was ridiculous. The wages paid by the Company were not paid from philanthropic motives, but from purely commercial instincts. He did

not wish any harm to the Gas Company. He hoped the undertaking would continue to prosper; but he did not wish it to prosper at the expense of a concern that belonged to the Wakefield ratepayers.

Mr. Cope said the Gas Company had always done very well in the matter of street illumination. Electric lighting was not yet perfect; and the Committee had tried to run the public lighting of the city on the best business lines.

Alderman Atkinson remarked that he held no brief for the Gas Company, and was only anxious to do that which was fair.

The minutes were adopted.

SALFORD GAS-METER RENT CHARGES.

Gas Committee Recommend their Abolition.

The Gas Committee of the Salford Town Council held a special meeting last Friday afternoon to consider the protests which have been made by gas consumers against the re-imposition of gas-meter rents. After a long discussion, the following resolution was agreed to: "That, in view of the strong feeling prevalent in the borough against the imposition of charges for gas-meter rents, this Committee recommend the Council to rescind so much of the resolution passed on June 22, 1910, as relates to gas-meter rents." This recommendation will come before the Council at their meeting to-morrow. Alderman Desquesnes had given notice that he would move the adoption of the following resolution at this meeting of the Council: "That it be an instruction to the Gas Committee to discontinue the charge for meter-rents as from the first practicable date; and should it be necessary to raise any further revenue in lieu thereof, in order to meet the increased cost of coal or of the administration of the gas undertaking, to so raise it by re-adjustment of the charges for gas in the usual way." As the recommendation of the Gas Committee is pretty certain to be adopted, in view of the widespread feeling of indignation expressed at public meetings and otherwise, to which reference has been made in the "Journal," there will be no need for Alderman Desquesnes to bring forward his motion. It is understood that those who have paid meter-rents in last quarter's bills will have the money refunded if the Council adopt the Gas Committee's recommendation.

A member of the Salford Gas Committee, in the course of an interview on Saturday, admitted that the resolution agreed to by the Committee the previous afternoon was in the nature of a "climb down." He said they had ample evidence that the great majority of the gas consumers were strongly opposed to the re-imposition of the meter-rent charges; and recognizing this, the Committee came to the conclusion that the best thing to do was to rescind the resolution passed at the June meeting. He also admitted that the Committee would now have to consider the question of raising the price of gas if they were to be in a position to meet their obligations. When the estimates were before the Town Council in the early part of the year, pressure was brought to bear upon the Committee to increase their contribution out of profits in relief of the rates; and this being so, they had to look for a means of augmenting the revenue of the Gas Department, especially as coal was going to cost them more in the current year. An additional reason for the re-imposition of meter-rents after sixteen years was that in the interval the number of consumers of electricity had greatly increased, all of whom practically kept gas-meters at their establishments merely for use in emergencies. The Corporation had a considerable sum invested in gas-meters; and the cost of inspection and maintenance was no small item per annum. Therefore the Gas Committee thought that, under the circumstances, it would be best to re-impose the rents; this being preferable to raising the price of gas.

GAS PROFITS AT KEIGHLEY.

The statement of accounts of the Keighley Corporation Gas Department for the year to June 30 was submitted by the Chairman of the Gas Committee (Mr. J. Harrison) to the monthly meeting of the Town Council. It showed that there had been a gross profit of £17,473; and after deduction of interest on loans and charges in respect of sinking fund, renewals, and insurance, there remained a net profit of £8493. Of this amount, it was proposed to transfer £6013 in relief of the rates. This left a balance of £2480, which, with the balance brought forward from last year's account of £8101, gave a surplus of £10,581. In addition to the sum which it was proposed to transfer in relief of the rates, the Committee recommended that £50 be given to the funds of the Keighley Victoria Hospital, £5000 transferred to the renewals and insurance account, and the balance carried forward.

The adoption of the statement and of the Committee's recommendation having been moved and seconded, Mr. Smith asked for consideration for the penny-in-the-slot meter users, who were charged 5d. per 1000 cubic feet more for gas than the credit customers. Alderman Howley moved an amendment to refer the recommendation back, with an instruction to the Committee to consider the desirability of giving a reduction to prepayment-meter users. Mr. Walsh seconded, and Mr. Midgley supported, the amendment; the latter also contending that a concern which was making £10,000 a year profit ought not to be paying 20s. per week to men who had been working for the Corporation for six or seven years. Mr. Whitehead said the Committee already had under consideration a reduction in the price of gas all round; and the members were fully alive to the various matters mentioned.

The amendment was carried, after more than half the members of the Council had spoken on it and several remarks had been made on the coincidence of this subject invariably cropping up on the approach of the November elections.

Borrowing Powers at Belfast.—The Belfast Gas Committee have decided to recommend the Council to include in the proposed Bill to be promoted in Parliament powers to enable them to borrow the sum of £100,000 for the general purposes of the gas undertaking.

ELECTRIC LIGHTING IN BERMONDSEY.

An Unprofitable Undertaking.

The Electricity and Street Lighting Committee of the Bermondsey Borough Council having proposed that application should be made to the Board of Trade for a Provisional Order authorizing the Council to supply electricity within the parishes of St. Olave (Southwark) and St. Thomas and St. John (Horsleydown), the subject was considered at a special meeting held last Tuesday. The district which the Council are desirous of supplying includes the large warehouses, wharves, and business premises in Tooley Street, which are now served by the County of London Electric Supply Company and the London Electric Supply Corporation.

In moving that the Council should agree to the proposal, Mr. J. W. Oake said the parishes named were anxious to enjoy the same blessings as the other parts of the borough; and the Committee had, by a large majority, decided to recommend that they should be linked up with them. Mr. E. Stickland, in opposing the recommendation, said that the area concerned was the richest part of the borough, and the Council were led to believe that the three parishes wished to be supplied by them. This was not true. They did not desire to be served by an undertaking which had been a charge upon the rates. It was a most unfair proposal to the poorer ratepayers, who had to make up any loss. They had had a good deal of experience in supplying three-fifths of Bermondsey, and had no wish to add to their burdens. The undertaking, as revealed by the accounts presented to the Council did not show that it was in anything like a flourishing condition. The total debt upon it was now £152,974. The total loans raised amounted to £170,000; and of this they had paid back only £12,000. The interest paid for loans and overdrafts had increased from £3654 in 1906 to £5458 in 1910. Only in the first year of the undertaking had they set apart any sum for a reserve fund, when they allocated £3000. For the past year, they could only show a surplus of £43 on a capital of about £152,000; and it seemed ridiculous that they could only produce such meagre results. It had been stated that the gross profits were equal to a dividend of 6½ per cent.; but the figures were illusive, as the Council had no depreciation account. The cost of generating current was 0·69d. per unit for establishment charges; but when they included repayment of loans and interest, it was 1·49d. per unit. Yet they were selling electricity at ¾d. per unit to some consumers. To counterbalance the loss, the Committee charged the Council 1¾d. per unit for lighting the streets, which meant an extra cost to the borough of £2000 to £3000 a year. The Companies' figure for producing electricity was 0·35d. per unit; and they were prepared to fight the Council tooth and nail in their application for the Order. Mr. F. Franken said an undertaking with a capital of £152,000, showing a profit of only £43 on the year's working, could only be described as "rotten." By 28 votes to 23 the Council decided to adopt the proposal of the Committee.

ASSOCIATION OF MUNICIPAL CORPORATIONS.

There was a large attendance at the autumn general meeting of this Association, which took place on the 7th inst., in the Whitehall Rooms of the Hotel Metropole. The *agenda* was not a long one; but the subjects dealt with included two on which much diversity of opinion was expressed by speakers—namely, Local Taxation and the Shops (No. 2) Bill.

Mr. A. H. Scott, M.P. (Vice-President), occupied the chair, in the unavoidable absence of the President (Mr. J. Harmood-Banner, M.P.); and he read the remarks which the latter gentleman would have made had he been present. In the course of these, Mr. Harmood-Banner pointed out that one matter introduced by the Government which had passed into law was the Municipal Corporations Amendment Act, which effected an important alteration in the constitution of town councils. Then there was a Private Member's Bill which, if it had passed, would have had a far-reaching effect. This was the Water Supplies Protection Bill, which was referred to a Joint Committee of the two Houses. The Association issued a full report on the Bill—pointing out that it would place very severe difficulties in the way of local authorities who were proposing to undertake water supply schemes. The Bill was absolutely one-sided; and it was a matter of considerable satisfaction to find that the views urged upon them prevailed with the Joint Committee, who reported against the measure. The question of finance had again engaged much of the time of the Association; and it would continue to do so until the Government were prepared to meet the requirements of municipalities. The Association had been largely instrumental in securing some relaxation in regard to the periods fixed for the repayment of loans raised for the erection of school buildings. They had pointed out that thirty years was an unduly short time for the repayment of such loans.

Local Taxation.

The Town Clerk of Wolverhampton moved "That, in view of the remarks made by the Chancellor of the Exchequer to the deputation from the Convention of the Royal Burghs of Scotland and to the deputation from the Urban District Councils Association, it be an instruction to the Law Committee to submit for the consideration and approval of the Council and of the Association a scheme for submission to His Majesty's Government containing, *inter alia*, definite proposals (*a*) for the broadening of the basis of taxation for local purposes, and (*b*) for the solution of the problems in relation to local and Imperial finance." He suggested that for this purpose there should be added to the Law Committee the names of gentlemen who had been on other committees which had dealt with the subject of local taxation. In local taxation, he pointed out, a man paid, not according to his ability, but because of his occupation of certain property which had a certain rateable value. There was no taxation whatever of personal property, and before any system of broadening the basis of local taxation could be adopted, it was needful to provide a uniform system of valuation throughout the country. What was needed was the broadening of the basis of

taxation; but how could this be done? Various suggestions had been made at different times; and one of these had reference to a further income-tax as a possible source of revenue—that was to say, on investments, profits, and official salaries. Of the taxable income of the country, more than £185,000,000 were now untaxed, owing to certain exemptions. There was a little reservoir here which might be tapped. They must transfer the national services; have further grants towards such expenditure; or add to the basis of the present income-tax by receiving money in that direction. Thousands of men who were deriving great benefit from good local government did not pay one penny piece into the local exchequer. They had received a courteous invitation from the Chancellor of the Exchequer asking the local authorities to assist him in a very difficult matter; and as representing the municipalities of England, it was the bounden duty of the Association to set to work and show him what, in their opinion, ought to be done to relieve the authorities in respect of financial affairs.

The Town Clerk of Liverpool seconded the motion.

The Town Clerk of Blackburn moved, as an amendment, that the Special Committee alluded to in the resolution should be instructed to take into consideration the invitation addressed by the Chancellor of the Exchequer to the local authorities to make proposals for the broadening of taxation and for the solution of the problems relating to local finance, and report to the Council of the Association thereon. The original resolution instructed the Committee to bring forward definite proposals; while the amendment asked them to consider the matter, and advise the Association. "Broadening the basis of local taxation" was a very comforting phase; but it meant one of two things. Either they were going to take from the Chancellor of the Exchequer certain taxes and devote them to local purposes, or they were going to propose fresh taxes. Were the Association prepared seriously to take upon themselves the onus and opprobrium of proposing fresh taxes? It was the Chancellor's duty to do this. Instead of making definite proposals straightaway as the resolution suggested, the Special Committee should report with regard to the Chancellor's invitation. It would then be open to the Council to say to the Chancellor, "We have sent you a statement of our grievances and what we want. If you wish to know how this money is to be raised, take out of your pigeon-holes the report of the Commission on Local Taxation and study that."

The Town Clerk of Salford seconded the amendment, which was carried by a substantial majority.

The West Ham Overdraft Case.

The Town Clerk of Leeds said he thought there had been a considerable amount of misapprehension as to what was the effect of the West Ham Corporation case with respect to bankers' overdrafts. It seemed to him it had decided nothing fresh. All corporations of the country agreed that borrowing powers must be exercised for the specific purposes for which they were granted, and for nothing else. Two extremely important points were not decided at all—in fact, the two that were of the greatest importance to municipal corporations. The judgment specially exempted these two questions. No decision was come to as to whether a corporation might obtain an overdraft on capital account from their bankers for a specific purpose, or as to whether a corporation might obtain an overdraft for revenue purposes. He believed that the majority of the councils had power in respect to the first-named matter; and many also possessed it in regard to the second—the Scotch corporations almost universally had it. There was, of course, a great deal to be said on this subject; and it wanted carefully considering. But he was not at all alarmed about the West Ham case. He moved that the question be referred to the Law Committee to take such action upon it as they might think fit.

The Town Clerk of Woolwich, in seconding, said the question was an important one, especially to those corporations who were engaged in municipal undertakings, where the provision of a large working balance was absolutely essential. The only satisfactory way in which they could obtain this balance was by securing a temporary overdraft upon revenue account. Otherwise they would have to raise at the expense of the ratepayers a large sum for a working balance; and this he considered a very unfair method of meeting the difficulty. He agreed that there was probably nothing fresh in the West Ham case; but what troubled them was not so much what had been expressly decided in this action, as the inference which might be drawn from the judgment.

The Mayor of Newport remarked that in his town they were face to face with the effects of this decision; and they would like something done as soon as possible.

The motion was carried.

Audit of Municipal Accounts.

The Mayor of South Shields said he had been requested by his Council to ask what steps had been taken by the Law Committee (in pursuance of the resolution of the Council on June 17, 1909) to have carried out the recommendations of the Municipal Trading Committee of 1903, in regard to the audit of municipal accounts; and, if necessary, having regard to the unsatisfactory nature of the present system of auditing by elective auditors, to move that the Government be urged to bring in a Bill to deal with this question. He remarked that his Council felt strongly that the continuance of the present system of elective auditors was undesirable and in the highest degree inefficient. They therefore wished to know whether the Law Committee had taken any steps to deal with the matter.

The Town Clerk of Wolverhampton, as Chairman of the Law Committee, replied that the question was referred to a Sub-Committee, who reported in July last. They were of opinion that the system of audit recommended by the Municipal Trading Joint Committee would be more satisfactory, both to the local authorities and the ratepayers, than either audit under the Municipal Corporations Act or by district auditors; and they therefore recommended that the Prime Minister and the President of the Local Government Board be invited to introduce a Bill giving effect to the recommendations of the Joint Committee on Municipal Trading of 1903, and that the Institute of Chartered Accountants and the Incorporated Accountants' Society be invited to support

the action of the Association. This resolution had been submitted to the Council and forwarded to the Prime Minister and others. Subsequently, a resolution was passed by the Association of Chambers of Commerce of the United Kingdom to the effect that, in view of the recommendations of the Joint Committee of both Houses of Parliament in 1903, in regard to the abolition of the Local Government Board audit and the system of elective auditing, the Association desired to express regret that no action had been taken to put the recommendations into force, and respectfully urged the Government to bring in a Bill at the earliest opportunity to give effect to the Committee's recommendations.

The Mayor of South Shields expressed himself as satisfied with this explanation.

Several other items of no particular interest to "Journal" readers were discussed; and the proceedings terminated with a vote of thanks to the Chairman.

WATER SUPPLY OF LIVERPOOL.

At the final Meeting for the municipal year of the Liverpool Corporation Water Committee, a cordial vote of thanks was passed to Colonel Porter, the Chairman, for his services during the past twelve months.

Colonel Porter, in response, said it would be impossible for him to occupy such a responsible position with success but for the support he had received from the Deputy-Chairman (Major Denton) and every member of the Committee. He was sure they had shown him particular indulgence during his first year of office, considering that he had followed ex-Alderman Burgess, who occupied the position for so many years, and was so cognizant with the work. The total quantity of water supplied during the 52 weeks ending Sept. 24 to Liverpool and the out-townships, and including Chorley, amounted to 11,932,082,000 gallons; being an increase of 16,823,000 gallons on the corresponding period of the previous year. The population now supplied with water from the works of the Corporation was about 1,133,000; and it continued to grow steadily at the rate of 12,000 per annum. The number of new houses supplied with water during the past year in the Liverpool district was 2320, exclusive of new houses beyond the Liverpool district in places supplied in bulk. There was an increase of 42,000,000 gallons in the quantity supplied by meter for trade purposes, which was very encouraging, seeing that the previous year showed a decrease of 147,655,000 gallons. There were indications that between now and the end of the current financial year there would be still further improvement in trade consumption. The supply to shipping, on the other hand, was disappointing, showing a small decrease of 4,620,000 gallons; but the demand had been improving during the last month or two. The extension and relaying of iron pipes during the year was equal to 61 42 miles, or little more than half the mileage of the previous year—showing that fewer new streets had been laid out. As to afforestation, they had been proceeding steadily, having planted at Rivington during the year 363,863 trees of various kinds. It had been found that the Rivington area was particularly favourable to the production of birch; and they had therefore planted nearly double the number of birch trees than that of any other one variety. At Vyrnwy, they had planted 205,600 trees; the Douglas fir here taking the place of birch, as that variety gave the best results. The ordinary work of the Committee, which was constantly growing in importance, had gone on smoothly during the year; the principal event being the completion of the Marchnant diversion. Although this was only one of many great engineering works successfully carried out in connection with the water undertaking by Mr. Joseph Parry, their Engineer, ably seconded by his staff, yet, as it marked the completion of their great works at Vyrnwy, it was thought fitting to celebrate it in an especial manner; and the gracious visit of the Prince of Wales, now His Majesty the King, to Lake Vyrnwy on March 16, had, among other good results, had the effect of bringing prominently before the country the excellence and abundance of the water resources of Liverpool, and would make the year 1910 for ever memorable in the annals of the Corporation and of the Committee.

BRAMPTON WATER SUPPLY.

Inauguration of Reservoirs.

The new water-works for the supply of the district of Brampton, which have been under construction for some time past, have lately been inaugurated; the water being turned into the reservoirs by Mr. William Dobson, the Chairman of the Brampton Rural District Council, in the presence of a large company of local representatives and other gentlemen. The scheme is an extensive one; the district served covering 40 square miles, and there being 32 miles of pipes. The water is supplied under agreement originally by the Carlisle Corporation; and the reservoirs lately inaugurated have been constructed to receive it. One is at Garth Head, Castle Carrock, about four miles from Brampton; and into this the water is pumped, to a height 670 feet above sea level, from the Corporation's reservoir. The other is at Cowran, at a height of 440 feet, and the water enters this direct from the main. The Engineers of the scheme were Messrs. Taylor, Wallin, and Taylor, of Newcastle-on-Tyne.

On the occasion of the inaugural ceremony, a description of the works was given by Mr. W. Wallin, representing the Engineers. He said that ever since 1892, the water supply of the parishes of Castle Carrock, Hayton, Brampton, and Irthington had received the deliberations of the Rural District Council. Difficulties had to be overcome; and it was not until 1897 that the Council were able to definitely decide that the most satisfactory scheme for the Brampton portion of their district was a comprehensive one, to include all the local villages.

In February, 1898, Mr. Harry W. Taylor, the senior member of the firm he represented, was instructed by the Council to prepare a scheme of water supply for the districts; and in April, 1898, it was adopted. It consisted of tapping certain springs in Geltsdale, and was provisionally sanctioned by the Local Government Board in May of the same year. But by the passing of the Carlisle Water Act, 1899, the Carlisle Corporation obtained powers to take the water from the springs selected as part of their undertaking, and agreed to furnish a supply of water in bulk to the Brampton Rural District Council. Consequently the original scheme had to be revised, and the one now carried out was the result. In February, 1909, tenders were advertised for, and a commencement was made with the actual construction in the middle of June. The estimated population to be supplied was about 4000; but to this should be added a supply for the farms for agricultural purposes. The water was supplied to the Rural District Council by the Carlisle Corporation, in accordance with the undertaking given in their Act, at two points—at the Garth Head reservoir and at the Cowran reservoir. The former had a capacity of 97,500 gallons; and the latter would hold 75,000 gallons. There were three service reservoirs. The chief feature of these reservoirs was that they had been constructed of reinforced concrete. The estimated cost of the works was £15,700, and they had been carried out for £15,400, or a saving of £300.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards offered for sale, by order of Directors, 1000 new ordinary £10 shares (5 per cent. maximum) in the Southend Water-Works Company; the dividend on similar shares for the year ended Dec. 31 last having been 4½ per cent. They were all sold at £10 to £10 5s. each. On the same occasion, some £10 fully-paid original ordinary 10 per cent. shares in the North Middlesex Gas Company fetched £21 each; and some additional ordinary shares of the same nominal value, but carrying 7 per cent. dividend, £14 15s. to £14 17s. 6d. apiece. A parcel of £200 of "A" 10 per cent. stock of the Hornsey Gas Company, carrying 12½ per cent. dividend, was sold for £247 10s. per £100; and £400 of 5 per cent. preference stock, at £116 per £100. Under instructions from trustees, some fully-paid £10 "B" preference shares (5 per cent.) in the Dorking Water Company fetched £12 to £12 2s. 6d. each. Next day, Messrs. Craske and Sons sold at Colchester a few original £20 shares in the Colchester Gas Company, on which 10 per cent. has been paid for many years, at £47 15s. and £48 apiece.

In the list of receiving orders made in London under the Bankruptcy Acts, 1883 and 1890, in last Friday's "Gazette," the name appears of Edward Oxenford Preston, described as a financier carrying on business at Tokenhouse Buildings, E.C. Readers of the "JOURNAL" are not altogether unfamiliar with the name.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The accounts of the Gas Department of the Corporation of Kilmarnock for the year which ended on May 15 have been issued. It is shown that the capital expenditure during the year was £12,429, which brought up the capital outlay till now to £113,074. The quantity of gas manufactured last year was 175,325,500 cubic feet—an increase of over 11 millions. This is the largest quantity ever sent out from the works in one year, the next highest having been in 1908, when the output was almost 120 millions. The coal carbonized amounted to 18,403 tons, which cost, on an average, 10s. 7d. per ton—a decrease of 5d. upon the previous year. The yield of gas per ton of coal was 9500 cubic feet—a decrease of 66 cubic feet. Unaccounted-for gas amounted to 17,373,662 cubic feet, equal to 9·9 per cent., as compared with 7·2 per cent. in the previous year. The gas sold thus amounted to 157,951,838 cubic feet—an increase of 5½ millions. The prices of gas were: To ordinary consumers, 2s. 6d. per 1000 cubic feet; to prepayment meter consumers, 2s. 8¾d.; for gas-engines, 2s. 1d.; and for public lighting, 2s. 3½d. The revenue from gas was £20,568—an increase of £945. From ordinary consumers living within the burgh there was derived £13,686; from the prepayment meter consumers, £2412; from gas-engines, £890; and from public lighting, £1619. The revenue from tar was £2647, and from tar and sulphate of ammonia £3650. The expenditure amounted to £22,885, of which £9750 was for coal, £24 for benzol, £394 for lime, £1153 for maintenance of works, £4366 for wages, £2623 for distribution of gas, and £1424 for rents, rates, and insurances. The balance carried to the net revenue account amounted to £4514. From this sum there was paid £2519 in interest, and £1652 to the sinking fund, which now totals £3987. There was received from the hire of gas-stoves, fires, &c., £288. During the year, £3400 was written off the value of the old works, reducing the value to £8498. The value of the new Riverside works is stated to be £59,686. The value of meters, after allowing 10 per cent. for depreciation, is put at £1772. The expenditure upon gas-stoves, &c., during the year was £1325, raising the total under this head, to date, to £5153. An allowance of 10 per cent. is made upon them for depreciation; and the present value of cooking and heating appliances is entered at £3720. The accounts reveal that in ten years the annual output of gas has increased by 50 million cubic feet.

Bailie Bogle, the Convener of the Gas Committee of the Falkirk Corporation, in addressing the electors in the course of the present municipal election, sang the praises of the Gas Department in no unmeasured tune. He said that when they acquired the gas undertaking they had 4000 consumers, and sent out 78 million cubic feet of gas in a year; now they had 9000 consumers, and sent out 200 millions. The price of gas was now at the very lowest it had ever been. Two years ago there was an outcry over the gas-works; and he wished to state that he adhered entirely to every statement he made then regarding the works.

Subsequent events had proved these statements to be correct. On May 15, 1908, they dispensed with what at that time had been the cause of all their troubles—a machine called a hot-coke conveyor. It had been intended to do good work, and probably would have done so if it had not been for disadvantageous circumstances. The retort-bench, on which the conveyor was hung, sank very considerably. The machine was the cause of the gas-works losing £5000. Its cost was £2200. In the year ending May 15, 1908, through bad stoking, caused by the men being unable to stoke so well by hand as had been done since by machine, the balance-sheet for the year showed a loss of £2456. It spoke volumes for the way in which the gas-works had been administered that they had been able to wipe off all their financial difficulties. There was no works in the district in which everything was so well managed, or in which the organization was so perfect. In May last, the capital outlay on the gas-works had been £207,000, for the redemption of which they had laid aside £40,000; leaving their indebtedness at £167,000. They paid yearly into their sinking fund £4500, the compound interest upon which doubled it in 21½ years. In 21½ years they would have from these yearly instalments of £4500, with compound interest, a sum of £187,750, which would be £20,750 more than they required to pay off their capital. They had, in addition, the Parkhouse, Grahamston, and canal bank sites (valued, say, at £10,000), which would make the credit balance £30,750. In 14¾ years, therefore, their savings would equal the net capital expenditure—and that not taking into account increased business and increased profits. In 14¾ years, he hoped that Falkirk would be in the happy position of having that large industrial undertaking standing in their books free. They had to meet £12,000 per annum—£7500 in interest, and £4500 as the yearly contribution to the sinking fund—representing 1s. 5d. per 1000 cubic feet of gas. At the end of 14¾ years this would be wiped off, and then the community would get gas at the cost of putting it into the holder, which at present was 11·48d. per 1000 cubic feet.

A special meeting of the Kirkcaldy Town Council was held on Tuesday for the purpose of considering a proposal to extend the time within which the Gas Arbiters may determine the matters referred to them till three months after the 31st inst., which is the time fixed by agreement. Doubt was expressed by more than one member of the Council as to the desirability of giving more time for the running up of expenses; but Mr. J. Wright, the Convener of the Gas Committee, explained that it was entirely on behalf of the town that the extension of time was asked. The Gas Company officials wanted the arbitration to have taken place on Oct. 17; but the town's Arbiter, knowing that he had not the case up in proper form, considered it necessary to have the time extended. They did not want their representative to go on without a proper case. "If they did so, the Company would declare a price, and the town would have to pay, and there would be no more about it." The Town Clerk favoured an extension of time; and the Council then unanimously agreed to it.

An unfortunate litigation about shares in the Cowdenbeath Gas Company, Limited, has been originated in the Court of Session. The pursuers, Mr. Alex. Waddell, of Dunfermline, and Mr. Forbes Waddell, Manager of the South Queensferry Gas Company, Limited, sue Messrs. James Hutton, cashier, 70, Polwarth Terrace, Edinburgh, and G. B. Tweedie, solicitor, Edinburgh, for £1010. In 1901, it is stated, the pursuers and Mr. Hutton acquired a controlling interest in the Cowdenbeath Gas Company, Limited. Mr. Hutton was appointed Chairman of the Company, and Mr. Tweedie was Law Agent. It is averred that, in terms of the agreement between them, when new shares in the Company were issued, the pursuers were entitled to a proportion of the new shares at par, and that in 1906 they should have had allotted to them 101 new shares of £10 each at par. As the shares of the Company have been selling at £20 each, they claim to have lost, by failure to allot to them, £10 per share. In defence, it is disputed that the agreement required that the pursuers should have part of the new shares allotted to them. Lord Mackenzie closed the record on Thursday. As his Lordship has been since transferred to the Inner House, the further hearing of the case will be before Lord Ormidale, his successor in the Outer House.

The Cowdenbeath Gas Company, Limited, somewhat more than a year ago became Contractors for the supply of gas to the village of Crossgates; their offer being preferred to that of the Corporation of Dunfermline. In giving the supply last winter, it was found to be difficult to maintain a satisfactory pressure; and to remedy this, a compressing plant, by the Bryan Donkin Company, Limited, has been fitted up at the gas-works, at a cost of over £200. It is reported to be working satisfactorily.

Gas exhibitions may be expected to "catch on" now that the Smoke Abatement Exhibition in Glasgow has concluded so successfully. An exhibition was opened in the Town Hall, Greenock, on Tuesday evening, and will be continued till Tuesday next. Bailie J. H. Taylor, the Convener of the Gas Committee, was in the chair, and the opening ceremony was performed by Provost M'Millan. The area of the hall has been filled with exhibits by various firms of gas lighting, heating, cooking, and labour-saving appliances. Examples are given of high-pressure gas lighting. Specimens of the smokeless fuel known as "Coalexld" are shown; and in the saloon artistically furnished residential rooms are lighted and heated by gas. Admission to the exhibition is free. Lectures and demonstrations in cookery are given by Miss E. M. Dods.

On the evening of last Wednesday, an accident occurred in the Corporation gas-works at Dumfries, through the unintentional production of a large quantity of acetylene gas and its ignition. Four men had been at work upon new machinery which is being introduced into the works. In the darkness, they obtained light from an acetylene torch. When they had finished their work, they proceeded to put out the light, the mode of doing which was to take the vessel containing the carbide out of the water. Just as it was lifted clear of the water, the bottom of the vessel gave way, and the carbide falling into the water a great quantity of gas was at once generated. This was ignited; and the four men were all burned somewhat severely.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 22.

Sulphate of Ammonia.

Although the demand direct from consumers has fallen away to some extent, the week's requirements have been ample to absorb current production, and the keen competition for all parcels placed on the market has been continued at still hardening prices. At the close, the quotations for prompt delivery are £13 to £13 1s. 3d. per ton f.o.b. Hull, £13 1s. 3d. to £13 2s. 6d. per ton f.o.b. Liverpool, and £13 3s. 9d. to £13 5s. per ton f.o.b. Leith. For delivery this year and the first half of next year, manufacturers are very firm in their ideas, and decline to make sales unless they can realize approximately spot values; but for July-December, 1911, they would accept a substantial discount. Buyers, however, do not show much disposition to operate beyond the near position.

Nitrate of Soda.

The market for this article is still unchanged in either tone or value, and the quotations on spot remain 9s. $4\frac{1}{2}$d. to 9s. $7\frac{1}{2}$d. per cwt. for ordinary and refined qualities respectively.

LONDON, *Oct.* 24.

Tar Products.

The markets for tar products have been steady during the past week, though there has been rather an easier feeling all round regarding pitch. Business was done early in the week at one of the best ports on the east coast at 36s.; and since then some quantity has changed hands at 34s. In London, the principal sellers are practically out of the market; being exceedingly well sold, and under no necessity to place any further quantity for some time to come. They are asking 40s., which to all intents and purposes is a nominal price. It would, however, be possible to secure some small quantity of London pitch at 35s. to 36s. per ton. On the west coast, Scottish pitch makers are still very firm in their ideas; being pretty well sold. There has been a slightly easier feeling even here, as it is now possible to buy at 36s. 6d. to 37s. In Manchester, the majority of makers are asking very high prices, also Liverpool; but there are second-hand sellers at considerably under their figures. Benzol, 90 per cent., is firm, and for prompt delivery is fetching good prices; 6d. having been paid on the east coast in buyers' drums. In London, it is understood that 7d. is asked. Fifty-ninety per cent. benzol is steady; but there is not very much inquiry for same. Toluol is quiet, and consumers appear to be quite easy; while makers are well sold, and are quite prepared to wait before placing any further quantity. Solvent naphtha is unchanged; but it is still difficult to do business in London except at low prices. Heavy naphtha is steady, and consumers are offering $11\frac{3}{4}$d. for delivery all over next year; but makers decline to accept less than 1s. Carbolic acid is unchanged. Creosote continues very quiet. In the North, sales have been made at $1\frac{7}{8}$d. to 2d. at makers' works; while for delivery to consumers, $2\frac{1}{4}$d. has been pretty generally accepted, and in one case even under this figure.

The average values during the week were: Tar, 17s. 9d. to 21s. 3d. *ex* works. Pitch, London, 35s. to 35s. 6d.; east coast, 34s. to 35s.; west coast, 37s. to 38s. 6d. Clyde ports, 34s. to 35s. Manchester, 34s. to 35s. Liverpool. Benzol, 90 per cent., casks included, London, $7\frac{3}{4}$d. to 8d.; North, $7\frac{1}{2}$d. to $7\frac{3}{4}$d.; 50-90 per cent., casks included, London, $7\frac{3}{4}$d. to 8d.; North, $7\frac{1}{2}$d. to $7\frac{3}{4}$d. Toluol, casks included, London, 9d. to $9\frac{1}{2}$d.; North, 9d. Crude naphtha, in bulk, London, $3\frac{3}{4}$d. to 4d.; North, $3\frac{1}{8}$d. to $3\frac{1}{4}$d.; solvent naphtha, casks included, London, $11\frac{1}{2}$d. to 1s. $0\frac{1}{2}$d.; North, 11d. to 1s.; heavy naphtha, casks included, London, $11\frac{3}{4}$d. to 1s.; North, $10\frac{1}{2}$d. to 11d. Creosote, in bulk, London, $2\frac{3}{8}$d. to $2\frac{1}{2}$d.; North, $1\frac{7}{8}$d. to $2\frac{1}{8}$d. Heavy oils, in bulk, $2\frac{3}{4}$d. to $2\frac{7}{8}$d. Carbolic acid, 60 per cent., casks included, east coast, 1s. $0\frac{1}{2}$d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 50s., bags included. Anthracene, "A" quality, $1\frac{1}{2}$d. to $1\frac{3}{4}$d, per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been very firm throughout the past week, and prices finish at top practically. The principal Gas Companies are now quoting £12 12s. 6d. in any position, and state that they would find considerable difficulty in supplying prompt parcels. Ordinary London makers are asking £12 7s. 6d. to £12 10s. In Hull, £13 1s. 3d. to £13 2s. 6d. is about the value, and in Liverpool the same. In Leith, what little there is to be obtained could certainly not be secured at anything under £13 5s.; but the majority of makers are known to be sold out for this month. In Middlesbrough, £13 2s. 6d. is about the value.

COAL TRADE REPORTS.

Northern Coal Trade.

The demand for both steam and gas coals has shown a little improvement; but there is an ample supply in most classes. In the steam coal trade, the request is fair for this season. Best Northumbrians are quoted from 9s. 6d. to 10s. per ton f.o.b., second-class steams from 8s. 3d. to 8s. 9d., and steam smalls from 5s. 3d. to 6s. 6d. There is a steady output at the collieries, and the demand is a little fuller than it was. In the gas coal trade, the demand is now more rapidly increasing; and deliveries on the long contracts are heavy. Prices of Durham gas coals vary according to the quality. The usual classes are from 8s. 6d. to 9s. 9d. per ton f.o.b.; while for "Wear specials," up to 10s. 3d. is quoted. One or two contracts are announced; but they are for quantities that are small in comparison with those reported last week. There are offers for coal for some of the Italian ports; but the prices do not tempt sellers just at the present time, as the running contracts take up much of the output, and the quantities under these will be increased to the end of the year at least. In coke, the trade is brisk; but the larger output of gas coke keeps its price easy at 13s. 6d. to 13s. 9d. per ton f.o.b. for good quality.

Scotch Coal Trade.

The better side of the coal market is the foreign. The home market is affected by the indecision which continues to hang over the shipyard industries. This is expected to be soon overcome; but in the meantime it has a deadening influence upon trade. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 329,337 tons—a decrease of 11,393 tons upon the previous week, and of 4197 tons upon the corresponding week last year. For the year to date, the total shipments have been 12,785,550 tons—an increase upon the corresponding period of 698,463 tons.

Public Lighting of Petersfield.—At the last meeting of the Petersfield Urban District Council, the Clerk (Mr. W. H. Robins) reported that Mr. J. H. Lyon's term of appointment as gas inspector had expired. The Chairman (Mr. C. W. Seward, J.P.) said he thought there had been a very great improvement in the lighting of the town generally speaking, and that it would be a wise thing for the Council to reappoint Mr. Lyon. It was unanimously decided to do this, on the same terms as before. The gas is supplied by the Petersfield Gas Company, of which Mr. F. E. Pye is the Manager.

Responsibility for Maintaining Water-Pipes.—Referring to the case of *Parnell v. Portsmouth Water-Works Company*, reported in our "Legal Intelligence," a local correspondent writes: "The success of the Company's appeal has created some astonishment, as householders at Portsmouth have always regarded their responsibility for repairs as being confined to pipes actually within the house; and this was borne out by the fact that a former Engineer of the Company actually refused to give permission to a consumer to have a turnkey for the tap which the Company some years ago had placed at the outer wall of every house in the borough."

Proposed Combination in the Scottish Tube Trade.—The following remarks appeared in a leading Scottish newspaper last Saturday: "Negotiations are stated to be on foot for the amalgamation of nearly all the principal Scottish iron and steel tube manufacturing companies into one concern. For some years competition in the trade has been excessively keen, profits have been at the vanishing-point, and the present movement is a reaction from that state of affairs. Eight or ten companies were represented at a conference on the subject held in Glasgow yesterday. Proposals were submitted and discussed at much length, and after protracted proceedings the meeting adjourned to allow opportunity for consideration of amended proposals. Matters, however, have not yet reached a stage at which it can be said with any confidence that the scheme will be realized." In another newspaper the announcement concludes with this remark: "If a Scotch combination is successfully brought about, the next move will be to approach English makers with a view to an Anglo-Scotch combination."

Gas for Improved Public Lighting at Faversham.

The General Purposes Committee of the Faversham Corporation discussed last Tuesday the subject of the improved lighting of the London Road. The Surveyor (Mr. S. P. Andrews) reported that the initial cost for the erection by the Gas Company of five lamps would be £4 5s. each (£21 5s.), and the annual charge for gas, maintenance of mantles, &c., £3 8s. per lamp. The lamps would have Sugg's latest type of inverted burners, each giving a light of 108-candle power; and they would become the property of the Corporation. Reporting upon the proposed adoption of electricity, the Surveyor said the cost of laying the cable would be £220, the annual charge for current and maintenance would be £4 per lamp, and each lamp would be of 100-candle power. On the line of the cable there were already six gas-lamps which would be converted if electricity were decided upon. The income from the eleven lamps would amount to £44; and another £10 might be added as probable income from private consumers. Alderman Child said the Council were faced with the fact that for £3 8s. they would get a better article than they would get for £4—a superior light at 12s. less cost. Under these circumstances, it must be best for the ratepayers to adopt gas; and he therefore moved that gas-lamps be supplied. Mr. Johnson proposed, as an amendment, that the Council do the lighting by electricity. He said that, allowing £10 as interest on the capital outlay of £220, there would be a clear income of £34 from the new lamps. Beyond this, they would be in a position to supply current to private consumers along the London Road, which they were not able to do at present. On the amendment being put, the voting was equal. It was then suggested that the matter should be deferred till another meeting, when there might be a larger attendance. Eventually, however, the Mayor (Mr. T. G. Gillett), who is the Chairman of the Electric Light Committee, gave his casting vote for gas, as the Council were, he said, practically agreed that this was best for the public lighting.

Collection of Water-Rents from Small Properties.—A long discussion took place at the last meeting of the Redruth District Council on the question of the collection of water-rents from small houses. The Water Committee recommended that, in the case of houses of not more than £10 annual value, the rents should be collected from the owners instead of the occupiers where the latter neglected to pay, and that the owners have notice to this effect. Considerable opposition was offered to the proposal, on the ground that it involved discrimination between the different owners of small property, and would entail on some the hardship of having to pay water-rents which should have been paid by the tenants. On the other hand, it was said that the amounts in many cases were so small as to be hardly worth collecting, and that about 100 persons each year did not pay. The remedy of cutting off the water was objectionable from a sanitary point of view. A majority of the Council, however, rejected the proposal to collect the money through the owner.

Still Another "Eaton" Concern.

Under this heading, the "Financial News" last Friday called attention to the issue by the Secretary of the Patent Block Tar, Motor Oil, and Asphalte Company, Limited (Mr. E. T. Leaver), of a circular stating that he has been instructed, on behalf of the owners, "to offer for sale some shares in this (the parent) Company, owing to the vendors having taken nearly the whole of the purchase money due to them in shares, and are realizing some to further financially assist the Company until completion of negotiations now pending to acquire the present Company's interest, when each shareholder would receive about £2 in cash or shares for every £1 share now purchased." Mr. Leaver explains that "a draft scheme of the intended larger Company is under consideration, under which it is the intention to put up new works in England and abroad to produce under the Syndicate's patent process, at first, about 100,000 tons of material yearly, which the Company's representative reports he can himself book orders for, and which he estimates would result in a net profit to the Company of about £15,000, which on a capital of £50,000 would provide dividends of 30 per cent.; leaving about 2 million gallons of oil recovered under the patent process—an important saleable asset. As soon as the intended works can be erected I believe the shares will be unobtainable except at a high premium, as instanced by reference to the enormous value of the original shares (such as are now offered) of other parent companies holding patents for a monopoly on which large industries have been built up; and meanwhile the sellers guarantee interest on the shares you may purchase at the rate of £10 per cent. for twelve months, payable in advance, by which time it is expected the new Company will be formed and a considerable profit received upon the shares now offered." Our contemporary points out that the Directors of the Company are Sir C. B. H. Soame, Bart., and Mr. H. W. L. Way, and adds: "They should be able to co-operate effectively, since they have both been on the directorate of the Water and Gas Debenture and Share Investment Trust, Limited, in company with no less a person than Mr. Eaton himself."

Slough Water-Works Purchase.—The Slough Urban District Council have unanimously decided to proceed with the purchase of the undertaking of the Slough Water Company, and to promote in the next session of Parliament a Bill authorizing them to do so. In the Slough Water Act of this year, the Council got a clause inserted giving them the right of purchase provided they promoted a Bill for the purpose within a certain period.

The Recent Road Subsidence at Slough.—As an outcome of the road subsidence at Slough on the 30th of August, the Town Council have received from the Water Company a claim for £29 16s. 9d., made up as follows: Repairing broken main, £3 11s. 9d.; hire of horses, 19s. 6d.; estimated waste of water, 96,000 gallons, at 1s. 6d. per 1000 gallons, £7 4s.; surveyor's and engineer's fees, £18 1s. 6d. The last item, compared with the first, seems extraordinary.

Bucks and Oxon District Gas Company, Limited.

A creditors' petition presented by the Vulcan Stove Company, Limited, for the compulsory winding-up of this Company, came before Mr. Justice Neville last Tuesday. Counsel stated that the petitioners were judgment creditors for £398, and were supported by debenture-holders to the amount of £5000. The Company was incorporated in May, 1907, for the purpose of supplying gas to certain districts in Bucks and Oxon. In June last, resolutions were passed for voluntary liquidation and the appointment of Mr. White as liquidator. On the 12th of July, a meeting of creditors was held, at which it was resolved unanimously that it was desirable the Company should be wound up compulsorily. The petition had the support of the Liquidator. His Lordship asked whether the petition made a case for compulsory liquidation. Counsel replied that it did, and said it was presented after the resolution had been come to for voluntary liquidation. There was no opposition to the petition; and there was no appearance for the Company. His Lordship made the usual order for compulsory liquidation.

Portchester Water Supply.—The required public supply of pure water to Portchester is still under discussion; and at a recent parish meeting a computation was given that this could be obtained from the Portsmouth Water Company by laying a main along two miles of road. The cost would probably amount to £1200; and the consumption of water daily is estimated at 16,000 gallons. The Fareham authorities, who govern the district, affirm that the expense of laying mains from the town would be too great for them to undertake the work.

Troon Water Supply.—The Town Council of Troon have just inspected their new water-works at Loch Bradan. The loch is being raised 8 feet above its normal level, and, after junction with an adjoining loch, will give a storage capacity of 400 million gallons. The valve tower and screening chamber of granite and whinstone are finished; and a concrete breastwork, founded on the solid rock, is nearing completion. The new water supply is expected to be available in six weeks' time. The pipes, which are now all laid, pass through Dalmellington, Patna, and Waterside.

Beverley Water Supply.—At a recent meeting of the Beverley Town Council, it was reported in the minutes of the Gas and Water Committee that the Manager had submitted particulars of a trial bore put down in the proposed new site for the water-works, together with a report upon the result of a chemical analysis of a sample of water taken from the bore, which showed it to be of a very satisfactory quality. The result of the bacteriological analysis had not been received. The Committee resolved that the particulars of the boring and analysis be forwarded to Mr. Baldwin Latham, and that, subject to his approval, he be requested to prepare the necessary specification and drawings for the proposed new well; that tenders be invited by advertisement for the execution of the work; and that the Town Clerk obtain quotations for a proposed advance of £2711 for carrying out the work.

To Solve the Smoke Problem.

Under the above heading, the "South Wales Daily News" publishes the following: "The latest addition to fuel manufacture, which will be in full working order at Swansea in about three weeks' time, is to solve the smoke question, to generate steam easily and effectively, to answer household purposes, and at the same time to possess the all-important virtue of economy. There are being completed on one of the most convenient sites at the new King's Dock, Swansea, by the Welsh Fuel Company, patent fuel works of an extensive character, which will be capable of an output of 400 tons a day. For many years, inventors have been engaged in solving the problem of utilizing what is generally regarded as a waste product—anthracite duff. It is generally agreed that it is by the incorporation of anthracite that the smoke difficulty in fuel can alone be completely overcome. Hence the present venture (which has passed the experimental stage) will be watched with interest. Prudent business men, the Directors (with Mr. Joseph Birkenshaw, the well-known colliery proprietor, at their head), before launching on the undertaking, tried every conceivable experiment so as to be thoroughly satisfied of the commercial value of the invention they have adopted. They tried it in steam raising, both afloat and ashore, when it is claimed it more than answered anticipations. They tested its effect in the household grate, and found it free from smoke, dust, and smell. Moreover, it has the important quality of coking. They have also tested it from an economical standpoint to the extent of being satisfied it can be sold at least 25 per cent. cheaper than coal. The invention is known as the Morris; and Mr. Vincent Groom is the Managing-Director, under whose supervision the new works have been erected."

Southampton Gaslight and Coke Company.—The report of this Company for the half year ended June 30 last states that, after payment of debenture interest and other charges, the profit and loss account shows a balance available for dividend of £15,989; and the Directors recommend that the maximum dividends, less income-tax, amounting to £13,563 for the half year, be paid on Nov. 4, leaving £2426 to be carried forward.

Water-Works Purchase Question at Southampton.—The Southampton Town Council on Monday of last week held a special meeting to take into consideration the report of the Parliamentary Committee with reference to the proposed purchase by the Corporation of the South Hants water undertaking. In their report, the Committee recommended that the purchase should be effected. The Mayor (Alderman C. J. Sharp) pointed out that the Corporation had previously introduced a Bill into Parliament to enable them to acquire the concern; but on a technicality it was thrown out, and a second Bill for the acquisition of a part of the undertaking was also thrown out. After some discussion, the Corporation adopted the report.

Sad Fatality at Duffield.—A young man named Ernest Wilkinson, twenty years of age, met his death last Friday week at Duffield, near Derby, under sad circumstances which were explained at the inquest. From the evidence of the father, it appeared that water had been put in the meter during the evening; but the plug was not replaced. The deceased slept alone, with his door slightly open. When Mr. Wilkinson got up on the Saturday morning, he found the house full of gas. Thinking it proceeded from his daughter's bedroom, he entered, and the girl swooned in his arms. Handing her to the care of his wife, he went to his son's bedroom, to find him lying in bed, suffocated by gas. The window was closed. Witness afterwards found that the bottom plug of the gas-meter had been left out, and gas was escaping. Dr. Morrison stated that the deceased was asphyxiated by gas while asleep. Had the window been open—especially at the top—he would have been saved. The girl escaped because she was lying on the floor the greater part of the night. A verdict of "Death from asphyxiation by gas while asleep" was returned.

Colonial Gas Association, Limited.—The accounts to be presented at the annual general meeting of the Association next Tuesday show that, after writing off £997 for depreciation of works, there remains a profit of £6612 on the working in the year ended the 30th of June last. Adding the balance brought forward (£1068), and deducting the interim dividend (£3463), there is left a sum of £4217 available for distribution. The Directors recommend the payment of a final dividend of 3½ per cent., making 5½ per cent. for the year, free of income-tax, amounting to £2966, and carrying forward £1251. They report a further expansion in the sale of gas in the twelve months covered by the accounts; the average increase having been upwards of 11 per cent. compared with the preceding year. Owing chiefly to the disastrous coal strike in Australia, which lasted for more than five months, the accounts show a large increase in the cost of raw material. But for this, the Directors state, the profit would have exceeded that of the year 1908-9. They announce with regret the decease, already noticed in our columns, of their colleague Mr. A. Godwin Hammack, who was a Director for more than fifteen years; and they state that it is not proposed at present to fill up the vacancy.

Stokers' Wages at St. Ives (Cornwall).—At a meeting of the St. Ives Town Council on Monday last week, an application was received from the stokers at the gas-works for an increase of wages from 26s. to 29s. 3d. per week; and the Gas Committee recommended that an advance be made to 27s. 6d. Mr. Uren asked if this would satisfy the men; and the Gas Manager (Mr. Hearson) replied that it would not. He added that he should be glad if the Council would give them what they asked, as otherwise there would be similar trouble every eighteen months. Mr. J. Pearce said the Council had to consider the ratepayers and gas consumers as well as the employees. The Committee thought 27s. 6d. a week good wages for the work done. Mr. G. Williams expressed the opinion that 78 hours a week were too many for the men to work. Mr. Pearce said if the matter were referred back, the Council must be prepared to pay 28s. a week for an extra man. Mr. Blight, the Chairman of the Committee, said the stokers wanted the same pay for eight hours a day as for twelve hours. Mr. Uren proposed, and Mr. Daniel seconded, that they be paid 29s. 3d. a week. The voting was even; and the Mayor (Lieut.-Col. H. W. Williams) gave his casting vote in favour of the proposition.

Port Rates on Goods.—It is announced by the Port of London Authority that on and after Tuesday next port rates will be payable in respect of all goods imported or exported into or from the Port of London from or to parts beyond the seas or coastwise. Each payment must be accompanied by a bill giving particulars of the goods in respect of which it is made. Copies of the list of rates can be obtained at No. 109, Leadenhall Street.

A Too Generous Electric Power Company.—According to a paragraph in the "Newcastle Daily Chronicle," the Directors of the Cleveland and Durham Electric Power Company, Limited, of Middlesbrough, have issued a circular to shareholders calling an extraordinary meeting to be held at Newcastle to-day, when resolutions will be proposed for the reduction of the capital from £1,000,000 to £700,000, by the cancelling of capital lost or unrepresented by available assets. Upon this reduction taking effect, it is proposed to make a number of further alterations in the shares. This is the Company which arranged to give free public lighting to the Consett Urban District Council, to commence about two years hence. With a lost capital of £300,000, the gift is rather superfluous, one would think.

Gas Lighting during "Shopping Week" in Reading.—Reflecting upon the many successful exhibitions made in Reading during the recent "shopping week," a writer in the "Reading Standard" last Saturday said the brilliancy of the illuminations could not be overlooked. Friar Street was a blaze of light, thanks to the enterprise of the Reading Gas Company. The exterior of their extensive show-room was beautifully illuminated at night; and large crowds were attracted to the spot, watching, as the writer says, "the twinkling fairy lights outlining the outside of the building and the brilliant lights within." A representative of the paper entered the show-room with the rest of the public, and was agreeably surprised to see many improvements in gas lighting. At the time of his visit there were 95 incandescent lights burning, and, he says, the scene was "intensely interesting." He describes the contents of the show-room.

Gas Lighting in Poland.—The annual British consular report upon the trade of Poland shows that, notwithstanding the large number of new plants for electric lighting, there was a considerable increase in the gas installations at Warsaw during the year. The price of gas—4s. 2¾d. per 1000 cubic feet—remained the same. The chemical works attached to the gas-works at Warsaw developed considerably; the chief product being sulphate of ammonia, for which there is an ever-increasing demand for artificial manure. It is proposed to construct new gas-works at Lodz. With the exception of Tomaszow, in the province of Radom, there was no development of the gas industry in other provincial towns. Local coal cannot be used for making gas, for which British coal must be imported. Consequently electric plants, for which Russian coal can be employed, are preferred for lighting purposes. In Tomaszow, a concession for building gas-works has been granted for 4½ years to a private company. It is proposed, to begin with, to erect 414 lamps in the streets.

The Burden of Electric Lighting at Redditch.—The proceedings at the meeting of the Redditch Urban District Council last Tuesday were not of a character to cause pleasure to the ratepayers, inasmuch as these long-suffering individuals have to meet a further increase in the general district rate to the extent of 3d. in the pound for the half year ending the 31st of March next. For the six months lately closed, the rate was 2s. in the pound; and for the preceding period 1s. 10d. The electricity supply undertaking is the cause of the trouble. A decrease in the revenue and the necessity of a prompt repayment of a bank overdraft compelled the Council to ask for £1500 from the rates in support of the undertaking. A rate of 1d. in the pound produces rather less than £200; and as the demand upon the rates to keep the undertaking going is now equal to £3000 a year, it means that this business is annually absorbing an amount equal to a rate of 1s. 3d. or 1s. 4d. in the pound. Referring to the position, a local paper says: "Think of it ye struggling tradespeople, who, in the face of higher rents and diminished trade, are scarcely able to make both ends meet."

Prices of Gas and Boiler Tubes in Berlin Last Year.—The latest British consular report on the trade of Berlin contains the following remarks in regard to gas and boiler tubes: "The depression in this market continued during 1909, and became more acute. The prices for wrought-iron tubes underwent a reduction of 10 per cent. net; and though a slight improvement set in during the third quarter of the year (more especially for galvanized tubes), a further abatement had to be made towards the end of the year, in consequence of a decreased demand and of fresh competition that suddenly sprang up. The dissolution of the pig-iron syndicate and the competition that ensued between western and eastern works, led to a further reduction in prices for cast-iron pipes during the first half of the year, despite the fact that those at the end of 1908 were far from being satisfactory. . . . In general, sales were normal, being rather better during the first half of the year than the second. The Association formed for the sale of gas-pipe joints among manufacturers enabled the normal prices to be adhered to during the year under consideration. Wrought-iron gas-pipe joints have come down in price, and business in this commodity is extremely unsatisfactory in consequence of keen competition and the producers not being organized."

In a report to the Sunbury Urban District Council, regarding a test of the gas which he had made, Mr. P. Egerton stated that he found the apparatus for testing the illuminating power and the room in which it was installed at the Company's works in a very dirty and neglected condition. He was not able, therefore, to make a test which he could consider to be accurate. It was resolved to issue a summons against the Gas Company.

A Sub-Committee of the Preston Streets and Buildings Committee, who were appointed to receive a deputation from the Preston Gas Company, have reported the result of an interview, when the Company stated that it was their intention to apply for a Provisional Order to reduce the illuminating power of the gas from 18 to 14 candles. Proposals were submitted to the deputation for the consideration of the Corporation; and the Committee decided to engage an expert to advise them on the matter.

Messrs. James Milne and Son, Limited, ask us to contradict a rumour that has reached them to the effect that they are closing-down their London branch. They add: "We are hoping to go stronger than ever, and certainly have no idea of closing it."

The advertisement columns of the "JOURNAL" last week contained an announcement that the Redhill Gas Company were inviting tenders for an issue of £5000 of ordinary "B" stock, which will rank for a standard dividend of 5 per cent. per annum, subject to the sliding-scale. The minimum price is £101 per £100 of stock; and tenders must be sent in by noon on Tuesday next.

The Oswaldtwistle Urban District Council, who own their own gas-works, recently invited ratepayers desirous of using electricity for lighting purposes, to notify the department. The response, however, has been so meagre that last week the Sub-Committee specially appointed to negotiate with the Accrington Corporation for the supply of electric current to Oswaldtwistle, informed the latter Council that they could not recommend them to pursue the matter further. The Accrington Corporation's terms, too, have not been recommended for acceptance.

According to the annual consular report upon the trade of Bavaria, which has just been issued, the arc lamp industry has been affected by the increasing competition of powerful gas-lamps, due to the low price of the gas in proportion to the amount of light obtained. The Consul adds: "Especially for street lighting, the powerful gas-lamps have lately gained the superiority; whereas the lighting by electricity (arc lamps) has fallen off."

In replying to a vote of thanks for the manner in which he had occupied the chair of the Liverpool Corporation Lighting Sub-Committee, Mr. W. W. Walker mentioned that, in addition to the ordinary work of street lighting, gas and meter testing, &c., carried out during the year, the scheme of automatically lighting street-lamps had advanced a further stage—1000 more controllers having been fixed. This had been accomplished without dismissing any of the permanent staff. There were now 2063 controllers in use; an annual saving of approximately £700 having been effected. The mileage of electrically-lighted streets had been increased from 5½ to 6¾. The reduction in the price of gas by 1d. per 1000 cubic feet meant an annual saving in the street-lighting bill of £725.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SECOND ENGINEER (ARGENTINA). Apply to Hugo Brown and Co., Liverpool.

FOREMAN. No. 5305.

YOUTH FOR MANAGER AND COLLECTOR'S OFFICE. Chapel-en-le-Frith Gas-Works.

Situation Wanted.

CHEMICAL ENGINEER. No. 5306.

Plant, &c. (Second-Hand), for Sale.

HIGH-PRESSURE FILTERS, &c. Colwyn Bay and Colwyn Urban District Council.

Patent Licence, &c.

ACETYLENE GAS GENERATORS. Haseltine, Lake, and Co., Southampton Buildings, Chancery Lane, W.C.

GAS GENERATORS. Carpmael and Co., Southampton Buildings, W.C.

Stocks and Shares.

GAS METER COMPANY (BY AUCTION). Nov. 8.

LOWESTOFT WATER AND GAS COMPANY (BY AUCTION). Nov. 8.

REDHILL GAS COMPANY (BY TENDER). Nov. 1.

TUNBRIDGE WELLS GAS COMPANY (BY TENDER). Nov. 5.

TENDERS FOR

Coal and Coke Handling Plant.

BUDAPEST CORPORATION. Tenders by Jan. 28.

Fire-Clay Goods.

SHEFFIELD GAS COMPANY. Tenders by Nov. 8.

Gas Generating Equipment.

BUDAPEST CORPORATION. Tenders by Jan. 28.

Gasholders.

BUDAPEST CORPORATION. Tenders by Jan. 28.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

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GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 246.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord.	86—88*	..	5 13 8
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
200,000	5	May 12	7	Bombay, Ltd.	6⅛—6⅝	..	5 5 8
40,000	5		7	Do. New, £4 paid	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246—249	..	5 0 5
330,000	,,	,,	9½	Do. New	184—186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,		8	Do. A Ord. Stk.	157—160	..	5 0 0
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	50½—51½	..	5 16 6
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	$5\frac{2}{10}$	Commercial 4 p.c. Stk.	105—108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	..	3 14 1
800 000	Stk.	June 10	5	Continental Union, Ltd.	96—98	−1	5 2 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—106	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103—105*	..	4 15 3
486,090	10	July 14	12	European, Ltd.	24—24½	+¼	4 18 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4¾	Gas light and Coke 4 p.c. Ord.	105—106	−½	4 8 0
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,002,235	,,	,,	4	Do. 4 p.c. Con. Pref.	104—106	..	3 15 6
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	8 —82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 [illegible]
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½*	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112—114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 [illegible]

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental	187—189	..	4 15 3
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	162—164	..	4 5 4
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅝—4⅞	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd.	12½—13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	101½—102½	..	4 5 4
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138—140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd.	6—6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A.	131—133	..	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	..	4 16 2
398,490	5	Apl. 29	7	Primitiva Ord.	7⅜—7⅝	..	4 11 10
796,980	5	June 29	5	Do. 5 p.c. Pref.	$5\frac{3}{16}$—$5\frac{7}{16}$	$-\frac{1}{16}$	4 11 11
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼*	..	5 6 [illegible]
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅝	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord.	110—112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	Aug 31	6¾	Wandsworth B 3½ p.c.	139—141	..	4 15 9
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	73—75	..	4 0 [illegible]

Prices marked * are "Ex div." † Next dividend will be at this rate.

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For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

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Resists 4500° Fahr. Best for GAS-WORKS.
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SIMULTANEOUS Discharging-Charger.
The one Machine which Discharges and Charges at One Stroke.
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Results Guaranteed. No Working Costs.
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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
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Are prepared to Supply
BENZOL, TOLUOLE, NAPHTHA, AND CREOSOTE
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Apply, THOMAS HORROCKS,
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Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

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[See Illustrated Advertisement, Oct. 11, p. 80.]

GAS
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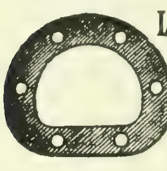

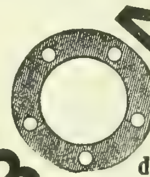

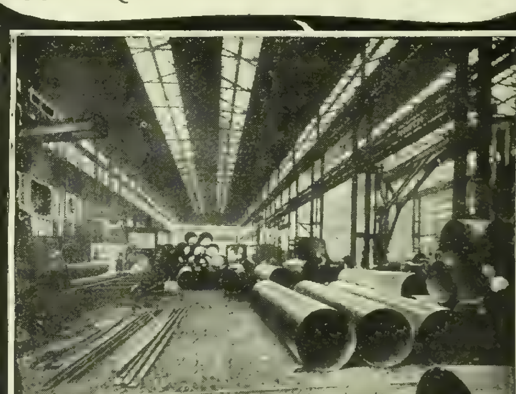

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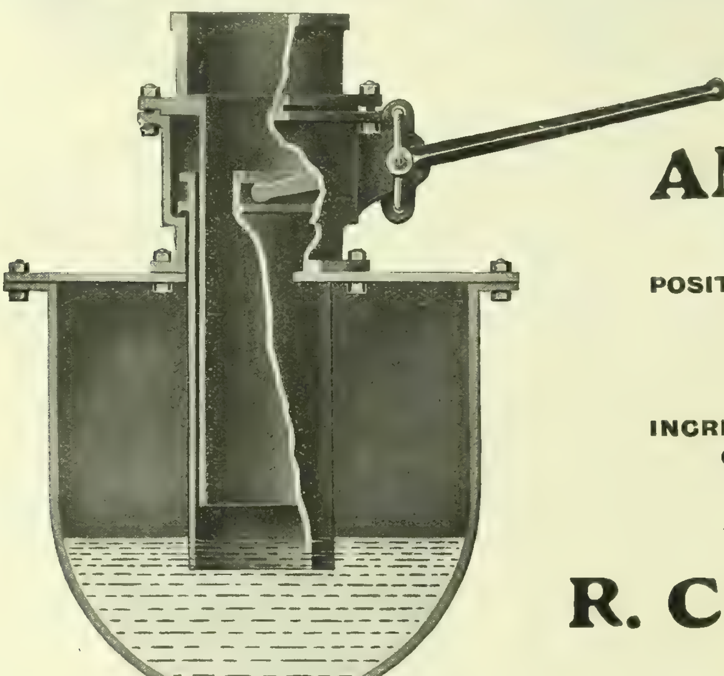

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INCREASED MAKE PER TON,
GREATER ILLUMINATING POWER,
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THE STRONGEST AND BEST PREVENTIVE AGAINST THEFTS FROM SLOT METERS.

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THE JOURNAL OF GAS LIGHTING
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VOL. CXII. No. 2477.] LONDON, NOVEMBER 1, 1910. [62ND YEAR. PRICE 6d.

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Results have been obtained which have never been equalled by any other System of Carbonization.

Charges 8 to 10 Tons each
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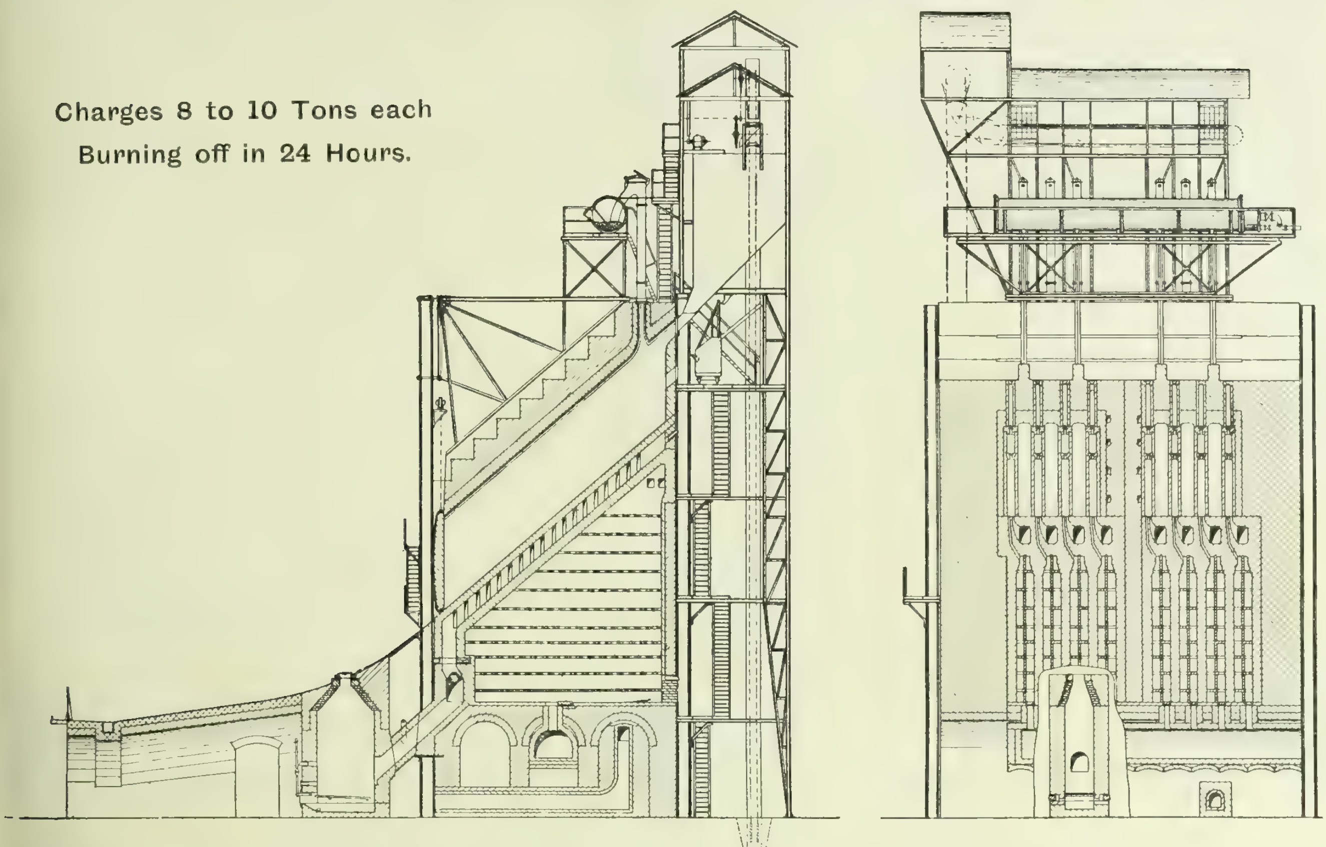

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		OVENS.	Cub. Ft. per Day.
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The Vienna Corporation Gas-Works, Austria		15	1,400,000
,, ,, ,, ,,	(1st Repeat Order)	19	1,750,000
,, ,, ,, ,,	(2nd Repeat Order)	46	5,250,000
,, ,, ,, ,,	(3rd Repeat Order)	72	7,400,000
The Innsbruck Gas-Works, Austria		12	600,000
,, ,, ,,	(Repeat Order)	6	300,000
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		186	17,790,000

ADVANTAGES:

GREATER YIELD OF GAS OF HIGHER LIGHTING AND HEATING POWER.
COKE PRODUCED CAN BE EMPLOYED FOR METALLURGICAL PURPOSES.
INCREASED YIELD OF SULPHATE OF AMMONIA.
TAR PRODUCED IS OF A LIGHT FLUID CHARACTER.
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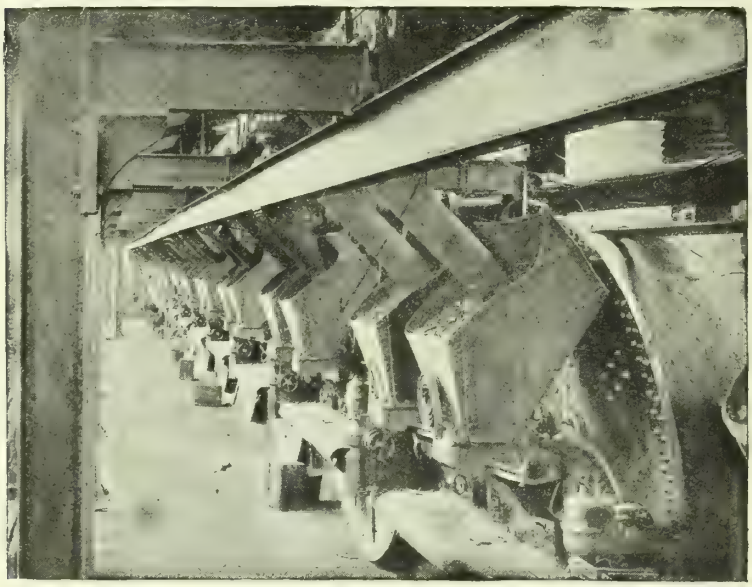
The arguments that have appeared under these head-lines in this Journal will doubtless be familiar to most of its readers. The majority of Gas Engineers will have agreed with them, and—must it be confessed?—"still go on from day to day just as they always went." The wise minority have translated the arguments practically and thereby transmuted smoke into gold, and converted poor and unsatisfactory dividends into something better.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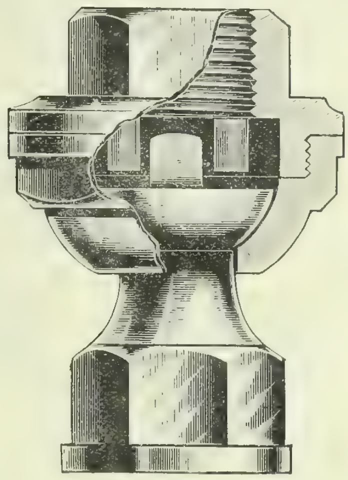

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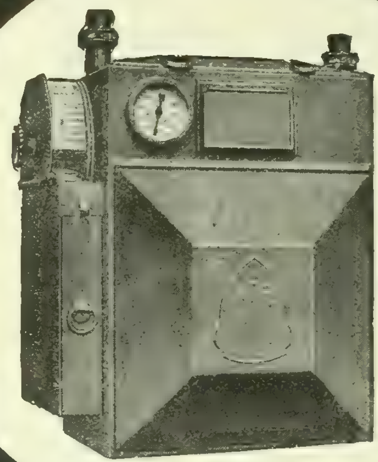
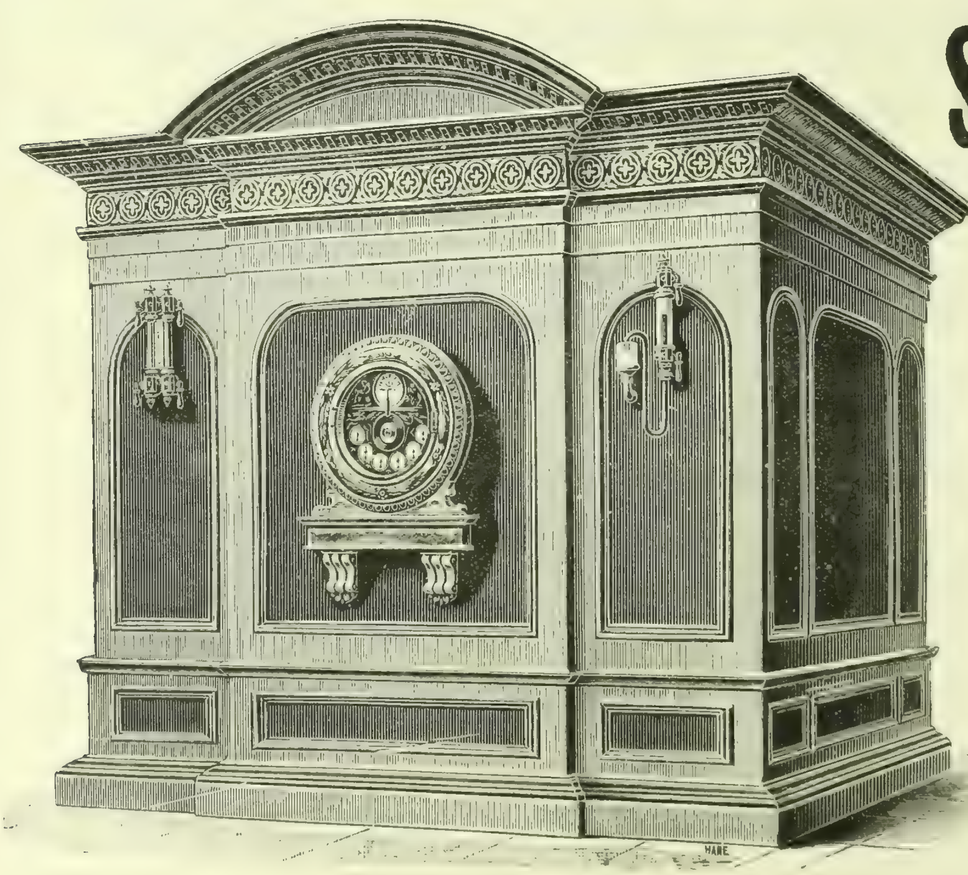




JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2477.——TUESDAY, NOVEMBER 1, 1910.

EDITORIAL NOTES—GAS, &c.

In the Interests of Gas Companies.

LOOKING back over the many annual meetings of the Gas Companies' Protection Association held since its inception, one is not remembered at which members outside the Committee have evinced such a marked interest in the proceedings, or have been more suggestive regarding the future, than was the case at the meeting yesterday week. Such discussion as that which took place can only conduce to greater vigour and usefulness, and probably to an expansion of the scope of the Association's activities. Much good work has been done by the Association; and some of the members seem to think the organization supplies the centre around which further serviceability may be made to grow. We are quite with those who so think, because there is undeniably much work to be done in the interests of private gas enterprise that cannot possibly be undertaken by an organization of composite constitution such as the Institution of Gas Engineers, which incorporates the officials of both gas companies and of municipal bodies owning gas-works, and some of them also electricity supply undertakings. In this fact we have one of the externally-imposed disabilities of the Institution, no matter how much the technical officials of that body in municipal service may personally sympathize with all the objects that stand for the progress and the defence of the interests of the gas industry. It is—and it becomes more marked year by year—through the ownership of competing undertakings on the part of so many local authorities that the defence of gas interests, and the furtherance of projects for progress, are left almost completely at the present day to private enterprise in gas supply. Much the same might be said in relation to the electricity supply interests. A considerable part of the heap of trouble that has arisen in connection with that industry has been due to its domination by municipal policy of a character that had not had precedent in the prior policy applied to the direction of municipal gas undertakings.

The usefulness of the Gas Companies' Protection Association has been illustrated in several ways in the past; and this year has seen that usefulness accentuated in an important manner. But it is quite possible that, if the limits of the scope of activities are drawn too tightly, there will be years with very lean reports of usefulness in which, with a more extensive field in which to exercise existent influence and power, some effective work in directions not now touched might be accomplished. There were the indications of a desire for something more in the expressed wish of members at the meeting to have earlier knowledge than has hitherto been afforded as to the contents of the Committee's report upon the work during the year, and to have, so far as prudence dictates, information as to the replies to questions addressed to the Secretary, in order that, on the one hand, there might be opportunity for a studied discussion of the report at the meeting, and, on the other hand, there might be, from the experience of members, serviceable addition to the information tendered by the Secretary in reply to inquiries. The requests are altogether reasonable, so far as can be seen; and the Chairman (Mr. H. E. Jones) gave a prompt promise as to these matters being considered by the Committee, and the manner of his promise did not suggest that his own immediate judgment saw any difficulty in the way of compliance. It is clear that this would enhance the character of the proceedings at the annual meeting, lift them from something little more than formal, to something more informative, infuse more life into them, and possibly be more suggestive than in times past. But that will not be enough to satisfy some of the members. The first seed has been sown which may germinate, and result eventually in the broadening of the operations of the Association. The seed fell from the hand of Mr. T. H. Duxbury, in connection with the recent issue broadcast of a letter by the Electricity Publicity Committee which was misleading (as has been shown in our columns) in regard to the public lighting of London. It has been nobody's business so far to send a controverting or correcting letter similarly to the press throughout the country; and this shows a present defect in the operative organizations of the gas industry. With the coming into active existence of the Gas Publicity Committee, this particular defect will, we hope, be fully remedied. But the Commitee is not yet at work; and the doing of what the Directors of the South Shields Gas Company suggested that the Gas Companies' Protection Association should do was outside the "scope" of the Association. The Committee of the Association were quite within their rights in declining to take up the matter. But we do feel that, if the Association had stepped into the breach on such an occasion as this, pending the coming into active existence of the Gas Publicity Committee, and without usurping their duties for longer time than their advent into activity, the proceeding would have redounded to the credit of the Association, and shown that it was not a body tethered by an inflexible series of rules. However, there will be no surprise if now the scope of the organization receives some further attention by the members.

It is not at all peculiar that this enhanced interest in the work of the Association has arisen just at this particular time when the Committee had a report presenting some excellent results of work for the year. The report shows, and looking round at the affairs of the industry generally the same thing is seen there, that never in the history of the industry has there been greater need for a Gas Companies' Protection Association, and that of a very active character, and with a broad base. Look at all that has happened in connection with the Standard Burner Bills, and the alertness that has been required on the part of the Association and their Parliamentary Agents who saw these measures through to the point of present success. Their work for the Bills is not yet done; and every gas company in the country who have the interests of the future of the gas industry at heart ought to make representations to their local Members of Parliament with the view to getting the measures through their third reading by an overwhelming majority. Let it be borne in mind as a general axiom that mischief as great may be done by omission as by deliberate commission. On the success of these Bills depends much in connection with future gas company applications to Parliament. The report calls the effect of the opposition on the third reading a "vexatious "delay." It is something more than that. The success of the opposition would mean the destruction of much most excellent work that has been accomplished on behalf of the gas industry. We have not, however, a shadow of fear that the hostility will prove successful; but nothing must be left to chance.

The Committee, it will be seen from their report, has also elicited what is tantamount to a confession, though not a withdrawal of the offending document, that the issue of the circular by the Inland Revenue Authorities, regarding the disallowance of depreciation for income-tax purposes, was a mistake, and that "it is not the desire or intention of the "Board by the circular to remove the question from the "jurisdiction of the District Commissioners of Taxes who "make the assessments." The advice is that those companies who have a grievance in this connection should go direct to the Commissioners to secure what is an undoubted right. It is also shown by the report, in the matter of the taxation of land values, that Form IV. need have no terrors for gas-works owners, as such undertakings are expressly exempt, except in the case of land being sold for which there is no longer use at a higher price than the original cost. As to immediate future work, Mr. Robert Hall, of Matlock, brought before the meeting, the question of the promotion of the proposed Bill to authorize municipal authorities to undertake electric wiring and the supply of fittings. The

Committee have the question now under consideration; but their attitude in regard to the matter remains for shaping on further deliberation.

It will therefore be seen that, though there is a feeling in some quarters that the scope of the Association might be usefully enlarged, this is not by any means due to the want of useful activity in the past. The record of the body, and especially the present report, completely negative any such idea, if it exists.

Commercially Working High-Pressure Gas Supply.

Is the time coming when the gas undertakings in all our principal cities and towns will have in their chief quarters a dual supply of high and low pressure gas? We are of opinion that it is, and that we are within measurable distance of this coming to pass. The gas-supply industry has shown during the last few years a big capacity for progressive work; and this question of carrying a supply of high-pressure gas through the main streets and into manufacturing areas where heat is required in the operations of the factories, is one that will be receiving, we believe immediately, a greater amount of attention than it has had hitherto. London has, as the whole gas industry knows, been doing its part in the work of carrying high-pressure gas through a number of streets as a means chiefly of competing with the flame arc lamp; and in the area round about Fleet Street, this supply has been found of great economic advantage to the printing industry. But it is to Birmingham that we shall now be looking for the results of the expansion of the business of the Gas Department into a general supply of high-pressure gas; and we feel sure that the Secretary and General Manager of the Department (Mr. R. S. Hilton) may be relied upon to keep, for the benefit of the gas industry as a whole, the technical and the commercial officers of the industry informed, either directly or through members of his staff, as to developments and experiences from the inceptive stage of the business to-day, as reported upon in later pages of this issue of the "Journal." It is no mere tentative scheme of high-pressure gas supply that the department has gone in for; but something large, substantial, and permanent. More than this is not wanted to tell and assure us of the confidence of the technical and commercial advisers of the Gas Department, nor to inform us of the liberal manner in which the Gas Committee, with the sanction of the Corporation, have allowed the executive of the department full scope in giving material proof of their confidence in a high-pressure gas supply being of economic value to the industries of the city, and a trading benefit to the Gas Department.

This project, which has, within recent weeks, been unostentatiously brought into active existence, as described elsewhere, is going to be worked in a thorough manner and separately from the ordinary gas supply, though forming an inherent part of the future business operations of the department. But, as a matter of fact, though the primary object of the scheme is the service of the industries of Birmingham in which heat—controllable and always ready for use by the mere turning of a tap and the ignition of the issuing gaseous fuel—is needed, the project has a fourfold intention: It is intended to serve the industries, to boost-up the ordinary supply of gas where required, to light (if the Corporation can be persuaded by demonstration) the main thoroughfares of the city, and to induce any shopkeepers who have a liking for high-power sources of light for their premises to have the high-pressure gas-mains tapped for the purpose. For this variety of use, a margin of pressure somewhat beyond the maximum requirement will be maintained in the system; and regulation to the diverse points of desired pressure will be effected by governors in all situations. The importance of the power that this high-pressure system puts into the hands of the commercial department of the gas undertaking of the city cannot be gainsaid or over-estimated. Without it in such a city, it is easy to see that somewhat stringent limits would be set to commercial activity. It goes without saying that upon the distribution department, the introduction of this additional power has brought a considerable expansion of work; but we shall look, in regard to the commercial side, to the new business serving to prominently mark the inaugural work of Mr. Hilton as Secretary and General Manager, and to crown that of Mr. S. R. Barrett, the Superintendent of the Fittings Department.

It is from the industrial work of this high-pressure gas business at Birmingham that we anticipate most of interest. The city is blessed in the matter of, and it may be said is continuously prosperous through, the range of its metallurgical industries, in all of which a form of heat-raising that has flexibility in the matter of temperatures must be of benefit. But in initiating the application of high-pressure gas to all these various industries, requirements will be so varied that the modes of doing it must also have an extensive range. In the methods of this application, the Gas Department are treading in largely unexplored ways; and therefore the right thing has been done in appointing Mr. E. W. Smith (who has been engaged in the gas-heating research work, on behalf of the Institution of Gas Engineers, at the Leeds University, and will resign it on the 12th inst.) to devote his talents to investigating and demonstrating methods and applications whereby the high-pressure service may be of most utility. In this appointment lies both technical and commercial advantage; and, from the standpoint of the technical worker in the department, we cannot imagine a more interesting, instructive, and profitable new field than this in which an ambitious and active trained experimentalist can be engaged. So far, the experiments of the department (prior to the incoming of Mr. Smith) have shown a simplicity in the design of the means of the application of high-pressure gas to industrial operations, and a wide suitability of high-pressure gas to purpose, which are surprising, and give excellent ground for the fulfilment of expectations. To the new enterprise, we wish, and look for with assurance, an abundant success.

The Carbonizing Maze.

The difficulties of arriving at some settled conclusions on carbonizing questions as they are spread in glorious profusion before us to-day take pre-eminence of all difficulties that have ever fallen in the path of the gas technician; and we cannot say that the discussion, extensive as it was, at the meeting of the Midland Association last Thursday, has done anything to serve to let light through the mass of conflicting submissions that individual experience and judgment lavishly offer for acceptance. And while this conflict of the advocates continues, we are afraid that each system must be left to work its way forward according to its opportunities. For it must be clear now to all observers who are unprejudiced, and who make disinterested judicial survey of the position, that there are so many problems involved in it all that nothing short of a systematic and expensive investigation by a competent and altogether unfettered tribunal of experts, without favourable prepossession towards any one system, can possibly produce anything like settled conclusion and leading facts from the complexity which abounds. The process of affording any assistance to this end followed by the Carbonization Committee of the Institution, is an unsatisfactory one; and what is required beyond it, as just suggested, is quite outside the region of practical politics in the existing disunited conditions of the industry in relation to co-operative technical investigation. The only hope of relief is that some one or other system will rise so superior in the combination of results to all the others that there can be no further question as to which is the best all-round process for the purposes of the industry.

But taking the position of things as it is in regard to the more prominent claimants for preference, including the most modern methods of working horizontal retorts, it cannot be said that there is such a marked superiority (in the results as we have them before us) between the one and the other—assuming local conditions to be suitable for the application of any one of them—that an engineer can say, with any degree of confidence, that this or that system is absolutely the best for his particular purpose. Those with personal interest in advocating the various systems know the common prevalence of this feeling, without reading the testimony to uncertainty that is the most marked feature of Thursday's Midland debate. But it is for those interested advocates, in the absence of anything better in the way of independent inquiry, to make a determined effort to remove false impressions and set doubts at rest, and to place before the industry modern results from everyday British working conditions. The whole position has attained to such complexity that, at any rate, a statement of the kind from each source would enable us to abandon the confusing mass of information published in the past (which tends to swell mostly by deduction from the conflicting statement and views on record), and give us, as it were, a new starting-point. The "open mind" is still suggested as the proper course; but the "open mind" has been the receptacle into which so much has been forced

in respect of this matter, that it is grievously tormented by the quantity of the opposing material. In truth, the "open "mind" gets tired of remaining open for years in respect of any one particular subject; and, with the flight of time, there inevitably arrives a point at which it has to close, and come to some positive conclusion on the question of procedure through, in this connection, the necessity of renewals or extension. But there is one matter for thankfulness, and it is that carbonization for gas production cannot, under the new circumstances, again drop into the rut in which it stuck for at least a quarter of a century.

However, there is information to be drawn from the proceedings at the Midland meeting, when there were under discussion Mr. A. T. Harris's critical paper (read by him at the spring meeting) on "Carbonizing Systems and Results," in which special reference was made to Love's 45° retorts, and one by Mr. J. S. Lucking, of Clay Cross, on "The Utiliza-"tion of Surplus Gas from Coke-Oven Recovery Plants," and when prepared contributions to the discussion by Mr. T. Glover, Mr. S. Glover, and Mr. J. Ferguson Bell gave principal lead to the general debate. In the first place, it cannot be said that Mr. Harris's experience with Love's 45's will be of assistance in furthering the installation of the system elsewhere; and the fact that at Guildford it has not been adopted in the new retort-house, has not been in its favour. Then Mr. Lucking's experiences with the use of surplus coke-oven gas for general supply—a good enough gas for the purpose, albeit a 13 per cent. content of nitrogen —will act as a warning against such adoption without satisfactory precautions against cessation of the output or variation of the surplus quantity, and against adoption without ample protection, by the provision of stand-by retort plant, in respect of labour disturbances, for coke-ovens are, as a rule, situated where labour is sensitive. Such provision Mr. Ernest Bury, M.Sc., F.C.S., has been careful to make in connection with his Little Hulton gas-supply scheme from the coke-oven plant of the Earl of Ellesmere. Then we have Mr. Thomas Glover admitting that his small chambers on the coke-oven principle have not sufficient flexibility for works of moderate size, though they do possess certain advantages; and he, like his brother (Mr. Samuel Glover), has considerable confidence in the future of the continuous vertical retort system.

So far, we have a little clearance made from the field; but these proposals have only been occupying, so to speak, an experimental place on the border of the larger applied systems and methods of operation over which the spirit of controversy rules. But there is one point on which there is almost common acceptance; and it is that the newer systems and the modern methods of operating the old ones, are the superiors of quondam carbonizing practice. The time has therefore now come when, in the discussion of present-day carbonization, we may forsake comparison with the old (just as we have given up contrasting the incandescent gas-burner with the flat-flame type), and devote attention to comparison between the systems as currently operated in the most approved manner. We cannot understand how anyone can doubt the efficacy (it is not merely a question of foot-candles per ton of coal carbonized) of the heavier charge in producing real and tangible result. There need be only reference to working and revenue statements of certain well-known gas undertakings for the proof. It is found in the quantity and cost of the coal carbonized; in the total production and sale of gas from the coal; and in the ultimate results of the balance-sheet—these being supplemented by the reduced price of gas to the consumers. We may argue about candle-feet per ton and so forth; but such argument will not dispose of the tangible tale of the revenue account. Several undertakings that we have in mind—working under different circumstances in regard to character of coal, size of retorts, and other conditions affecting the carbonizing plant—would not now forsake those new practices that have proved so beneficial to themselves and to the consumers. And this does not apply to large or medium size undertakings only, but to small works such as were referred to by Mr. Berridge and Mr. Ward in the Midland Association discussion. Solid financial considerations such as have been placed before us the last year or two require rather a substantial amount of deposing from the position to which they have attained.

To return, however, for a final word, to the primary consideration as to which is the best of the several systems now courting favour—if there is one that can claim the title. If there could only be some definite conclusion as to which was theoretically the best, then there could be inquiry as to why it did not establish its theoretical superiority in practice. Ascertain the reasons, and then —— well, perhaps there is little benefit to be derived from prediction on such a matter.

Comfort in the Home.

While personally we may lament the brevity of our British summers, that very brevity is unquestionably an excellent thing for the gas industry; and this year again we believe its effect in increased gas output will be shown by the reports on the operations of gas concerns. What we lose on the higher efficiency lamps of the day, is certainly receiving some compensation in the expansion of the heating business, which has a further good effect on capital charges. The brevity nowadays of the British summer extends those periods of the year, preceding and succeeding the season called summer, when there is a chilliness about the atmosphere which, for comfort in the home, we like to have removed. The disposition to increased comfort at home grows on one; and the growth finds a good stimulant in the climatic conditions of the times. There is no doubt that the length of the periods of low temperatures sways and impresses considerably more than the shorter duration of the summer; and therein the gas industry has an advantage in prosecuting the heating business—a much greater advantage than the electrical industry has in promulgating as a consideration advantageous to itself that the use of the electric light, in the summer time, keeps rooms pleasant and cool. The lighting hours in summer are really very few compared with the lighting hours of the year when the temperatures are low, and the lighting hours, too, of the summer are those of lowest temperature during that period.

But the senseless parade of electrical superiority during the few lighting hours of summer has about had its day. The electricians are feeling the effect of public experience; and their own advertising literature is not sufficient for successfully plugging their ears in the effort to keep out the complaints of their patrons as the stuffiness of rooms and headaches where several people happen to be assembled during the time of artificial lighting. This knowledge of a common complaint is reflected by the advice tendered in one of the leaflets (which has been largely distributed) prepared by the Electricity Publicity Committee, in which electric fans are spoken of as being "indispensable for "keeping the house healthy." We have also before us an advertisement issued by the Beckenham District Council Electricity Department in which it is remarked that "wherever electric light is installed, the air of the rooms "can be kept cool and pleasant in the hottest days by means "of electric ventilating-fans." Just so; but fans cause an additional expense, and they are not altogether free from a buzzing noise that is somewhat irritating in the otherwise quiet rooms of the home. But that by the way.

Apart from the question of a supplementary and indispensable aid to the electric light to keep atmospheric conditions comfortable and wholesome, electricians cannot have their recommendation as to the coolness and pleasantness of electric lighting applying to all seasons. Side by side (in the same local paper) with the Beckenham electricity advertisement is a more prominent one of the South Suburban Gas Company, headed "How to be Happy and Comfort-"able at Home," and succeeding the comfort, convenience, and economy of the gas-fire are set forth. It is interesting to note at the end the warning and information: "The "rush for gas-fires this winter is sure to be great. Already "the Company have fixed 5000 of them, and orders are "coming in for them at the rate of 70 per week. To save "delay and disappointment, therefore, it is well to order as "soon as possible." Assuming (and it is only an assumption in view of the Electricity Publicity Committee's statement) that the electric light is cool and pleasant in the summer time, and that it does not require any auxiliary aid to maintain the air of a room in a sanitary state by changing its quiescence into activity, then it cannot be such a valuable adjunct in the home—both economically and healthfully—during the longer period of lower temperatures. The point was made at a recent meeting of the Stoke Newington Borough Council, when the account for gas supplied to the Public Library was brought forward. One councillor asked why, if "electricity was cheaper than gas," it was not used in the library. The reply of Alderman W. S. Wright was that the reasons for not making the change were the cost

of altering the fittings and the usefulness of gas for heating purposes. And his experience was that electricity was not cheaper than gas. This is not an isolated case of the recognition of the heating utility of gas lighting.

As a matter of fact, the use of electricity for lighting makes the question of heating one of greater importance; and (in addition to the cost of the electric ventilating-fan) it supplements the heating expenses of a house. The experience of one well-known Gas Company, in a limited portion of whose district electricity has been adopted for lighting to perhaps a larger extent than in any other area in the country, is that, in the territory in question, the electric light has been an effective force in impelling the adoption of gas-fires. And it comes about through the users of electric light missing the genial warmth of their gas-burners in the evenings of the early autumn and in springtime, when the air of the evening for comfort's sake, when sitting indoors, requires its chilliness removed. The convenience and utility of the gas-fire (the electric light not being a recommendation for electric radiators) for this purpose among electric light users is becoming very largely appreciated; and their introductory use in this way and for this purpose educates, and at length they have come to be looked upon as indispensable. As a consequence, in many electrically lighted houses (with cooking-stoves in continued service from a period prior to the advent of the electric light), gas bills have shown an ascent and not a descent. In such instances, electric lighting is a friend in disguise.

This is an age in which progress ministers more and more to human comfort; and it is of the nature of humanity not to be adverse to the movement, but rather to give to it the encouragement of its patronage.

Conference on Gas-Heating Research.

Those who are alive to the principal direction in which there is going to be large commercial expansion for the gas industry cannot fail to highly appreciate the work that has been done, through the Gas-Heating Research Committee, at the Leeds University. This work has expanded knowledge, and has made without doubt its mark on gas-fire production by raising the standards to which the gas-fire makers have to work. The Committee desire to make their work of the utmost value by taking counsel with all who are interested in the lines of the research and the problems involved. In pursuance of this desire—it is learned from a letter received from Professor Arthur Smithells, reproduced in our "Correspondence" columns—arrangements have been made for an open conference of all interested (whether gas-engineers or gas-fire manufacturers) to-morrow week, Nov. 9, at the Leeds University. No further invitation than this is necessary; but it would be useful if those who intend being present will send an intimation to that effect to Professor Bone at the University. We are particularly glad to see at this time the announcement regarding this conference, as there is promise in it that there will be no break in the work the Committee have in hand, in consequence of the fact that Mr. E. W. Smith (who has been conducting the research) has received and accepted a "call" to a new field of labour in connection with the Birmingham Corporation Gas Department's new enterprise in high-pressure gas supply, to which reference is made in an earlier leader column and in a special article later. The conference will be (so to speak) the occasion of Mr. Smith saying "farewell" to the work on which he has been engaged, and engaged with so much industry and ability and personal credit. A summary of the work that has been accomplished, and an account of the questions involved in it, to be presented at the conference, will be his final duty in connection with the work of the Committee; but he will in effect be only transferring his services from one promising field of the gas-supply industry to another, and this the one in which there is a large amount of initial work awaiting the competent hand. We hope the conference will be a large success.

Manchester District Institution.

We cannot to-day, owing to pressure of time and the claims on our space, notice editorially the final event of the past week for gas engineers—the visit of the Manchester District Institution of Gas Engineers to Stretford. There will be a return to the proceedings next week; but meanwhile a full report is published elsewhere. We must, however, take this the earliest opportunity of saying how kindly and generously the members—who were present in excellent number—were received by the Chairman (Mr. Lewis Galloway), Vice-Chairman (Mr. Nicholls), and Directors of the Stretford Gas Company. When good nature and courtesy are evinced in such manner and on such an occasion as on Saturday, it is a sure sign that between the members of a Board of Directors and their chief technical officer there exist absolute confidence and friendly feeling. This is the condition of affairs at Stretford between the Board of the Gas Company and their Engineer and Manager (Mr. H. Kendrick); and the results were seen by the visitors on all hands. There was good speech-making after lunch; and the proceedings at the afternoon's meeting were extremely interesting—one feature being the discussion of the highly suggestive Presidential Address delivered by Mr. Kendrick at the February meeting.

Municipal Trading in Germany.

Of recent years, municipal trading has received a considerable set-back in Germany; and this is not to be wondered at when it is seen what enormous revenues can be obtained by municipalities who make judicious arrangements for the leasing of so-called public services to private undertakings. The city fathers of Berlin, for instance, do not appear to believe in municipal trading where it can be avoided; for, though they have for many years possessed gas-works of their own supplying a portion of Berlin, a considerable area is served by a Private Company, and both the electricity supply and the tramway service are in private hands. For the year 1909, these undertakings paid into the municipal coffers the very large sum of nearly ten million marks by way of fees for the use of the streets and percentage on profits, made up as follows:—

Gas Company	608,031 marks
Berlin Electricity Works	4,916,445 ..
Berlin Tramway Company	3,344,090 ..
Charlottenburg Tramway Company	83,572 ..
Siemens Tramway Company	80,783 ..
South Berlin Suburban Tramway Company	20,497 ..
West Berlin Tramway Company	23,055 ..
North East Berlin Tramway Company	12,282 ..
Overhead and Underground Electric Railway	126,690 ..
Public Advertising Stations	415,600 ..
	9,631,045 marks

This very considerable revenue is received by the town without their having to provide or risk a pennypiece of capital, or having to create and maintain an army of functionaries, officials, and workmen—in short, they have all the benefits, without any of the disadvantages, attaching to the carrying on of these public services. The municipal trader will, of course, retort that the public suffer by having to pay higher prices than they would do were the services in the hands of the Municipality direct. Unfortunately for this argument, it happens that both the town and the Gas Company charge the same prices at Berlin. The chief point which the municipal trader overlooks, or refuses to see, is that a private commercial company can always work more cheaply than a public authority—a point of which we, in England, have recently had a very good illustration in connection with London Water Affairs.

Lead Poisoning on a Gas-Works.

Many strange points have called for judicial decision since the passing of the first Workmen's Compensation Act; and though, of course, the wider scope of the latest Statute dealing with the subject has somewhat lessened the chances of dispute there are still, it would appear, plenty of arguable questions left. One of these has come before Judge Harington at Wandsworth County Court; and it has been thought worthy of reporting at length in the "Legal Intelligence" in this issue on account both of the unusual circumstances of the claim in connection with the gas industry, and of the interesting nature of the answer put forward. The applicant for a compensation award for total disablement was a man who had for a great number of years been in the employ of the Wandsworth and Putney Gas Company as a fitter and it was stated that his work of making joints involved the continuous use of lead in different forms—red lead, white lead, and molten lead. In September of last year, he was engaged near the roof of a new meter-house on the 24-inch inlet and outlet main of a station-meter; and the allegation was that he developed lea

poisoning from the fumes of the molten lead, from which he was unable to escape. The Company, in view of this being an isolated case, and of the fact that there appeared to be plenty of ventilation in the meter-house at the time the man was taken ill, looked about for a possible explanation. They were medically advised that the applicant could only have been poisoned by taking the lead into his mouth; and evidence was forthcoming that he had been known to chew tobacco. Under these circumstances, they felt it their duty to contest the matter, on the ground that putting the tobacco in his mouth with his hand would account for his getting lead poisoning where others had not, and that therefore the disease was not "due to the nature of the employment," but to a habit which the man had acquired for himself personally. For the applicant, a doctor said one could get lead poisoning from absorption through the skin, by inhaling or by swallowing; while for the Company, a medical man from Harley Street stated that lead paint or putty on the hands would not affect a person through the skin as the applicant was affected. The man himself, when in the box, told the Court that he had not chewed since 1908; and that when he did do so, he had not taken pinches of tobacco when he had lead putty or paint on his hands. This statement the Judge said he accepted; and he expressed himself satisfied, after hearing the evidence, that the poisoning was due to the nature of the work on which the applicant was employed. "Even supposing," he added, "it had been contracted because he happened not to have his hands quite clean—though it is not necessary to decide this point—in my opinion that would not have deprived him from obtaining compensation." He therefore awarded the applicant the £1 per week asked for.

The Spirit of Unrest.

The manifestation of the feeling of unrest in the South Wales coalfield nowadays seems to be only a question of degree. More or less, it is always with us; but at intervals of time—generally very shortly separated from one another—the trouble threatens to come to a head. Those sectional strikes which have been straining so much the organization of the Conciliation Board, are continued as light-heartedly as ever; and one wonders how long the present unsatisfactory position can be maintained. Within the last few days, the trouble has again become acute; and there is ample evidence that a section of the men do not regard the prospects of a severe fight with any feelings of aversion. No doubt, these are the younger and less responsible miners; but in a public meeting at which a course of action may be decided upon, they are likely to be the most demonstrative element. In the Aberdare Valley there are already a lot of men out; and it is possible many thousands more in the Rhondda may also be idle this week. The coalowners, in fact, we are told, take a very grave view of the immediate outlook. It is pointed out that on previous occasions during the past two years when meetings of the owners have been convened to deal with labour crises, there have been differences of opinion on questions of general policy; but at a gathering which was held last week to discuss the situation, absolute unanimity prevailed, and a determination was expressed to deal firmly with what is generally regarded as an intolerable state of affairs. The decisions arrived at have not been disclosed; but a correspondent of a local paper states that there is good reason for believing that the Association pledged themselves up to the hilt to support by indemnity those owners whose collieries are now idle or are likely to be rendered idle this month under notices served by the workmen. It was said by one of those present that never since the existence of the Association had there been so united and determined a spirit displayed by the members, and that they were not only ready, but fully prepared, to deal with any eventuality that may arise.

Gratifying evidence has lately been afforded that the articles which appeared in the "JOURNAL" for the 18th ult., on the substitution of gas for electricity by the Society of Medical Officers of Health, have been appreciated. Reprints of the articles have been supplied to several gas companies for distribution; and Mr. John Young, the Engineer and Manager of the Hull station of the British Gaslight Company, Limited, has sent us a card which he has had prepared, setting forth in prominent characters the important fact that "doctors agree that gas is supreme," as shown by the action of the above-named Society. The card is 12 in. by 10 in., the concise statement upon it is printed in red and blue, and there is a flap at the back to support it when standing upon a show-room table. It is another vehicle for publicity.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 346.)

THE feature last week in the Stock Exchange and in financial circles was the fall in Consols to a price untouched for half-a-century or more. The barest discussion of the causes is beyond the scope of this article; but one thing is certain, and it is that prices can be "talked down." Market value is the credit a security enjoys in the public estimation; and if sufficient people will but unite to alarm each other, the fall is an automatic certainty. Last week opened in an anæmic sort of condition, and the general tone was weak, though Rails were fairly steady. The gilt-edged class suffered, and Consols began their downward course with a fall of $\frac{1}{4}$. Tuesday was dull and heavy; and one failure (it was account week) was a disagreeable reminder of sinister possibilities. Consols fell another $\frac{1}{4}$; and there was scarcely a firm spot anywhere. On Wednesday, Consols were done at $78\frac{13}{16}$; but later prices were a little better, and the net loss on the day was no worse than $\frac{3}{8}$. Most other markets were sympathetically affected; but Rails were not much hurt. On Thursday, business was still quiet and cautious, but inclined to brighten up a bit. Consols steadied, and Rails improved. Americans shaped better; and in some miscellaneous lines there were advances. Friday made a good show of cheerfulness, though some realizations before the close brought the last prices down below the best of the day. Government issues rose in response to inquiry. Rails were quite strong, and Americans improved. Saturday was very quiet; but the tone was good, and Consols rose $\frac{1}{8}$. The Money Market was hard at first in face of a strong demand, but relaxed later on when the supply was largely augmented. Discount rates closed easy. Business in the Gas Market was quieter and rather dull—as might be expected in such an agitated week. Very few quotations made any change, but the tendency was rather inclined downhill. In Gaslight and Coke issues, the ordinary receded another half-point, with transactions ranging from $105\frac{7}{8}$ down to $104\frac{1}{4}$. In the secured issues, the preference was a point easier at from 104 to $104\frac{1}{2}$, and the debenture was done at 81. South Metropolitan was quiet at from 121 to 122; and the debenture changed hands at $81\frac{1}{2}$. In Commercials, there was one bargain in the 4 per cent. at $107\frac{1}{2}$, and one in the $3\frac{1}{2}$ per cent. at 103. Among the Suburban and Provincial group, Alliance and Dublin advanced 1, and the debenture was done at $97\frac{1}{4}$. Bournemouth "B" realized $16\frac{9}{16}$, Brighton original $215\frac{1}{2}$, and ditto ordinary $158\frac{1}{2}$. On the local Exchanges, Liverpool "B" was done at 164, and Sheffield "C" at 230, while Newcastle and Gateshead rose $\frac{1}{2}$. In the Continental companies, Imperial was unchanged at from 187 to $188\frac{1}{2}$—figures unaltered for three weeks. Union marked $96\frac{1}{2}$ (a fall of 1), European fully-paid $24\frac{1}{4}$, ditto part-paid $18\frac{1}{8}$, and Tuscan $9\frac{3}{16}$ and $9\frac{3}{8}$. Among the undertakings of the remoter world, Bombay changed hands at $6\frac{1}{2}$, Melbourne $4\frac{1}{2}$ per cent. at $100\frac{3}{4}$, Monte Video at $12\frac{5}{8}$ and $12\frac{7}{8}$, Oriental at 140, Primitiva at from $7\frac{3}{8}$ to $7\frac{9}{16}$, ditto preference at from $5\frac{3}{16}$ to $5\frac{3}{8}$, and San Paulo at $15\frac{3}{8}$ and $15\frac{3}{4}$.

ELECTRICITY SUPPLY MEMORANDA.

Conflicting Interests and Influences—Library Lighting and Intelligence—Flame Arcs and a Doubtful Future—Poor Dwellers and Poor Lights at High Cost.

THERE is no question about it that the Incorporated Municipal Electrical Association are missing no opportunity for getting fresh recruits to the ranks of those local authorities who are prepared to give material support for the Electric Wiring and Fittings Bill that it is proposed to promote under the ægis of the Association. There have been special attempts to stir up the waverers—those local authorities who are halting before a decision as to whether they shall financially or merely morally support the measure, and those who are hesitating as to whether it is more politic to upset the Municipal Electrical Association or the local contractors for electric wiring and fittings. There are so many influences brought to bear, that forsooth some of the local authorities cannot determine what to do. Their electrical engineers tell them the municipal undertakings are languishing for these powers, so indirectly suggesting that the undertakings are in a very anæmic condition, and that nothing can brace them up again but the free wiring and fittings powers. Experience from other places tells of this extension of municipal powers (where obtained) having been fruitful of loss; and there are future meetings with ratepayers to be thought of if any adoption of the new scheme results in similar financial failure. Then the Municipal Electrical Association say: "Come and help us to get this power, which we mean to have to spite private enterprise in gas supply and private enterprise in electric wiring and fittings, and to the four winds or to the ratepayers' pockets with the consequences, and to Halifax, Hull, or some other place with the Electrical Contractors' Association." Then the local electrical contractors appeal to those tradesmen on the councils to respect private enterprise, and to let competition with the gas company mark the limits of municipal operations in this regard.

So between conflicting influences and interests there are many local authorities who do not know precisely what to do. But encouragement is being given to those who are faltering to come

in by statements as to a fairly considerable sum having been promised by other authorities for the contest; but the individual sums that we have seen promised have not been striking for their generous character. Doubtless to a few conscientious councillors there is something repulsive about spending any considerable sum in fighting for powers to deprive a local ratepayer of his business. However, the Municipal Electrical Association must have learned ere this that combination fights of this character are expensive things, when there are resolute opponents defending their private interests against bodies originally created for the express purpose of safeguarding the common interests, but who are now using their position for malignantly attacking them. At the same time, the Electrical Contractors' Association are now girding up their loins for the fray. They have been successful hitherto in this matter. They have to meet the now frenzied victims of their success. In Parliament and in the Law Courts, the Association have won; and the more the enemies of private enterprise are repulsed, the more vigorous do they renew the attack. Hence the Bill. The Ironmongers' Association will take part in opposing it, if the Municipal Electrical Association consider the support received is sufficient for them carrying a contested measure through Parliament. The Gas Companies' Protection Association are also looking into the question as will be seen by the report elsewhere of the proceedings at the annual meeting of the members. Everything seems to be shaping for a big fight for and against an extension of municipal trading into what has been proved to be a highly speculative business.

The librarian of the Deptford Borough Council is a person it would be worth one's while to meet for an interesting little chat. There has been some question as to the system of lighting that shall be adopted for the library in course of erection at New Cross Gate. The librarian is of opinion that gas has a very injurious effect upon books; but he does not state his reasons for taking upon himself the responsibility for the resurrection of this statement, which we had thought had been made for the last time long ago—since people have found that the processes of making leather bindings are not altogether free from fault in this matter, and since it has been found that where no artificial light is used in libraries or where electric light is employed, book bindings are not immortal things, and that they go the same way as the bindings of books in gas-lighted libraries. We suppose a librarian who is so pronounced in his opinion that "gas *has* a *very* injurious effect upon books" will next ask that it be made a condition precedent to issue that borrowers should have electric lighting installed in their houses. We take it that at Deptford, as elsewhere, the books whose bindings wear out the quickest are those that are the most popular, and those that are the most popular find rest in the library for only short intervals. There is a good deal of nonsense talked about this question of library lighting, and it has formed a subject for discussion frequently in these pages—in days lang syne. The Deptford librarian has not to go far from his own centre of useful labour to find other library buildings where gas is used, and in which the wear of the bindings of books is about normal. But in the lighting of libraries there are other questions to be considered, besides the bindings of books—there are the eyes of the readers in the library, which are more important than book bindings. And those eyes want a good light, and the light which suffers least from the fault of glare. For the lighting of the library, the London Electric Supply Corporation, Limited, offered 1830-candle power for £34 a year; the South Metropolitan Gas Company 6600-candle power for £42 5s. The measure between 1830 and 6600 candle power ought surely to have made the most economically inclined willing to pay the additional £8 5s. to the Gas Company with the greatest of pleasure and benedictions on their head for providing such an economical light. If the Gas Company think 6600-candle power necessary for the library, then we can see, if the Electric Light Company only put in 1830-candle power (the Council, after much hesitation, having adopted their tender), there will be such a demand for more light that the electricity account will reach to more than the Gas Company were asking, and for far less illuminating power than gas offered.

The contribution to literature in the lighter vein with which the "Electrical Times" favoured its readers less than a fortnight ago contained an article on "Arc Lamps," reading between the lines of which it is easy to see that the writer is not comfortable in his mind as to their future. The policy of our contemporary is to deride all progress in gas, and to sing loud the praises of everything that is electrical—from a new switch upwards. In this article, however, on "Arc Lamps," there is doubt as to their future. "During the next few years," it is remarked, "the arc lamp will pass through one of the most critical periods in its existence." In stating the causes for this, the writer very properly gives first place to the high-pressure gas-lamp, and second place to the metallic filament lamp. But this is how the relative position in importance is stated: "Beset as it [the arc lamp] is by the somewhat feeble opposition of a practically untried, but gorgeously advertised, competitor in the high-pressure gas-lamp, and by its more to-be-feared stable companions, the high candle-power tungsten lamp and the improving mercury vapour lamp, the ordinary pattern arc lamp will not maintain its position without a struggle." This certainly does not look at all promising for the flame arc lamp, which is the best thing the electrical industry can put forward as the arc lamp champion. Materially assisting to this conclusion have no doubt been the demonstrations made between high-pressure inverted lamps and the various types of electric arc lamps. It must, for instance, give electricians quite a nasty shock to turn out of Victoria Street, Westminster, into the Vauxhall Bridge Road just at the present time. It is also interesting to note that "any revolutionary change" in flame arcs "can only be expected from an equally revolutionary departure in the design of lamp, or in the manufacture of the carbons." So we know where we are for the time being in the matter of the competition that has to be met. But the flame arcs of the day have still their acknowledged defects; and the ordinary ones suffer seriously from their short burning hours. But there are the magazine forms of lamp, in the making of which "the troubles experienced have been many;" and we trace a sort of non-committal tone in the words "we believe that the magazine lamps now being offered can command every respect." The electrical readers of the article will have wished that the writer could have adopted a more positive and hope-inspiring tone.

In his last annual report, Mr. A. H. Seabrook stated that the number of new consumers connected during the twelve months was 600, compared with 300 the previous year; and that, though the value of the revenue per consumer was smaller, the establishment charges were nearly as heavy. The drop in the average price obtained per unit goes on, while the costs of production do not show a downward tendency at an equal rate. These facts indicate the direction in which many electric undertakings are drifting, and not to the advantage of their finances. Another report shows us how the Department are securing, in what appears to be an undignified manner, some of their business from the poorer inhabitants in the district. It is not only compulsory public lighting in the Marylebone district as a result of municipal trading in electricity there, but it seems—at least so we understand the report [we shall be pleased to publish the denial if we have misinterpreted what is here stated]—that the occupiers of John Street Dwellings are also being compelled, by arrangement with the Improvements and Housing Committee of the Borough Council, to take electricity, and at a rate which will show prepayment gas consumers what are the notions of electricians as to what they ought to pay for the so-called cheapest light provided by electricity. The charges are: 7d. per week per lamp (sitting-room), 5d. per week per lamp (bedroom, with metallic filament lamp), or 3d. per week per lamp with carbon filament lamp. Now why is that formand the carbon filament lamp charged less than the metallic filament? We do not know the candle powers of these lamps; but the prices per single lamp are pretty steep for poor people for each room, though the charge is inclusive of installation and maintenance. In no case, it is remarked, is there more than one lamp in a room. Poor dwellers! But these people have had something else to contend with. They probably have to put up with having the electric light, but they have kicked against being deprived of their gas cookers. But why? Has not it gone forth from Marylebone that cooking by electricity is as cheap as cooking by gas. However, this is what the report says: "The situation has been a little complicated by the action of the Gaslight and Coke Company in removing their meters and heating apparatus. In case this were done, we had already agreed a course of action with the Improvement and Housing Committee, which would immediately put the tenants in a position in no way inferior to that occupied in relation to the Gas Company. We give them the choice of retaining their gas cooking apparatus on the same terms, or of having an electric heating plate to answer the same purpose. The Gas Company are, of course, bound to supply gas to the dwellings; and those tenants who do not prefer electricity for cooking purposes will be supplied with gas and apparatus on hire as before, only by the Council." The position is an interesting one not only for the tenants of John Street Dwellings, but for onlookers who will be curious to see how long (if our surmise is correct) the dwellers will put up with despotic government of this kind. What is municipal management of electricity concerns descending to, and how much greater will be the descent?

Yorkshire Junior Gas Association.—At the opening meeting of the Association for the present session, a report of the proceedings at which appeared in the "JOURNAL" for the 18th ult., Mr. J. E. Sutton, of Bradford, was elected Hon. Secretary. We learn, however, that he is unable to take up the duties, and that Mr. E. Garsed, of Elland, the Hon. Treasurer, will do so; the position that he relinquishes being filled by Mr. C. H. Turner, of Mirfield.

Institution of Civil Engineers.—The first ordinary meeting of the Institution for the session 1910-11 will be held this evening, when the new President, Mr. Alexander Siemens, will deliver his Inaugural Address, and the medals and prizes awarded by the Council for papers will be presented. The business will be followed by a reception by the President in the library. The foundation stone of the new building, particulars of which have already been given in the "JOURNAL," was laid last Tuesday by Mr. James C. Inglis, the outgoing President. The site is at the corner of Great George Street and Princes Street, and consequently on the opposite side of the road from the present building. In the course of the proceedings, Sir William White stated that when the present building was erected in 1894, the membership of the Institution was 6621, whereas at Midsummer last it was 9053. On the basis of numbers, therefore, greater accommodation was required, and this would be provided in the new premises.

TRADING IN HIGH-PRESSURE GAS IN BIRMINGHAM.

The Birmingham Corporation Gas Department will be able henceforth to claim that they were the first, among provincial industrial cities and towns, to appreciate what a really important factor high-pressure gas is destined to be in the future in the economic methods of industry, and, so appreciating, to afford to the manufacturers of the city a general supply of high-pressure gas on tap at all hours of the day. The City Council have endorsed the desire of the Gas Department to be of the greatest possible service to the city in contributing to the conveniences and economies of its industries; and the department, on their part, have not proceeded with the matter in any niggardly spirit, for the system they have put down, and will extend as opportunity suggests, is of a character that shows that real and permanent business is intended. So much so is this the case, that offices and demonstration-rooms will, in the course of about ten days, be specially devoted to the high-pressure business; and Mr. E. W. Smith, of gas-heating research fame at the Leeds University, is to be the presiding technical head of this sub-department, for the purpose of devoting his knowledge to ascertaining and advising on the requirements of manufacturers and experimenting as to the best means of effecting their processes by means of high-pressure gas. From this it will be seen that serious business, commercially and technically, is in view, and that it will not be long before manufacturers will see that the Gas Department heartily deserve their thanks for the time and money economies and conveniences that they are providing for them.

The Secretary and General Manager of the Department (Mr. R. S. Hilton) and the Superintendent of the Fittings Department (Mr. S. R. Barrett) are, as indeed are all the officials, very enthusiastic over this new departure; and in an interview with the gentlemen named last week, many interesting particulars regarding it were obtained. In the first place, as to the compressing plant and distribution system. There have been installed at Windsor Street works two Worthington compressors, capable of supplying 60,000 cubic feet of gas per hour each, at a pressure of 15 lbs. per square inch. The leading main from these compressors is 18 inches in diameter; and there are already 7 miles of main laid. The smallest main is a 6-inch; and an important part of the system is about 3½ miles of 12 inch main running from the centre to King's Norton. But this main represents a distribution convenience as well as an industrial advantage, as, running out to a part of the border of the general supply area where the mains are somewhat small, the general supply can, through a governor, be strengthened. This, of course, as has been generally recognized, is a cheap means of securing a distinct benefit. It is interesting to learn that for this high-pressure supply, the Gas Department have adopted cast-iron mains (with lead joints carefully made, and the pipes a little longer in the spigot and socket); and as they have been tested up to 30 lbs. per square inch, they may be relied upon to stand any pressure demanded of them. The department felt that the tests fully justified their selection of cast-iron pipes. Of course, the system as it exists at present will be subject to many ramifications, as it is not the intention of the department to deny the advantages of the high-pressure gas to any part of their area to which it can reasonably and profitably be carried.

While speaking of piping, a word may be said as to internal fittings for the use of the high-pressure gas. Brass is found to be of no use; and so gun metal is employed. In some cases solid-drawn copper tubing is used; but weldless steel is now being substituted. It must be remembered that the department are as it were starting *de novo* in this business, so far as the application of high-pressure gas to their industries is concerned; and they have had to feel their way, make all their own experiments, and come to their own conclusions in every respect. For this detailed work (Mr. Hilton privately mentioned to the writer) a great deal of credit is due to Mr. Barrett.

Then as to the pressures in the mains, the department are arranging for this to be at a height that will exceed the maximum required by any manufacturer. One may want a pressure of 100 inches, another 150, another 60; and governors will stand guard to see that the various customers get just what they want. The Department, in fact, guarantees a constant supply at any pressure arranged for; and already negotiations and inquiries are plentiful.

It is not intended to convey by what has been said that the department has not before this had experience of high-pressure gas. It has had for some three years a plant for experimenting and lighting. But the present scheme is something altogether different; and within the past few weeks the first commercial installation has been connected up to the new system. This is at the Birmingham Aluminium Company's works. There they have installed a furnace to be heated by the high-pressure gas for melting aluminium alloy, which is used for casting motor gear cases and things of this kind. For the same purpose, they have hitherto used blast-furnace coke. In making the change from the one fuel to the other, they have simply taken the same pot, put in a fire-clay lining, and made holes in the sides through which the gas plays on to the pot. The Company are very pleased with the change that has been effected, because they get perfect regulation of the heat (which is of importance to them); and furthermore there is no difficulty regarding oxidation of the metal, which oxidation is reduced considerably by the gas flame as compared with the coke flame. They also find that in melting-up the scrap aluminium or shavings they can recover about 75 per cent., instead of about 25 per cent. as under the old method, in which the oxidation was so great that it practically destroyed the value of the shavings or chippings. It is a great point in favour of the high-pressure gas flame that it is not an oxidizing one; and another valuable thing with the high-pressure furnace is found to be that, while the whole of the products of combustion are sent out at the end of the furnace—a furnace such as is used for pipe or bicycle rim brazing—at the open or working end there is no cooling by the inrush of cold air. This was demonstrated later on a visit to the experimental room. The variety of purposes to which they are confident the new service will be applied in the way of annealing and hardening were explained by Mr. Hilton and Mr. Barrett; and one could not but agree with them that unquestionably the Gas Department have done the right thing in entering upon this new enterprise.

It was further explained that for ordinary crucible work the adoption of high-pressure gas is the simplest thing in the world; and so it is for all hand blowpipe work. Another advantage is that it is so safe. There is no lighting-back, and no explosion when the gas is turned on; and when the temperature rises beyond a certain point, it can be immediately reduced, and thus constancy be ensured. The simplicity of the whole of the fittings is another commendation. For example, the burners are nothing but a piece of gas-pipe with a jet on the end. The high-pressure gas does all the rest—taking for itself all the oxygen it requires out of the atmosphere; and, burning in the open, it produces a highly oxidizing flame.

The measurement of the high-pressure gas was a problem to be dealt with—seeing that, with the pressure given in Birmingham, the volume of the gas is reduced by one-half. What has been done is to introduce a meter with an automatic compensating arrangement, whereby the measurement can be reduced down to ordinary gas pressure, or (say) 3 inches water pressure. The arrangement referred to is a beautiful and reliable piece of apparatus. It has been designed by Messrs. Parkinson and W. & B. Cowan, Limited, and is on the aneroid barometer principle. To say the least, it is a very ingenious arrangement. Mr. Barrett has also designed an automatic safety shut-off valve for all high-pressure services—lamp or otherwise. It is really an improvement (Mr. Barrett modestly says) on a device that has previously been in use in America. The valve comes into operation on a sudden demand being made for high-pressure gas in excess of its capacity. If this happens, it would be through accidental fracturing of a pipe, or some other casualty; and so safety is ensured by its use on every high-pressure service.

In addition to industrial supply, the high-pressure system is going to be tapped for public lighting purposes; and the first trial is to be made in Stephenson Place and Victoria Square with high-pressure inverted burner lamps of 3000-candle power, arranged on standards 18 feet high from the pavement level. The contracts are divided between the James Keith and Blackman Company and Messrs. Thomas Glover and Sons. In this first trial, there will be ten standards carrying single lamps, and a double standard carrying two lamps. The lamps will be controlled by means of a doorway in the base of each standard. A ½-inch service will go to each lamp; and the pressure, whatever it is, will be broken down to 100 inches by means of a governor that is visible on opening the door. Two taps are also seen; and it is learned that one of these controls one burner in the lantern, and the second tap the other burner. There is also adjacent a screw adjustment for controlling the bye-pass. This arrangement of dual taps will allow of one burner being turned off at midnight. It is seen that in connection with the fittings every precaution has been taken to ensure constancy. For the supply of the burners, solid-drawn copper tubes run up the columns, which by the way are handsome, and are the work of Messrs. Macfarlane and Co., of Glasgow.

Before leaving, the writer was taken by Mr. Barrett to a basement room at the gas offices, where the high-pressure experimental work has been proceeding. A furnace and crucible are fitted there, and blowpipes of all kinds are lying about for demonstration purposes, be the work of large, rough character or the fine and delicate work of the operator in precious metals. The exceedingly high temperatures that can be quickly and economically obtained in furnace or crucible or otherwise were observed. The gas is supplied here at rather more than 50 inches pressure; and, consuming about 300 cubic feet per hour, a temperature of 1100° Fahr. was being obtained in the furnace, using three simple burners on each side. The crucible, as employed in the melting of copper, was seen at a temperature of 1150° Fahr. But what was astonishing was that such great effects were obtained by such unpretentious and inexpensive means; and another thing was the flexibility of high-pressure gas in getting just the temperature required. The safety of the employment of the high-pressure gas under the devised arrangements is demonstrable in this little installation.

Then the writer was taken to the Aluminium Company's works; and he there saw what had been done in fitting-up the premises

for the use of the high-pressure gas. The large crucible which is heated by this means was seen, and in which, starting cold, 1 cwt. of aluminium can be melted in 65 minutes. The saving is in factory time, and in the increased output of the plant, compared with the old conditions—the latter representing a 20 per cent. increase during the working day. The safety-valve is situated by the meter; and this automatically shuts off the supply should at any time an accident befall the inside service.

To Birmingham and its neighbourhood much is due in connection with the gas industry; and in this general distribution of high-pressure gas, it is once more showing its pioneering spirit, though what has been done in London must take precedence in the matter of time, if not in the character of application.

PERSONAL.

Alderman W. T. Heap, J.P., who has been Chairman of the Water Committee of the Rochdale Corporation for the last twenty years, is to be invited to occupy this position for another term.

In the "Journal" for the 27th of September we recorded the death, on his way to England from South America, of Mr. Herbert Gandon, the Engineer and Manager of the Ceará Gas Company, Limited. It will be seen, from the report of the proceedings at the annual meeting of the Company on Friday which appears elsewhere, that the Directors have appointed as his successor Mr. John Reid, who is, they say, an old and reliable servant of the Company.

At a farewell gathering held last Friday evening, Mr. Robert Wardell, who is relinquishing the post of Assistant Fittings Superintendent under the Birmingham Corporation Gas Department to take up the position of Assistant-Engineer of the Cambridge Gas Company, was the recipient of a variety of useful presents from the officials, fittings staff, and gas-fitters of the Birmingham Gas Department. In the comparatively short time Mr. Wardell has been in Birmingham—less than two years—he has apparently won the respect and affection of all with whom he has been brought in contact; the meeting on Friday being a crowded and most enthusiastic one. A very enjoyable musical entertainment was given during the evening by members of the fittings staff and the gas-fitters. During the interval, Mr. S. R. Barrett, Fittings Superintendent, who presided, asked Mr. Wardell's acceptance of a handsome Sheraton music cabinet subscribed for by the officials and fittings staff, and of the following useful gifts from the gas-fitters: A slide-rule in case, with magnifying prism; a copy of O'Connor's "Gas Engineer's Handbook;" and an inkstand. Mr. Barrett was supported by Mr. A. W. Tooley (the Office Superintendent) on behalf of the officials, and Mr. S. Watts on behalf of the gas-fitters, both of whom paid eloquent tribute to the esteem and affection which Mr. Wardell had won from those under him during the short time he had been with them, and wished him every success at Cambridge. Mr. Wardell, in the course of his acknowledgment, stated that Birmingham had always held a foremost place in the gas industry, and he was proud to have had the opportunity of serving such a department. He touched on the competition the gas industry had now to meet, and emphasized the necessity of continual "forging ahead." He expressed the hope that the Birmingham Gas Department would always be found in the van of progress. A vote of thanks to Mr. Barrett for presiding, proposed by Mr. Y. Dingley, the Assistant Secretary, and seconded by Mr. Wardell, terminated a most successful and enthusiastic gathering.

OBITUARY.

The death has lately occurred at his residence, at Whitley Bay, of Mr. Charles D. Main, one of the oldest officials of the Newcastle and Gateshead Water Company. For nearly forty years he had been in their service, and occupied the position of Registrar. A short time ago he had a paralytic seizure. The deceased, who was widely known and esteemed, took a prominent part in the public affairs of Whitley Bay. He was 55 years of age, and leaves a widow and one son.

The death occurred recently of Sir Joseph Thomas Firbank, the Deputy-Chairman of the Newport (Mon.) Gas Company. Sir Joseph had resided at Chislehurst for many years; but he died at Tunbridge Wells, where he was staying for the benefit of his health. The interment took place in St. Nicholas Churchyard, Chislehurst, last Tuesday, in the presence of a number of relatives and friends. Mr. T. H. Hazell (the Secretary) represented the Newport Gas Company, the Directors and staff of which sent one of the many beautiful floral tributes to the memory of the deceased.

The death has recently occurred, as the result of illness consequent upon a paralytic seizure rather more than two years ago, of Mr. William Mansfield Gardiner, a well-known and highly-esteemed Solicitor of Uxbridge, of which town he was a native. His father, Mr. William Gardiner, who was also a Solicitor, was the first Secretary of the Uxbridge Gas Company. On his death he was succeeded by his son, who had been acting jointly with him, and who held the position till two years ago. Together, they had been connected with the Company for fifty years. Deceased leaves a widow, one daughter, and two sons.

The death is recorded, at the age of 83, of Mr. Theodore Aston, K.C., who was one of the principal specialists at the Bar on the law of patents. About forty years ago, Mr. Aston was one of the chief competitors of Mr. Webster, Q.C. (father of the present Lord Chief Justice), who was almost the earliest member of the Bar to devote himself exclusively or mainly to this branch of work. He was called in 1853, and took silk in 1872. From that year he enjoyed a commanding practice in patent actions, among the most important of which was one brought by Mr. R. H. Patterson against the Gaslight and Coke Company for an alleged infringement of the patent in connection with his process for the purification of gas. He retired from active practice some years ago.

A sad incident attended a football match between Sunderland and Stockton boys in the English Schools Shield competition at the West End football ground, Sunderland, on the 22nd ult. During the progress of the match, one of the spectators—Mr. John Grant, of the Westlands, Sunderland—was seen to fall; and on medical aid being summoned, life was found to be extinct. Deceased, who was 65 years of age, was Outdoor Superintendent of the Sunderland Gas Company, whose service he entered in 1859, when a lad of fifteen. From the position of shop boy, he gradually rose to be meter inspector, meter repairer, superintendent of the Ayres Quay Gas-Works, and finally to the position he occupied at the time of his distressingly sudden death. His jubilee with the Company was celebrated last November, when he was the recipient of a present from his co-workers, as recorded in the "Journal." Ever of a genial and kindly disposition, he was held in great esteem both among his colleagues and the general public with whom his duties brought him into contact, and his sudden decease will be widely mourned. Mr. Grant, who was a widower, leaves a grown-up family of three daughters and a son. At the inquest, a medical man who had attended deceased said that he suffered from weak action of the heart, and that death was attributable to its failure accelerated by chill. A verdict was returned in accordance with this testimony.

Tanks with Bulging Sides.

It will be remembered that a translation of the important paper on "Gasholder Tanks with Bulging Sides," read by M. Bonnet at the last meeting of the Société Technique du Gaz, has already been given in the "Journal." We have since received a pamphlet of eight pages dealing with the mathematical aspects of this interesting and novel design of tank. First, a general formula is set out, applicable to all curved or bulging tank sides, and embodying the fundamental relationship existing between different strains per unit of surface. Then follows a more detailed consideration of this general formula, with a concluding paragraph relating to annular tanks. The system is known as the "M.A.N." system; and no doubt fuller information concerning it would be forthcoming from the Maschinenfabrik Augsburg Nürnberg.

Gas Culinary Installations in the United States.

The last number to hand of our American contemporary "Progressive Age" contains a feature which we believe to be absolutely unique in gas journalism. Out of 44 large pages (11 in. by 8 in. of reading matter), 24 of them are occupied with illustrated descriptions of installations of gas appliances in hotels, restaurants, and large establishments in the United States. The articles are led off by Mr. John M. Brock, who describes "Hotel Ranges in New York City," with the assistance of photographs and particulars supplied by Messrs. H. P. M'Lean and William De Frietas, of the Consolidated Gas Company. Then follows an article by Mr. G. E. Smith, the Gas Fuel Expert and Gas Appliance Superintendent for Hudson County for the Public Service Gas Company of New Jersey. Next comes a description of the gas-ranges in Baltimore, by Mr. H. K. Dodson, the Commercial Agent of the Gas Division of the Consolidated Gas, Electric Light, and Power Company of Baltimore. Mr. E. D. Brewer, who is responsible for the advertisements of the Atlanta Gas Company, has something to tell about the gas installations in that city; and Mr. Philmer Eves, the Sales Agent for the Indianapolis (Ind.) Gas Company, follows him on the subject of those in his district. The other places dealt with are Atlantic City (N.J.), by Mr. Clark R. Graves; Denver (Col.), by Mr. H. V. MacPherson; Portland (Ore.), by Mr. H. M. Papst; Philadelphia (Pa.), by Mr. T. R. Elcock, jun.; Milwaukee (Wis.), by Mr. F. P. Kelsey; Detroit (Mich.), by Mr. Alonzo P. Ewing; and Wausau (Wis.), by Mr. J. D. Taylor, jun. Following these articles is a description of the gas appliances at the new hospital in Munich, taken from the "Journal für Gasbeleuchtung;" and an article on the "Selection of Water-Heaters for Hotel or Restaurant Service," by Mr. G. P. Blakiston, Advertising Manager for the Pittsburg (Pa.) Water-Heater Company. The text of this interesting series of articles is accompanied by eighty illustrations.

Scottish Junior Gas Association (Western District).—The members of the Western District Division of the Scottish Junior Gas Association will meet in the Technical College, Glasgow, next Saturday evening, when a paper on "The Repair of Meters" will be read by Mr. George Scott, of Glasgow.

STRETFORD GAS COMPANY AND THEIR WORKS.

Visited last Saturday by the Manchester District Institution of Gas Engineers.

The Stretford Gas-Works were established in 1854 by a number of residents in the district, after a public meeting had been held to consider the matter; and for many years the whole of the shares were held locally, largely by the consumers. With the efflux of time, however, they are now more generally distributed, though a large proportion are still held by residents in the district. In 1855 additional land was taken, and a new Company formed to extend the works; and in 1862 the first Act was obtained, conferring statutory powers on the Company, defining the area of supply as covering the districts of Stretford, Chorlton-cum-Hardy, Urmston, Lostock, Flixton, Davyhulme, and Croft's Bank in Lancashire, and Ashton-on-Mersey, Sale, and Timperley in Cheshire. The Company has never exercised any of its powers in Timperley; and in 1906 Chorlton-cum-Hardy was transferred to Manchester. The area now supplied exceeds 17 square miles, and has seven different centres of population. With the exception of the Trafford Park area, it is entirely residential, with a large proportion of good and middle-class houses.

In 1877 it was necessary to appeal again to Parliament, and further powers and land were secured. Again, in 1899, by a third Act, the authorized capital was extended, additional land secured, and several valuable powers conferred on the Company, including power to lay pipes in streets not dedicated to the public use, to supply and inspect gas-fittings, &c., to form an insurance fund, &c. These powers have been particularly valuable during the last few years.

The Company is a maximum-dividend one, with power to raise capital and pay interest as follows: 10 per cent. on £25,000, 7½ per cent. on £14,000, 7 per cent. on £61,000, and 5 per cent. on £160,000, with the usual powers of raising 20 per cent. in addition by loans or debenture bonds. The present paid-up capital is £163,118, of which £23,854 is unexpended. The actual amount spent on capital account is £189,263; but this has been reduced by £50,000, the sum paid by Manchester for the Chorlton area.

The output of gas from the works increased gradually at first, but it has grown more rapidly since the Cheshire Lines Railway was opened in 1875 and the land laid out for building purposes. The rate of increase has been checked by the establishment of four electrical undertakings within the area—viz., Stretford and Sale Urban District Councils, Trafford Park Supply Company, and the Altrincham Electrical Supply Corporation. The number of consumers who have wholly, or nearly so, gone over to electricity is comparatively small; but the Company are obtaining less of

General View of the Stretford Gas-Works from the Canal Towing-Path.

the better-class new property than they would if they had a freer hand. The make of gas increased from 55,254,000 cubic feet in 1876 to 238,219,000 cubic feet in 1900, and to 365,971,000 cubic feet last year. The Company have adopted many means of increasing the consumption—hiring cookers and loaning grillers; free cleaning of gas-fires, cookers, and grillers; maintenance of incandescent burners; holding periodical exhibitions of all appliances; opening show-rooms, and prompt attention to all complaints by an efficient home-trained body of gas-fitters who are instructed to give every assistance and advice to the consumers. In 1890 there were no cookers, grillers, or prepayment meters, and only 3743 ordinary ones, in use; whereas now there are in operation 1463 cookers, 5128 grillers, 8788 ordinary meters, and 2970 prepayment meters. As a consequence, the consumption of gas in the daytime has increased at a greater rate than in the evening, as shown by the following figures giving the daily consumption in thousands of cubic feet:—

Year.	Summer. a.m. to 6 p.m.	Summer. 6 p.m. to 6 a.m.	Winter. 6 a.m. to 6 p.m.	Winter. 6 p.m. to 6 a.m.
1890	32	148	168	421
1909	369	375	730	966

POSITION AND EXTENT OF THE WORKS.

The works are situated on the banks of the Bridgewater Canal (now the property of the Manchester Ship Canal Company), about midway between the Manchester South Junction and Altrincham Railway and the Cheshire Lines Committee Railway—divided from the former by the main Chester Road; and they are without any railway sidings. Nearly all the coal received at the works is brought by water from the Wigan district, which is the natural source of the Company's supply. The works have been altered, extended, and partially rebuilt from time to time, originally with little regard to future extensions being on the most economical lines. Some of the buildings—notably the coal-stores and the range of buildings containing the engine, boiler, and pump-houses —are part of the original works erected in 1862, and now used for different purposes from those originally intended.

RETORT-HOUSE.

The retort-house plant is capable of producing 2¼ million cubic feet per day, and contains two stacks each of eight through settings of 22 inch by 16 inch retorts, 20 feet long, built over regenerator furnaces, and fitted with self-sealing mouthpieces and hydraulic mains on both sides of the settings, with 6-inch diameter ascension, bridge, and dip pipes. The hydraulic mains are provided with Dillamore tar-columns, and all are fitted with Meunier's patent hydraulic main floats. Each stack is provided with a 12-inch Braddock retort-house governor.

The retorts are charged by means of West's manual stoking machinery, fitted with their latest form of manual charger, and supplied with coal from two overhead hoppers (one on either side

of the retort-stack), each capable of holding 20 tons of broken coal. The coal-breakers are in duplicate, and are of a specially strong type for breaking-down cannel. They are driven by 12-H.P. vertical steam-engines. The breakers are fitted with clutch gearing, so that they may be thrown out of action when slack is being carbonized; and each is provided with two sliding doors—one to regulate the supply of coal to the breaker, and the other directly supplying the elevator. The latter, which with the breakers are placed on opposite sides of the retort-house, are of the usual bucket type, capable of elevating 15 tons each per hour, and are connected at the top in the retort-house roof by an 18-inch reversible band conveyor, so that both storage hoppers can be filled from one elevator if necessary. The adoption of power machinery and coke plant is under consideration.

The main coal-stores are between the retort-house and the canal wharf, with a subsidiary store on the north side of the former. The main store is served by coal-handling machinery, while in the latter is stored the coal received by rail, which is carted from the Stretford Railway Station nearly a mile away. The two stores will hold 4000 tons of coal.

Coal-Handling Machinery.

This consists of an elevator and conveyors for discharging boats, and either storing the coal in the sheds or feeding the coal-breakers and retort-house hoppers. The elevator is a movable one, capable of being lowered into the boats, and consists of a trunk, 48 feet long, 2 ft. 3 in. wide, and 4 feet deep, fixed at the centre to radial arms which are in turn attached by heavy trunnions to the framework. The elevator is counterbalanced by weights slung from wire ropes, and is raised or lowered by means of a friction hoist and wire ropes working over heavy blocks. The framework is built of steel joists and substantially braced.

The elevator chains are double, 12-inch pitch, working over hexagonal drums, with tightening screws at the foot. The buckets are of large size, 24 in. by 12 in. by 12 in., originally built for dealing with large coal, and capable of elevating 20 tons per hour. The coal is fed into the boot by hand, three men working together, and it is delivered on to the main 24-inch steel plate conveyor, 102 feet long, which is provided with throw-off ploughs to allow the coal-store to be filled up all along its length. At the delivery end a small hopper and shoot are provided, so that coal can be shot direct into the coal-breaker. A cross conveyor of the same size as the main conveyor is fixed at the canal end of the coal-store, and feeds a secondary conveyor, 80 feet long, in the adjoining store. The framework of the conveyors is constructed entirely of steel angles and flat bars, and carries sets of rollers on the top and bottom members to ease the friction and carry the weight of the conveyor plates. The conveyors stack the coal 20 feet high, and very little has to be trimmed after being deposited in the stores. A 40 B.H.P. gas-engine, working on a line shaft, drives the plant. The cross and secondary conveyors can be thrown out of action by a clutch on the main line shaft.

Condensing Plant.

This plant consists of an 18-inch cooling main along the south side of the retort-house and round the main coal-store, connecting

The Works' Interior.

up both the retort-stacks to the coolers. The latter consist of a battery of nine annular towers, 32 feet high and 4 feet outside and 3 ft. 3 in. inside diameter, provided with butterfly valves and water-sprinklers. The battery is arranged in three series of three columns, each capable of being worked separately. The connections are so arranged that the gas is always travelling down the columns. The water coolers consist of four Clapham towers, 20 feet high by 3 ft. 4 in. by 3 ft. 4 in., each containing 81 water-tubes. The gas in these also travels downwards and the water upwards. The connections are arranged so that the gas can travel through the towers in one or two streams as desired.

Exhausters and Boilers.

There are two four-blade and one three-blade Waller exhausters of 60,000 and 45,000 cubic feet per hour capacity respectively, governed by Donkin steam gas regulators driven by steam-engines—two Lancashire boilers, 28 feet by 7 feet diameter, fitted with Galloway tubes in the flues, fired by Wilton's forced-draught furnaces, fed by water heated by the exhaust steam from the exhauster engines.

Washer, Scrubbers, and Purifiers.

There is a Livesey washer, of 2 million cubic feet capacity per day, fed by weak liquor from No. 2 scrubber. There are two tower scrubbers, 72 feet high and 11 feet diameter, fitted with boards, one fed with weak liquor pumped from the well and the other with town's water regulated from an overhead tank. The distributor of the latter is worked by a small engine at the base of the former. The purifiers are eight in number, 20 feet square and 5 feet deep, of the old water-lute pattern, elevated on a stage, provided with discharging shoots, and worked by two centre-valves. They are all fitted with Spencer's hurdle grids. The spent material from the boxes is revivified on the floor under the purifiers, and lifted to refill them by two elevators, one serving six and the other two purifiers. A disintegrator has been provided for better preparing the oxide for use; but it has only just been installed. It consists of a quadruple cage of square iron bars fitted to plates in pairs, each pair revolving in opposite directions at 500 to 600 revolutions per minute. The material is fed into the centre of the machine, and driven by centrifugal force to the outside. In passing through the revolving bars, it is broken up into the consistency of coarse or fine sand according to the speed of the machine; the object being to break up the lumps in the partly-spent material, which nearly always contain a core of oxide which has not been sulphided, making it more active and of uniform size. It is expected to more than regain the cost of preparation by the saving in the cost of emptying and refilling the purifiers and turning the material when on the revivifying floor. A 20-B.H.P. gas-engine drives both the disintegrator and oxide elevators.

The Coal Elevator at the Canal Side.

Pumps and Tar, Liquor, and Water Wells.

The pumps consist of one Cameron for the scrubbers, another for the works water supply (which is wholly pumped from surface wells), one horizontal double-acting tar and liquor pump, and a battery of three pumps employed as stand-bys to the first. The tar, liquor, and water wells were originally gasholder tanks, which have been covered over and lined inside with 4½-inch brick-work in cement. The tar and liquor well is 50 feet diameter and 18 feet deep; the water well is 60 feet diameter and 18 feet deep. All the surplus water from the coolers and retort-house supply, as well as the rain water, is stored in the latter, and drawn upon only when it is full, and when the surface-well suction-pipes are receiving attention.

Naphthalene Removal.

There is a steam-heated vaporizer into which shale naphtha is run by gravity; the quantity being regulated by a micrometer cock and sight-glass. Part of the gas made passes through the body of the vaporizer, sweeps out the naphtha vapour, and carries it forward into the holders. Traces of naphthalene are found in the district at a distance of more than three miles from the works.

Carburetted Water-Gas Plant.

This consists of one complete set of gas-making plant by the Economical Gas Apparatus Construction Company, Limited, capable of producing 500,000 cubic feet of gas per day, complete with the usual producer, superheater, fixing chamber, and wash-box. The oil is fed into the gasifying chamber through two injectors at a pressure of 80 lbs. per square inch. The heats of the fixer are kept at a predetermined temperature by observations on a Crompton nickel-steel pyrometer; and a check is kept on the working by means of a Thorp cycle recorder. No special instrument is used to ascertain the amount of carbonic acid present; but by means of the Orsat apparatus the blast pressure is arranged to give a crude gas containing 2¾ to 3 per cent. of carbonic acid, which is found to be the most economical working.

The condenser, 18 ft. high by 5 ft. 6 in. diameter, is of the usual water-tube type; the scrubber being of the same size, and fitted with boards. The exhausters are of Waller's make, with four blades, each capable of passing 50,000 cubic feet per hour.

The buildings are arranged so that two more sets can be installed when necessary; and the auxiliary plant is all capable of dealing with a million cubic feet of gas per day.

The boilers are in duplicate, of Lancashire type, 24 ft. long by 6 ft. 6 in diameter, provided with one of Green's economizers of 128 tubes. A steam feed-water heater is also installed; the water entering the boilers at a temperature of 180° Fahr. The Sturtevant blowers are in duplicate, and are driven from a countershaft by 16 H.P. Tangye horizontal engines; each blower being large enough to supply blast to two plants. The pumps, of the Blake-Knowles pattern, are all in duplicate, except those for the cooler and oil-tank service; a large overhead water-tank, always kept full, being intended to supply the cooler and the boilers, should there be any failure of the well. The coolers are supplied from the gasholder tanks; the water being returned to them from the cooler overflow.

The separator consists of a steel tank, 22 feet long by 10 ft. 6 in. by 2 ft. 6 in. sunk into the ground, divided into sections by division-plates which do not reach the bottom. The mixed tar and water enter at one end, while the separated products overflow at the opposite end into separate brick tanks, the water being pumped over the seal-box and scrubber again and again, and the tar into an overhead tank, where it again settles out, and is finally run into the main tar-well and mixed with the coal-gas tar.

The relief holder is single-lift, 50 feet diameter and 20 feet deep, prepared for telescoping, in a brick and puddle tank. The inlet and outlet are on opposite sides, to allow of a thorough mixing of the gases. The oil-storage tank is of 400 tons capacity; the o being pumped into it from an underground receiving-tank. Al oil is delivered to the works by road tank-waggons.

The four purifiers are 30 feet square by 5 ft. 6 in. deep, built in two pairs, fitted with Green's luteless lids, and worked by four four-way valves. Three of the purifiers are filled with lime, and the fourth with oxide as a catch. They were built by Messrs. Newton, Chambers, and Co., Limited. The station meter is of 30,000 cubic feet per hour capacity—built by Messrs. Cowan.

The Purifier House and Revivifying Floor.

The streams of gas from the coal-gas and carburetted water-gas plants are joined at the meter outlets, and consequently are always thoroughly mixed before reaching the gasholders.

Gasholders.

There are three gasholders. Nos. 1 and 2 are three-lift, each 100 feet diameter and 72 feet high when fully extended, and of 540,000 cubic feet capacity. The tanks are of brick and puddle, with very low cones. They were originally two-lift holders; a third lift being added in 1895 and 1896 respectively by the late Daniel Howard. No. 3 holder, built in 1901 and 1902, has four lifts, and is 130 feet diameter and 80 feet high when fully extended. It is of 1,100,000 cubic feet capacity. The inner lift rises clear of the guide-framing. The crown is not trussed, but rests on a timber framework when down. The tank was constructed by Messrs. E. Nuttall and Co.; the holder being built by Messrs. Clayton, Son, and Co., Limited.

Station Meter and Governors.

There is one station meter, of 60,000 cubic feet per hour capacity, constructed by the Gas-Meter Company, Limited. A 15-inch old-type Braddock governor is now used as a safety governor. The district governors are water-loaded, and are three in number—viz., an old-pattern Parkinson, 18 inches diameter, supplying Stretford, Old Trafford, and Trafford Park; a Braddock double-beat governor, 21-inch size, supplying Sale and Ashton-on-Mersey; and a similar governor, 18-inch size, supplying Urmston, Flixton, Davyhulme, and the Westinghouse works.

Carburettors and Coal-Testing Plant.

Two carburettors are in use for enriching by benzol if necessary. They are of the Norwich type, the same as the naphthalene carburettor. A complete coal-testing plant—with retorts, coolers, purifiers, and gasholder—is capable of carbonizing 1-cwt. charges.

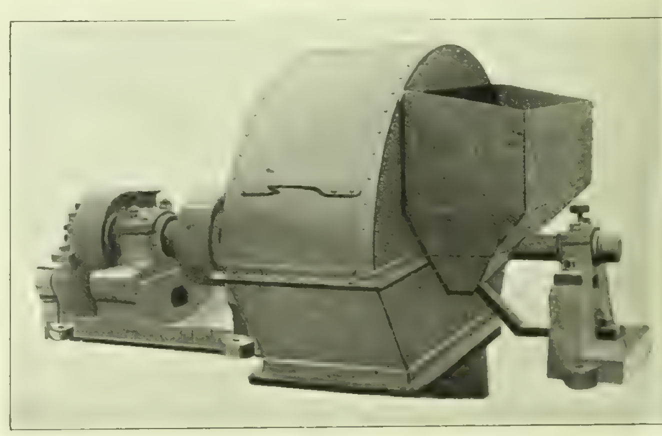
Stores, Workshops, and Offices.

The works are not provided with modern stores; but they have plenty of storage room. The brass and fitting stores are situated over the engine-room; and the timber and barrow stores are behind the scrubbers. The meter, cooker, bolt, tube, oil, and paint stores, as well as the stove-repairing shops, are situated in a building originally erected as a cannel-store. The fitting shop is small, but is fitted with engine, lathe, drilling-machine, and other tools. The blacksmith's shop is complete with a forge and shearing-machine and an iron-store adjoining. There are no joiners' or meter shops; all this work being given out.

The offices have just been improved and slightly extended, and are now large enough for the present wants of the Company; the most crowded being the laboratory. New and larger offices on a better site are under consideration. There are a branch office, show-room, and stores at Sale, and others are in contemplation at Urmston and Stretford.

In the portion of the above description dealing with the washing and scrubbing plant, reference is made to a "disintegrator," of which a few particulars are given. It was supplied by Messrs. Crone and Taylor, of Sutton Oak, St. Helens; and it is shown in the accompanying illustration.

The above-named firm have had many years' experience in the production of these machines, andhave made improvements in them, so that each is now specially designed for the work it has to do. They are constructed with two, three, or four rows of square, round, or rectangular bars. The one supplied for the Stretford Gas-Works is an improved type having special clearances and bars suitably spaced for dealing with oxide of iron. There are four rings of bars, two revolving in one direction and two in an opposite one; the grinding action being by percussion and centrifugal force. The material is fed into the centre of the machine by means of the feed hopper, and is delivered out in a spray fashion at the periphery, through the bottom side of the casing. It is of a very even grist, and of an open grain consistency; and there is no question as to the machine assisting revivification, the material dealt with being of a more absorbent nature. One of the chief advantages claimed for the disintegrator is that there is no tendency for it to clog or block up; and we understand that it will deal with oxide in almost any condition. Owing to its construction, there is a full current of air through it. These machines can be arranged to be driven electrically direct from a motor; the minimum of power being required, owing to the design of the discs, to their working independently of each other, and to the distribution of the bearings, which are of gun metal and large.



Crone and Taylor's Disintegrator.

Mr. Harold Porritt, J.P., Chairman of the St. Anne's-on-the-Sea Gas Company, whose death was announced in the "Journal" for the 9th of August last, left estate of the gross value of £87,567, with net personalty amounting to £78,764.

MIDLAND ASSOCIATION OF GAS MANAGERS.

Meeting in Birmingham.

The Autumn Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham—Mr. VINCENT HUGHES (Smethwick), the President, occupying the chair. The attendance of the members was about a normal one. Among the visitors were Mr. R. S. Hilton, the Secretary and Manager of the Birmingham Corporation Gas Department, Dr. Rudolf Lessing, and Dr. Davidson.

The HON. SECRETARY (Mr. Harold E. Copp, of West Bromwich) read the minutes of the last annual and the summer meetings; and they were confirmed.

ACKNOWLEDGMENT BY MRS. COLSON.

The HON. SECRETARY reported the receipt of the following acknowledgment from Mrs. Colson, of Leicester, of the message of condolence from the Association on the death of her husband:

June 26, 1910.

Gentlemen,—I am deeply touched by the very kind and sympathetic resolution passed at your last meeting concerning the death of my dear husband.

I should have replied earlier; but, as you are aware, at these times many things have to be done in a limited period, and little time is left for writing even if one had the courage.

It is, indeed, a terribly heavy blow which has fallen on us. We have not only lost the head and mainstay of the home, but the dearest and best husband and father. My family and myself beg to convey our very grateful thanks for your kind and appreciative mention of him, and your expression of sincere sympathy to ourselves in our great sorrow. A few days before his death, he desired his love to all his friends; and, I am sure, I am doing what he would have wished by sending his message to you all. This I do, and deliver it as coming direct from himself to you, with whom he was associated for many years.

Again assuring you that we value your expression of sympathy and regret very fully—I am, faithfully yours, MARGARETTA COLSON.

SCRUTINEERS.

On the motion of the PRESIDENT, seconded by Mr. W. LANGFORD (Longton), Mr. Charles Meiklejohn (Rugby) and Mr. S. O. Stephenson (Tipton) were appointed Scrutineers of the ballot-papers.

NEW MEMBER.

On the motion of the PRESIDENT, seconded by Mr. SAMUEL GLOVER (St. Helens), Mr. F. T. Callant, of Bedworth, near Nuneaton, was elected a member of the Association.

DEATH OF MR. G. B. SMEDLEY.

The PRESIDENT said he had next to report the death of Mr. G. B. Smedley, who had been very regular in his attendance at their meetings, and also at those of the Manchester Institution. Mr. Smedley was a great sufferer for the last year or two of his life. He proposed that a letter of condolence be sent to the representatives of his family.

Mr. HUBERT POOLEY (Stafford) seconded the motion, which was unanimously carried.

TWO DESERVING CASES FOR MATERIAL SYMPATHY.

The HON. SECRETARY said, as the President had remarked, that Mr. Smedley the last two or three years of his life suffered from a painful and serious illness, naturally, the expenses had been very heavy; and the result of it was that Mrs. Smedley had not been left in very happy circumstances. Upon the instructions of the Committee, he had written to Mr. Dunn, the Hon. Secretary of the Gas Institution Benevolent Fund. He found, however, that a movement had already been made in other directions for Mrs. Smedley by members of the Manchester Institution. Mr. Dunn replied that the matter would receive the attention of the Committee of the Benevolent Fund. But he also emphasized the fact to which the President (Mr. James W. Helps) referred at the last annual meeting—the fact that the funds were at present at a somewhat low ebb; and it was a question as to how far they could go in relieving a case of necessity of this kind. He (Mr. Copp) had also received a letter from Mrs. Darwin. This he read; and it showed a very sad case. This matter he had also placed before Mr. Dunn, and had received practically the same reply as to the former letter. He also asked him (Mr. Copp) to appeal to the members to see whether something more could not be done in aid of the fund. In a conversation with Mr. Meiklejohn, he had reminded him that the Midland Association had done very well for the fund; and the only way he (Mr. Copp) thought they ought to do more was by an increased number of subscribers from their members. About 60 out of the 112 were subscribers.

The PRESIDENT thought the proportion was a good one, and would compare favourably with other Associations. The Association had also voted sums from their surplus money for the Benevolent Fund. But after such letters as they had received, he would ask those gentlemen who were not subscribers to the Benevolent Fund to become so.

ALTERATION OF RULES.

This matter, which was fully discussed at the Spring Meeting, was again brought forward for final disposal.

The HON. SECRETARY introduced the subject, and said he did not agree with Rule 1, which provided for the formation of a class of associate members. He could not see there was any justification for a second class of membership; and he thought it quite sufficient to be in the position to elect "persons who, by reason of their professional knowledge or experience, are, in the opinion of the Committee, qualified to assist in promoting the objects of the Association, and who shall not be engaged in trade." Such gentlemen could be admitted as full members, and not as associate members at all. The deletion of the words: "And associate members shall be" would also meet the views of the Junior Association, who were exceedingly nervous that the Senior Association might trespass on their ground.

There was general support given to Mr. Copp's views by Mr. W. S. MORLAND, Mr. F. J. BYWATER, Mr. J. FERGUSON BELL, Mr. B. W. SMITH, and Mr. W. LANGFORD.

On the proposition of Mr. BYWATER, seconded by Mr. BELL, it was agreed to omit the words as to associate members; and thereafter the rules were passed—those that have undergone revision being the following (in their amended form):

That the Association be called "The Midland Association of Gas Engineers and Managers."

The object for which the Association is established is to promote the advancement of the gas industry in all or any of its branches.

RULE 1.—That this Association shall consist of (1) members and associates. Members must be engineers or managers of gas undertakings, or superintendents of gas-works making 500 millions or more per annum; and persons who, by reason of their professional knowledge or experience, are, in the opinion of the Committee, qualified to assist in promoting the objects of the Association, and who shall not be engaged in trade; and (2) honorary members, who, though formerly qualified as members, have retired from active management, to be elected at the discretion of the Committee. All members to have equal voting power.

RULE 2.—That the management of the affairs of the Association shall be confided to a Committee, which shall consist of a President, Vice-President, four immediate Past-Presidents, Hon. Treasurer, Hon. Secretary, and nine members, any four of the foregoing to form a quorum. The President and Honorary Secretary, for the time being, of the Midland Junior Gas Engineering Association to be *ex-officio* members of the Committee.

RULE 4.—Three elected members of the Committee and one of the Past-Presidents shall retire annually in rotation, and shall be ineligible for re-election during the following year. Nominations of office-bearers and members of Committee shall be made by two members (with the consent of the person nominated), and sent to the Hon. Secretary by the 30th of September in each year. That at least seven days prior to the autumn general meeting, a list of the members so nominated be posted to each member, together with printed envelope for reply, which must be returned to the Hon. Secretary within four days, or by the date named on the list. The ballot-papers to be opened by two scrutineers appointed at the autumn general meeting, and the result announced.

RULE 9.—All questions, except those of a personal nature, to be decided by any convenient system of open voting; the Chairman to have a second or casting vote when necessary. Questions of a personal nature to be decided by ballot.

RULE 13.—The annual subscription to be paid by each member shall be 10s. 6d., payable in advance on the 1st of January each year.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT said the Scrutineers reported that the gentlemen elected as officers for next year were as follows:

President: Mr. J. H. Brown, of Nottingham.
Vice-President: Mr. A. Cooke, of Oldbury.
Hon. Treasurer: Alderman W. R. Cooper, of Banbury.
Hon. Secretary: Mr. Harold E. Copp, of West Bromwich.
Members of Committee: Mr. W. A. Sapey, of Tamworth, Mr. W. J. R. Baker, of Great Malvern, Mr. W. G. S. Cranmer, of Willenhall, Mr. W. W. Townsend, of Hereford, Mr. J. M'Coll,* of Halesowen.

[* See succeeding remarks of President.]

Auditors: Mr. W. H. Adams, of Bilston, and J. R. Duff, of Banbury.

Proceeding, the President said he must congratulate Mr. Cooke on the honour conferred upon him. The new rules provided for five members of the Committee, so that the two gentlemen who would not otherwise have been elected were now members of the Committee. They were short of one name to make up the five; and so it had been suggested that Mr. M'Coll should be elected. He proposed his election.

Mr. A. T. HARRIS (Market Harborough) seconded the motion, which was unanimously carried.

Mr. BROWN thanked the members for the great honour conferred upon him in electing him President of the Association for the ensuing year. He could assure the members that he should do all in his power to maintain the honour and the success of the Association.

Mr. COOKE also expressed his sincere thanks to the members for having elected him to the office of Vice-President. He should

be very pleased to do what he could for the advancement of the Association.

THE HON. TREASURER.

Mr. J. FERGUSON BELL (Derby) said he thought he should be expressing the feelings of the members in saying how pleased they were to see Mr. Alderman Cooper at the meeting that day. He had been ill for some months; and at the last meeting, it would be remembered, they had passed a vote of condolence with him. They were indeed all delighted to see him; and hoped they would be able to welcome him for many years in the capacity of their esteemed Hon. Treasurer.

Alderman W. R. COOPER (Banbury) thanked the members very sincerely for their renewed confidence in him as their Treasurer. He also desired to take this, the earliest opportunity he had had, of thanking them all for the great kindness shown to him during his illness. The receipt of the letter of sympathy at that time afforded him much pleasure; and though unable to be with them on what he might term their annual holiday, when they visited the town of their President, he was with them in spirit.

BYE-PRODUCTS COKE-OVENS AND UTILIZING THE SURPLUS GAS FOR LIGHTING.

A paper (illustrated by lantern slides) was then read on this subject by Mr. J. S. LUCKING, of Clay Cross; and the discussion was taken in conjunction with that on the paper on

CARBONIZING SYSTEMS AND RESULTS,

read by Mr. Alfred T. Harris, of Market Harborough, at the Spring Meeting. A communication on the subject was read from Mr. Thomas Glover; and Mr. Samuel Glover and Mr. J. Ferguson Bell also made substantial contributions to the discussion. Several other members and visitors generally discussed the subject; and it was, in consequence, a long sitting that was indulged in. A report appears elsewhere (see pp. 326-32).

This concluded the business before the meeting; and in the evening the members dined together.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Autumn Meeting at Stretford and Manchester.

The One Hundred and Fifty-Ninth General Meeting of the Institution was held on Saturday. In the early part of the day, the members met at Stretford for an inspection of the works of the Stretford Gas Company, of which Mr. H. Kendrick, the President of the Institution, is Engineer and Manager. There were about a hundred present at the gathering.

WELCOME BY THE GAS COMPANY.

Before a tour of the works was commenced, Mr. LEWIS GALLOWAY, the Chairman of the Gas Company, in welcoming the members, expressed the hope that in the course of their inspection of the plant at the works they would see something which would be of interest to them.

Mr. S. GLOVER (St. Helens) expressed the thanks of the members for the hearty welcome that had been extended to them by the Chairman and Directors of the Stretford Gas Company, and for enabling them to inspect their works. Much of the success of the Manchester District Institution of Gas Engineers was due to the facilities which were afforded the members of going over different gas-works; and he was perfectly assured that in their visit to Stretford they would find something that would be of interest, and do them good in the work they had to carry out.

[For a description of the works, see pp. 315-18.]

THE LUNCHEON.

At the conclusion of an inspection of the works, the party proceeded by train to Manchester, and were entertained at luncheon at the Grand Hotel by the Chairman and Directors of the Stretford Gas Company. Mr. Lewis Galloway presided, and was supported by Mr. William A. Nicholls, the Deputy-Chairman of the Gas Company; Messrs. Thomas Lund and Edwin Hibbert, Directors; Mr. William Blundell, Secretary; Mr. Alex. Wilson, of Glasgow, President of the Institution of Gas Engineers; Mr. H. Kendrick, President of the Manchester District Institution; and others. A short toast list was gone through.

The toast of "His Majesty the King" having been submitted from the chair and honoured,

Mr. W. A. NICHOLLS proposed "The Manchester District Institution of Gas Engineers." He said that on a former occasion they took the opportunity of expressing their pleasure that the Association should elect Mr. Kendrick to be President. He (Mr. Nicholls) had not the advantage of being present at that meeting, or he should have been happy to have associated himself with the resolution. He did so now. The Directors of the Stretford Gas Company had for a long time a very high appreciation of Mr. Kendrick; and it was a source of much gratification to them to know that his brother engineers had endorsed this opinion by electing him President. Since that time, the opportunity presented itself (and the Directors were glad to avail themselves of it) of making Mr. Kendrick Manager as well as Engineer to the Stretford Gas Company. This was the position he held at the present moment; and it was the earnest hope of the Directors of the Company that the relationship between them and Mr. Kendrick would continue for a very long period, and that Mr. Kendrick would be blessed with good health and great happiness. Turning to the toast he had to propose, he considered it a real privilege to have been entrusted with it. At the same time, he had a feeling of a considerable drawback to this pleasure. He could not forget what he was himself, and that among those present were the very captains of the gas industry of the world. They were the capable captains—the thrice-equipped captains—of a great industry. In the first place, they seemed to have a natural aptitude for the business, taking to it as a duck took to water; then they had skill and learning in the theories of the gas business; and they were in addition trained and practical experts. To such an audience, what could he possibly say? He had only touched the outside fringe of the gas business; and it would be presumptuous on his part to say anything about gas problems to them. But he was glad of the opportunity given him of saying how much he appreciated the Manchester District Institution of Gas Engineers. He admired its objects, and fully appreciated its scope and its aims; and he also very much admired its activities and its proved usefulness. A great deal could be said about the activities of the Institution, even by people outside its ranks, such as himself. By it, they were able to associate together. They were able to rub shoulders with one another, compare notes, and tell each other of the difficulties and troubles they had had to contend with, and of the victories achieved. They could not possibly be members of such an Association without feeling that, however much they had learnt, they had still to go on learning. In the gas industry, there was no such word as finality. Almost every day one found something new. Gas engineers to-day were not content to simply mark-time. They were not content just simply to supply the quantity of gas that was required from time to time. They were men of progress, and ever aiming at improvements to bring them nearer and nearer to perfection. Gas engineers were always making experiments, finding out a new way to do this or that, making improvements in machinery and plant. The result of all this was that some discovery was made which put the industry a step higher. When such a discovery occurred, it was brought before the Association, and by this means everybody benefited. He would like to say in this connection that, though they might have the monopoly of supplying gas in their particular areas, they had not the monopoly of the supply of illumination. Gas undertakings had keen and fierce competition to face; and in some cases it was unfair competition. This being so, there was all the more need for Associations such as this, at the meetings of which they could discuss new discoveries, not only in connection with the manufacture of gas, but in relation to how best to increase its distribution—the natural result being of great advantage to the gas industry and greater advantage to the gas consuming population. As he had said, he had only touched the merest fringe of the gas industry; but it was a good many years since he did touch the fringe—that was when he became a member of the Gas Committee of the Manchester Corporation. He referred to this because he had some memories which might not be altogether uninteresting. He remembered one gentleman coming to him in those days—it would be about 1887—and saying, "The days of gas lighting are numbered." Another said the gas industry was doomed. And yet another declared that "the glorious sun of electricity has appeared upon the horizon, before which the mere moon-like gas will be turned into nothing." A good many things had happened since then; and the prophets of that day had been proved to be false prophets. He did not deny that electricity had made great strides since then, and was much cheaper now than was hoped for in those days, by reason of improvements in machinery and appliances. But if electricity had been much reduced in price and rendered more serviceable as an illuminant, gas had progressed even more, not only in a reduction in price, but as an illuminant and for heating and cooking. He hardly knew how far he might go on this subject; but he thought he was right in saying that, taking it all round, the average price of gas then and now, gas consumers as a body obtained on the average now 2000 cubic feet for the price they paid for 1000 cubic feet in those days, besides having five times as much light. He thought he could go further and say that, light for light, and price for price, gas to-day stood far ahead of every illuminant, and it had put out of existence a good many electric lighting installations. He was not a prophet, but could point to something accomplished, and could say that the glorious light of incandescent gas had burst upon the horizon and put out a good many electric installations. This was the result of the activities of the gas engineers and those associated with them; and they were justified in having a large measure of pride in the position they held to-day. But they must not rest and be thankful. He was one who thought that the last word in gas lighting had not been spoken. He believed if they lived a few years longer they would occupy an even better position than they did to-day, as they were a long way from finality in gas lighting. One thing was certain—there was a large field for their activities—a field of great scope and immense possibilities; and he ventured to suggest that much could be done in the way of smoke abatement. Who was going to do this in the interests of the people's health and their happiness? The eyes of the world were upon them, and they were expected to do it. Therefore they had to go on. They would have to go along the lines they had been on, and perhaps achieve this desirable result and make the price of gas even cheaper still, so that it could be used more and more for purposes of heating and cooking. If they could accomplish this, they would have conferred a boon upon the community. Therefore he said to them: "You must still be up and doing, with heart for any fate; still achieving, still

pursuing. You must learn to labour—We will wait." With the toast, he coupled the name of Mr. Kendrick, as President.

Mr. H. Kendrick, in responding, said that the Manchester District Institution of Gas Engineers had accomplished a good deal for the advancement of the industry, and hoped to accomplish more in the future. As to the remarks made about himself by the proposer, they were too flattering; but he had been given a character which it would be his endeavour to live up to. He thanked Mr. Nicholls for his remarks, and the references he had made to the work of the Manchester District Institution of Gas Engineers.

Mr. Robert Watson (Doncaster) next gave the toast of "The Stretford Gas Company." He said the members of the Institution present very much appreciated the opportunity afforded them by the Chairman and Directors of the Stretford Gas Company of inspecting their works, and also the hospitality which had been extended to them on the occasion of the visit. They had seen a most compact, well-equipped, and well-managed gas-works. They had previously known something about the Company's career, and they had now had the opportunity of seeing for themselves how the good results were obtained. Therefore they had every reason to congratulate the Company and their Engineer and Manager upon what they had done. From the time the works were established in 1854, the progress had been continuous. There was a set-back in 1906, when the Manchester Corporation acquired, or rather annexed, the Chorlton-cum-Medlock area; the make of gas falling from 343,238,000 cubic feet in 1905 to 334,052,000 cubic feet in 1906. Still, in spite of this, the Company next year more than made up for the loss in output through Chorlton being taken from them; and since 1907 they had progressed until to-day the undertaking was one of great magnitude, making 400 million cubic a year, and selling gas at 1s. 11d. per 1000 cubic feet for power, with a maximum of 2s. 3d. for lighting purposes. On these results they could heartily congratulate the Chairman, the Vice-Chairman, and Directors of the Company, as well as the Engineer and Manager. Mr. Galloway, the Chairman, had been associated with the undertaking as a Director for twenty-seven years, and been Chairman some twelve years. It must have been a matter for considerable satisfaction to him and his co-Directors to watch the progress the Company had made up to the present time. Along with the other members of the Institution, he (Mr. Watson) hoped the Company would continue to prosper; and they also wished their esteemed President, Mr. Kendrick, every success.

Mr. Galloway, in responding, said they had the satisfaction in knowing that the Stretford Gas Company, if not at the top of the scale in the gas world, were not far down the list, and stood very well to the fore. Their make of gas in 1895 was 182,503,000 cubic feet; in 1909, it was 365,971,000 cubic feet, exactly double. To have increased the make in 15 years by 100 per cent. must be regarded as a satisfactory rate of progress. He hoped it would continue; and he was confident they were working on right lines. It would be seen from the souvenir prepared in connection with the visit that the Company had adopted many means of increasing the consumption by hiring cookers and loaning grillers, the free cleaning of gas-fires, cookers, and grillers, and the maintenance of incandescent burners. The Directors thought it good policy to look after the consumer; and in this moving forward, Mr. Kendrick had been one of the spurs. In conclusion, Mr. Galloway said it had been a pleasure to him to meet the members of the Institution; and he hoped they had had a pleasant time.

Mr. E. Allen (Liverpool) proposed "Kindred Associations." In the course of his remarks, he said that the good feeling which existed between kindred associations was of the greatest advantage to the gas industry, and of great advantage, he might add, to the empire. It was their aim to serve the public with the best light possible, and also gas for heating and power at the lowest cost. It was along such lines they were working; and they hoped the gas industry would go on flourishing. There were other associations besides theirs, such as the Society of British Gas Industries, who were represented there that day by Mr. Marsh, of Manchester. In speaking of kindred associations, they ought not to forget the help they got from manufacturers of gas appliances, whose difficulties were considerable. What they wanted was to have a cosmopolitan meter, with a standard quality of gas and calorific value. Then they could have standard appliances, which would be to the gain of the public. Proceeding, Mr. Allen said they ought also to recognize the assistance they got from the Technical Press, and also from the lay Press which recorded the proceedings of the different associations. Then there was the keystone to the whole edifice, the Institution of Gas Engineers, represented by Mr. Alexander Wilson, the President. Never before in the history of their Institution had those connected with the gas industry received so much assistance from the Council of the parent Association as was the case at the present time. In Mr. Wilson they had a man of very broad sympathies and views; and his presence that day showed the interest he took in the work of the Institution of which he was President.

Mr. Alex. Wilson, acknowledging the toast, said he was glad of the opportunity of making the acquaintance of the members of the Manchester District Institution of Gas Engineers, and also of having the privilege of inspecting the works of the Stretford Gas Company. These two things had more than repaid him for travelling from Glasgow to Manchester. He desired to warmly congratulate Mr. Kendrick, and the Chairman and Directors of the Company, upon the excellent results they had achieved, as shown by the figures in the booklet which had been presented to them. He was pleased to notice the efforts made by the Company to increase the sales of gas by looking after the consumers. In former years, he was afraid, they as gas engineers had not given sufficient attention to the selling of the gas they manufactured. Though much had been done to improve the quality of gas and to cheapen it to the consumer, they had still a long way to go; and it must be their aim to prove to the public that they had still the best illuminant on the market.

Mr. Marsh, of the Society of British Gas Industries, also responded. He pointed out that during the past hundred years the gas industry had passed through good times and bad times, but gas stocks had always remained firm, which could not be said of other industries; and he had no doubt as to its future. They had many competitors and "live" men engaged in electrical undertakings; so it behoved them as gas engineers not only to improve the quality of the gas but to cheapen it, and give the best light possible with the use of the appliances on the market. He believed the time was coming when the smoke nuisance would be done away with; and gas engineers must see to it that the electricians did not slip in first.

The Business Meeting.

The business meeting of the Institution followed in the Lecture Hall of the hotel. Mr. H. Kendrick, the President, occupied the chair, and was supported by Mr. Alex. Wilson, of Glasgow, President of the Institution of Gas Engineers; Mr. Robert Watson, of Doncaster; Mr. J. W. Morrison, of Sheffield; and Mr. W. Whatmough, the Hon. Secretary.

Letters of Apology.

Letters of apology were read from a number of gentlemen, holding official positions with kindred associations in different parts of the country, who found it impossible to be at the meeting. There was a telegram from Mr. Thos. Newbigging, M.Inst.C.E., expressing regret at being unable to attend.

Votes of Condolence and Sympathy.

The President said that, before proceeding to the ordinary business of the meeting, he wished to refer to the death of Mr. G. B. Smedley, of Swadlincote, which had occurred since their last meeting. It was only right they should give an expression to their sorrow at the loss by death of a member.

A vote of condolence with the relatives was adopted; and the Hon. Secretary was instructed to convey it to the family of the late Mr. Smedley.

The President also called attention to the fact that three of their members were at present suffering from illness—at least, two of them were, and another had met with an accident. Mr. Leonard Hall, of Rhyl, he regretted to say, was in a very serious condition, having had an attack of paralysis. What made his case all the harder was the fact that his wife had become practically blind. He was sure the sympathy of the members would go out to Mr. Hall in his affliction, and the hope expressed that he might soon recover from his illness, and that his wife might recover her sight. Then Mr. Saville, of Penmaenmawr, was ill, having just undergone a serious operation; and they all wished him a speedy recovery. Mr. J. C. Belton, another of their members, had had the misfortune to be thrown from his bicycle. They hoped that his accident was not a serious one, and that he would soon be himself again.

Mr. T. Duxbury (Oldham) said there was another of their members who had done a great deal of work for the Institution, who was ill. He referred to Mr. Walter Hutchinson.

On the motion of Mr. E. Allen, seconded by Mr. R. Watson, it was resolved that the Hon. Secretary write to the gentlemen named, expressing the members' sympathy in their illness, and expressing the hope that they have a speedy recovery.

Appointment of Scrutineers.

Messrs. J. W. Bottomley, of Milnrow, and John Furness, of Slaithwaite, were appointed Scrutineers in the voting for the election of officers, committee, and new members.

Reports of the Committee.

The President read the following reports on the two subjects dealt with—

Special Lectures at the University of Manchester.

Gentlemen,—In accordance with the resolution passed at the May meeting authorizing the Committee to proceed with the arrangements for establishing special gas lectures in conjunction with the Manchester Junior Gas Association at the University of Manchester, and to incur an expense not exceeding £20, a Sub-Committee has been appointed consisting of members of both Associations, and a syllabus has been drawn up and approved by the Council of the Institution of Gas Engineers and by your Committee from time to time.

It has been arranged that two courses shall be inaugurated—the first to be in conjunction with the monthly meetings of the Junior Association, to consist of specialized lectures on gas-works, their processes and allied subjects, as follows:—

Oct. 1, 1910—Chemistry of Gaseous Combustion, Professor H. B. Dixon, M.A., Ph.D., F.R.S.
Nov. 5, „ —Internal Combustion Engines, Dugald Clerk, Esq., F.R.S.
Dec. 3, „ —Carbonizing, H. G. Colman, Esq., D.Sc., Ph.D.
Jan. 7, 1911—Construction as Applied to Gas-Works, C. Hunt, Esq., M.Inst.C.E.
Feb. 4, „ —Chemical Control of Gas-Works, J. T. Sheard, Esq.
Mar. 4, „ —Pyrometry, J. A. Harker, Esq., F.R.S.

The first of this series was exceedingly well-attended; and your Committee earnestly trust that members will turn up in increasing numbers at the remainder, which in their estimation constitute one of the most ambitious series of lectures relating to gas matters that have ever been arranged.

The second series, which has been arranged, consists of twelve lectures and demonstrations on the chemistry of gaseous fuel and flame, designed for those who have already acquired a knowledge of gas manufacture.

The syllabus was: Kinetic Theory of Gases. Pressure of Condensable Vapours. Nature of Chemical Change. Flame and its Structure. Theory of Luminous and Non-Luminous Flames. The Ignition Points and Specific Heats of Gases. Temperature of Flames. Phenomena of Explosion in Gases. Pyrometry. Standardization of Thermo-

Junction Pyrometers. Constant Temperature Furnaces. Calorimetry. Preparation of Pure Gases. Manipulation and Analysis of Gases. Theory of Fractional Distillation and Condensation.

These lectures will be given by Professors Dixon, Carpenter, and Petavel, Dr. Lapworth, Dr. Norman Smith, and other members of the staff.

The first meeting was held on Monday, Oct. 17, at 7 p.m. Fee, £1 1s. for the course. It is expected that some of those attending this course will undertake some research work in connection with gas problems.

These lectures will supply the needs of the general body of gas students; while the evening classes will meet the requirements of special students without in any way interfering with the Technical Schools or any other similar course. It is intended that the evening lectures shall be so prepared that they will have a direct bearing on the gas industry. Experiments are to be conducted by the students. Considering their advanced character, the attendance at the opening lectures has been fairly good.

Professor Dixon in his remarks at the opening meeting said: The advantages of experimenting in those (gas) problems in the laboratory was that many of them could best be attacked on a small scale, where the conditions were more under the control of the experimenter. The man who had seen the conditions necessary for success would be better able to guide and direct operations on a large scale. For that reason he welcomed what he hoped would be a lasting connection between the University and the gas industry of that district.

Your Committee join with Professor Dixon in his hopes, and trust that all the members will loyally support him in his aims, so that the status of the gas engineer will be raised to the same rank as the other engineering professions and the gas engineer be considered as a scientific man, rather than as a kind of glorified stoker as was the practice to treat him in some quarters.

Your Committee desire to thank Professor Dixon for meeting them so generously and for the many services rendered to the industry. The Manchester Junior Gas Association have earned the undying gratitude of the profession in forcing this question to the front, and in making the first negotiations which made their consummation possible, and to them must be given the praise for carrying through the arrangements.

On behalf of the Committee,
(Signed) H. Kendrick, President.

Education and Authorization of the Gas-Fitter.

Your Committee have had these questions under consideration from time to time since the matter was placed before you at the May meeting, and have been in communication with the Institute of Plumbers, who have referred the whole subject to the Advisory Committee on Plumbing to the City and Guilds of London Institute, which consists of representatives from the Institute of Plumbers, the Worshipful Company of Plumbers, the General Council for the National Registration of Plumbers, and the United Operative Plumbers' Association of Great Britain and Ireland. This Committee have not yet fully considered the communication sent by your Committee, and are expected to forward a definite reply at an early date.

Your Committee are pleased to be able to report that classes in gas-fittings and gas-appliances have been commenced at the Manchester and Salford Technical Schools. At Manchester, the ordinary course of "Gas Supply" has been extended and modified, with a view of meeting your recommendations; but it is difficult to say how many students the special course suggested has attracted there. At Salford, a special class in the subject has commenced, with an average attendance of 42 students. The syllabus, as already laid before you, is being strictly followed. The students are not altogether those your Committee hoped would attend, as they are all connected with gas-works or gas-plant works; and inasmuch as no gas-fitter or plumber has attended the class, it is a great disappointment to your Committee. The plumbers and gas-fitters of this district have been appealed to by the various managers and the authorities of the Technical School without any result; and until the Master Plumbers' Association are roused, it seems likely that our efforts are perhaps doomed to failure. The Master Gas-Fitters' Association of Birmingham are considering the subject; and a communication has been received from them, asking for particulars of the classes held in the district, and the result of the negotiations with the Plumbers' Association. Copies of the report and correspondence are being prepared, and will be forwarded to them in due course. Communications have also taken place with the President of the Ironmongers' Association; and he has promised to bring up the question of authorization and education at their next meeting.

If we are to be successful in our endeavours, all our members must interest themselves in the questions, and in and out of season urge upon the gas-fitters and plumbers the necessity of putting their houses in order if they and ourselves are to successfully meet the competition of our rivals.

On behalf of the Committee,
(Signed) H. Kendrick, President.

Description of the Stretford Gas-Works.

A description of the Stretford Gas-Works by the President was taken as read, and will be found in another part of this issue.

THE PRESIDENT'S ADDRESS AT THE ANNUAL MEETING.

The Postponed Discussion.

The discussion on the President's Inaugural Address, which was postponed at the February meeting for want of time, came next.

Mr. Kendrick said that in his address he raised a good many points of interest to the members generally; and he hoped that something could be made of them, and that from the discussion he might gain some information for himself. He had very little to add to the facts and figures given in the address; but as no doubt the main point of the discussion would turn on his carbonization results, it might be of interest to tell them what they had done since the address was read. The average yield per ton for the half year ended December, 1909, was 11,512 cubic feet; and for June, 1910, the average yield was 11,598 cubic feet. They had found, too, that by the use of the pitchpine boards in the hydraulic mains, they secured better results than from the red deal boards; the figures for the three months ending September being 12,023 cubic feet per ton, 513 B.Th.U. net, and 17·82 candle power. He could not say so much for what had been done in the diminution of naphthalene; for with the increased make they had had an increase of naphthalene, and therefore had to resort to the use of more solvent. The examination of gas-cookers and gas-fires had resulted in a very considerable increase in apparatus let out, and greater satisfaction to the users. His views on the question of fixing cookers and grillers free, and also in regard to wet and dry meters, were still the same as expressed in the address.

Mr. T. Duxbury (Oldham) said that at the February meeting he complimented the President upon the very useful information contained in his address. Since then he had had an opportunity of going through it carefully, and found that it embraced a great deal of information which would be useful in years to come. It appeared to him, on thinking the matter over, that it was scarcely wise for the President's Inaugural Address to be the subject of discussion. A president in his address on taking the chair ought to be allowed a certain amount of latitude for the expression of his views, without being subjected to having them discussed. He was afraid that, if the President's Address was to be the subject of discussion, it might have the effect of preventing some bringing forward matters of interest to the members generally. However, the President had invited discussion, and they accepted the invitation. There were two or three points in the address to which he would like to refer. With regard to the remarks of the President on the Commercial Sections, most of them were aware that his (Mr. Duxbury's) sympathies were entirely with the Commercial Sections. He knew they had done a great work, and were doing so to-day—not only in Lancashire and Yorkshire, but in other parts of the country. Members of the Commercial Sections would, no doubt, pardon him when he suggested that there were many technical papers read and discussed by them which might with advantage be dealt with at the ordinary meetings of the Institution. Those present knew the difficulty which their present Secretary had in getting papers; and if some of the subjects brought before the Commercial Sections were dealt with at ordinary meetings, he thought it would be of advantage and far better for the Institution. He did not want it to be understood that he was in any way antagonistic to the Commercial Sections. He merely mentioned this matter so that they might get papers of interest brought before the ordinary meetings. Turning to the question of vertical retorts, he entirely agreed with what the President had said as to their reducing the cost of labour, but he had some doubt as to whether it would mean a reduction in the price of gas to the consumer. Though they had no definite information as to the capital outlay, wear and tear, and renewal charges, it seemed to him the cost would be greater than with horizontal or inclined retorts. He did not see why the charges for inclined retorts should be heavier than horizontal retorts with stoking machinery. As the President of the Institution of Gas Engineers had had some experience of vertical retorts, he should like to have his opinion as to what he thought the capital charges, wear and tear, and renewals would be in their case. He agreed with Mr. Kendrick that the yields per ton and illuminating and calorific values obtained with verticals were not unattainable with horizontals, and that their friends who had been experimenting with heavy charges, and eight or ten hour carbonization, were to be congratulated upon splendid results. It was a fact that yields of 12,000 cubic feet per ton and over of gas of good illuminating and heating value were readily obtainable, but for the most part only within the reach of works having an installation of power machinery. There was one thing about the vertical retorts—they would help engineers to get rid of the smoke nuisance. At the present moment, he was having complaints from two different authorities as to smoke nuisance created from the retort-houses at the works of which he had charge, and which were in districts outside Oldham. His Committee had had notice from the two outside authorities on the subject; and a good deal of correspondence was taking place with reference to it. If by the use of vertical retorts the smoke nuisance could be done away with or minimized, it would be a great advantage. The continuous system of verticals was almost a perfect system of smoke prevention. They had no smoke given off, and in this respect the vertical retorts were much better than the horizontal or the inclined ones with stoking machinery.

Mr. E. A. Harman (Huddersfield) said that they must all congratulate their President on his very able and comprehensive address, which he had so kindly thrown open to discussion. It had been so thoughtful, and had covered so many subjects of vital importance to gas engineers, that the discussion ought to be of a very helpful and instructive character. They could not all be experts in every branch of the profession; and it was to their mutual advantage when members contributed their quota of information on subjects of which they had made a speciality. On hearing the address, he was particularly struck with one point in which their President's experience was evidently at variance with his own. He referred to the subject of coal testing. He did not wish his remarks to be construed in any way as a criticism of the address. Only admiration could be expressed for the way in

which the value of coals was arrived at, provided the yields of gas and residuals obtained in the test were a correct estimate of the corresponding yields obtained on the manufacturing scale. It was on this point that his experience of coal testing was at variance with the President's; and in his judgment it was worse than useless to make elaborate calculations of coal value when the figures on which the calculations were based were not correct. It was a recognized fact that coal testing was a difficult and tedious business, and that the results varied greatly with the type and size of apparatus employed. Samples of the same coal submitted to many independent analysts would yield as many different results, which might vary among themselves by as much as 50 to 60 per cent. In June, 1904, a paper on this subject was submitted to the Institution of Mining Engineers by Mr. G. P. Lishman, who came to the conclusion that not only were independent tests by different analysts unreliable, but, even working with the same plant under carefully regulated conditions, the results were extremely unsatisfactory. Small variations in the temperature of the retort, condenser, &c., had marked effects on the results of tests of short duration; while one very potent factor was the quality of the coal carbonized during a previous test. He suggested the use of a standard coal, a sample of which was carbonized on the same day and under the same conditions, and the results compared. But this was evidently too cumbersome a method for everyday use. At Huddersfield they had worked with both the 2·24-lb. and 28-lb. per charge plants; and, in the main, the results confirmed the observations of Mr. Lishman. They had found that when testing a series of sample coals it was possible, by observing due precautions, to obtain sperm values for the coals which nearly represented their relative gas-making qualities, but that the results obtained for residuals other than coke, and especially the yield of ammonia, were very misleading, and that no value could be attached to them in determining the "residuals" value of the coal. When the testing became a matter of checking the quality of coal delivered under contracts, the difficulties were immensely increased, and the results were not sufficiently reliable to warrant them in demanding allowances in respect of even fairly considerable variations in quality. In his judgment, it was only when testing on a manufacturing scale that reliable results could be obtained; and this sort of testing was, of course, out of the question in any but very large and very small works. It was interesting to him to note that their President could place sufficient reliance upon his tests to be able to calculate so closely the relative value of his coals; and he must be congratulated on his results. Perhaps he might be induced to tell them what type of plant was in use, and mention any special points regarding his method of working. There were a great many other points of interest in the address which were to be commended to the notice and discussion of other members.

Mr. ALEX. WILSON (Glasgow) said he had been much interested in the two reports read by the President. They were all deeply interested in the education of the men who had to do with the outside work of their departments, for it was most desirable they should be fully qualified if the best results were to be obtained by consumers of the gas which was produced. They could always obtain skilled assistance for the work inside; but it was difficult to get men with sufficient skill and knowledge for that which had to be done outside. He hoped that some good would come of the effort which the Manchester Institution were making in this direction. He had been shown the syllabus of lectures arranged for at the Victoria University; and he had made up his mind to take a leaf out of their book and see if something could not be done in the same direction in Scotland. With reference to the question put by Mr. Duxbury, as to vertical retorts, he might say that he first of all took a trip to Berlin in order to see the system in operation there. He had also seen the Woodall-Duckham system. But the Glover-West system was one that he had not seen. He might point out that the circumstances in Scotland were different from those they had to deal with in the South, where they had a different coal; and in considering the question of vertical retorts, he had to remember the class of coke he was to obtain. This was a point about which he was very anxious, and also the quality of gas to be produced. With the Dessau system, he could easily get a better class coke and gas of a high illuminating power (from 18 to 20 candle power); and, as most of them knew, with the Woodall-Duckham system they could get from 17 to 18 candle gas. Taking everything into consideration, they at Glasgow decided to combine the two systems; and theirs might be called the intermittent-continuous system. The manufacture of gas was continuous; while the charging and drawing were intermittent. They took the charges every four hours; and in this manner they obtained better coke, and, in a way, a very much better quality of gas. He was not going to give any figures yet. [Laughter.] This, however, he would say, they got a better return in gas, and of as good a quality as they were getting from their horizontals. They also obtained a much better coke, for which a better price was obtained; and the demand was still increasing. The installation was quite on a practical scale; and they were able to do away with the smoke nuisance. There was no doubt that the vertical system of working was going to help them very much in this respect.

Mr. J. H. BREARLEY (Longwood) also warmly complimented the President on the mass of information contained in his address; many of the subjects being worthy of careful investigation. With reference to the reports presented by the Chairman on the special lectures at the Manchester University, and the education of gas-fitters, he asked if it would not be better if such reports were printed and circulated to the members along with the notices of the meeting; so that they could have a week's reflection on the matters to be brought before them. These two schemes, which were brought before the Burnley meeting, were not adequately dealt with, and certainly did not receive the consideration from the members that they deserved. He did not put this in the way of a complaint; but simply mentioned it for the guidance of the Committee in the future. With the first part of the report, on the education and authorization of the gas-fitter, he quite agreed; but with the second part, he entirely disagreed. He thought that by a modification of the City and Guilds of London Institute scheme, and an alteration of the syllabus, they would get all that was wanted. He was much interested in this subject; and any suggestions which members could make to him would be greatly appreciated.

Mr. J. W. MORRISON (Sheffield) said he was surprised to hear the President say that he found evidence of an accumulation of naphthalene in the gasholder crown. This was not his experience. The naphthalene was generally found in the inlet-pipes; and they at Sheffield kept themselves free of it by the use of solvents, the cost of which, after all, was very small.

Mr. A. E. MOTTRAM (Ossett), referring to the report of the Committee on the education and authorization of the gas-fitter, said the matter was of great importance to master plumbers, who ought to see that their men were trained to give better attention to the work required from them than they had done in the past. He thought master plumbers would see that it would be to their benefit to fall in with the suggestions made. They ought, in his opinion, to impress upon the plumbers that they were going to lose very heavily if they did not adopt the suggestions made for the better training of the gas-fitter. He hoped the Committee would continue their work in this direction.

Mr. R. H. GARLICK (Salford) remarked that students attending the Manchester School of Technology, and taking the third course in "Plumbing," also attended the classes for "Gas Supply" which followed.

Mr. E. ALLEN (Liverpool) said their experience at Liverpool with naphthalene was similar to that of Mr. Morrison. It was not in the crown of the gasholder, but over the inlet-pipes, that it was found.

The PRESIDENT, in his reply, said that he could not agree with Mr. Duxbury's suggestion about the Commercial Sections. The subjects brought before them were almost entirely commercial ones. The technical subjects dealt with were very few, and were of a kind hardly suitable for discussion at a general meeting of the Institution. Further, they were brought forward by men who could not possibly stand up and face an audience like the present to give their opinions, as they did at what he might call the round-table conferences they had once a month. As to the question of vertical retorts raised by him in his address in February, nothing had been said or any information supplied to make him alter what he then set forth. From what information they did have on the subject, it seemed to him the cost of wear and tear and the capital required for vertical retorts would, to a certain extent, overshadow the saving in labour that would undoubtedly accrue. When they were at Burnley, they had some figures given to them as to capital costs; and he thought those present must admit that the cost and outlay would swallow up a considerable portion of the saving in the labour charges. Dealing with a question on his remarks about carburetted water gas and the enrichment costs, he might say the figures he gave were the result of tests carried out at Stretford. The cost of enriching to the extent of $2\frac{1}{2}$ candles by carburetted water gas worked out at 1·18d., compared with 1·61d. for benzol and 1·82d. for cannel. As he stated in his address, he preferred to use the more stable cannel gas instead of benzol, if the carburetted water-gas plant was out of action, and then only turned to benzol if this was unavoidable. With the benzol they obtained better results in the summer time than in the winter. With regard to the remarks made by Mr. Harman on the testing of coal, he did not agree with that gentleman when he said that the system adopted at Stretford was complicated. The tests were not based upon half-hundred-weight charges, nor upon a single charge. They did not think of basing their tests or calculations upon any number of charges less than five, and they did not make contracts for less than 250 or 300 tons. As to the finding of naphthalene in the crown of the holder, it seemed strange that he should have had a different experience from anybody else; but he thought he was correct. When the test was made, the holder was fully extended, and the oil was coming forward with the gas. They syphoned from the inside, and the result was what he gave in his address—viz., 31 per cent. from inside the gasholder.

This concluded the discussion.

ELECTION OF OFFICE-BEARERS AND NEW MEMBERS.

The PRESIDENT next presented the report of the Scrutineers on the election of officers and new members, which was as follows:—

President.—Mr. Robert Watson, of Doncaster.
Vice-Presidents.—Mr. Samuel Glover, of St. Helens. Mr. John C. Belton, of Chester.
Hon. Treasurer.—Mr. Thomas Newbigging, of Manchester.
Hon. Secretary.—Mr. W. Whatmough, of Heywood.
Committee.—Mr. John Bond, of Southport. Mr. F. H. Pickles, of Kildwick. Mr. F. D. Richmond, of Heckmondwike.

Auditors.—Mr. Charles Potts, of Hyde. Mr. William Hill, of Stalybridge.

New Members.—Mr. Edgar D. Martin, Ormskirk. Mr. Thomas H. Brown, Hathersage, Derbyshire. Mr. Leonard G. Hall, Rhyl. Mr. Thos. H. Rich, Millom, Cumberland. Mr. Clarence Whittell, Dinnington, Rotherham. Mr. William Rogerson, Bollington. Mr. William Severs, jun., Rainhill, near Liverpool. Mr. Ernest J. Sutcliffe, Deputy Engineer, Bradford. Mr. John Fazakerley, Goole. Mr. James G. Price, Neston, Cheshire.

Mr. R. Watson, acknowledging his election as President, said he had been a member of the Institution for eight years—ever since he came into the Yorkshire district—and he had been a regular attender at the meetings. During this time, it had been a pleasure to him to make the acquaintance of many of his fellow-members; and he had to thank them for having elected him as their President for the coming year.

THE NEXT UNIVERSITY LECTURE.

The President called attention to the fact that the next lecture of the series of six on gas manufacture and combustion at the Manchester University would be given on Saturday afternoon next; the Lecturer being Mr. Dugald Clerk, who would take for his subject "The Phenomena of Explosions in Gas and other Internal Combustion Engines."

This concluded the business meeting; and the members subsequently had tea together in the hotel.

Herr Friedrich Lux, of Ludwigshafen, has been awarded a gold medal for the exhibit of his purifying material at the Brussels Exhibition; and his coadjutors, Herren Geheimerat Haas and the Kommerzienrat Stradt, at Heidelberg, have received a silver medal.

On the recommendation of the Lord Chancellor, His Majesty the King has been pleased to approve of a number of barristers for appointment to the rank of King's Counsel. Among them is Mr. C. C. Hutchinson, whose name has from time to time appeared in our columns in connection with parliamentary and other inquiries.

Reference has already been made in the "Journal" to the formation of the Road Board, of which the Secretary is Mr. Rees Jeffreys, formerly Secretary of the Roads Protection Association. The Board have just appointed an Advisory Engineering Committee to advise them as to any matters in regard to which, in their opinion, "it would be desirable for the Board to have information or to take any action in order to promote or assist either general improvements or standardization in methods or materials used in the construction or maintenance of roads, or in the collection and dissemination of information in regard to such matters or to road traffic statistics." One of the members is Mr. H. P. Maybury, M.Inst.C.E., the County Engineer for Kent, who a few years ago was Gas Engineer and Manager to the Great Malvern Urban District Council.

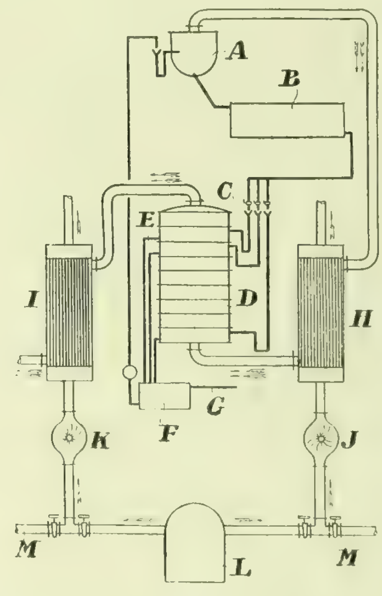
We have received from the Chief Inspector of Factories (Dr. B. Arthur Whitelegge, C.B.) a revised print of the memorandum on the use of water gas, suction gas, and other gases in factories, which has of late years been issued at intervals by the Factory Department of the Home Office. It differs only in a few particulars from its immediate predecessor, which was reproduced practically in its entirety in the "Journal" for the 5th of January last year. It is shown that whereas in the five years 1899 to 1903 there were 51 cases of carbonic oxide poisoning in factories, 17 of them being fatal, in 1906 and 1907 the fatalities were only 14 out of a total of 136, and in 1908 and 1909 only 11 out 108. This lessened mortality is considered to be due to better knowledge of the methods of resuscitation. Accompanying the memorandum is a form of notice, printed in large type, which it is recommended should be affixed in works, detailing the symptoms of gas poisoning, giving some plain directions for "first aid," and furnishing instructions as to artificial breathing.

We learn from the "Newcastle Daily Chronicle" that the commercial community of Quayside have decided to recognize in a public way the generous and public-spirited manner in which the Lord Mayor (Sir W. H. Stephenson), who is Chairman of the Newcastle and Gateshead Gas Company, has discharged the duties of Chief Magistrate, and also the valuable services he has rendered in furtherance of the trade and commerce of the Tyne over a period of many years. Some time ago, a number of the leading men on 'Change felt that steps ought to be taken to mark Sir William's long and honourable association with the business enterprise of the district; and it was intended to pay him some compliment in his present year of office. When it became known, however, that he had consented to accept the mayoralty for another year, it was resolved that a permanent token of esteem worthy of the city and the recipient should be promoted. The opportunity was regarded as most favourable; and a very hearty response has been made in the way of monetary support to the object in view. The Testimonial Committee have made such progress with their work that last week they commissioned Mr. J. Hodgson Campbell, of Newcastle, to paint a portrait of Sir William. It will be hung in the Commercial Exchange, Quayside; and a replica will be presented to Sir William.

REMOVING TAR FROM GAS.

With the view of obviating the distillation of the ammoniacal liquor produced in gas-works and coke-ovens, it has been proposed to send the gases direct into the acid solution intended to fix the ammonia. The success of this operation in practice requires the previous separation of the tar contained in the gas. Up to the present time, this result has been attained by cooling, and has necessarily been accompanied by condensation of water. It has been proposed in various quarters to keep the tar at temperatures at which the water does not condense; and, particularly, to employ liquid tar itself as the vehicle for retaining the tar in suspension in the gas. These matters are perfectly well known. The Solvay Company, however, have devised an apparatus for the removal of the tar without cooling. It consists of the combination of a distilling column with two regulators for keeping the gas at suitable temperatures both at the inlet and the outlet, and another regulator to govern the temperature of the tar supplied. This arrangement is essential for correcting the variations of temperature arising from distillation; and as the working of the appliances requires that all the water should remain in the state of vapour, but without useless superheating, it is necessary to be able to raise or lower as desired the temperature of the gas and the tar.

The column is of the ordinary type of washing apparatus employed in industrial operations; there being only one novel feature in it. The well-known appliances of this nature have only one inlet for liquid at the upper part. Having found by experience that it is not possible to ensure in this way the necessary homogeneity of the liquid washer, the Company have modified the usual action of the apparatus by having a special inlet at each division or series of divisions for the supply of the tar, and also a special outlet. On the accompanying illustration three are shown.



The arrangement indicated effects the methodical recuperation of the tar in the gas by the tar fed into the apparatus in this way—that, as the temperatures of the tar decrease from below upwards, this tar recuperates in succession all the constituents of the gas tar, from the heaviest at the bottom to the lightest at the top of the apparatus. This method of proceeding implies different temperatures at each compartment, as opposed to those processes in which a fixed temperature is maintained. The gas temperature regulators are boxes in which a double canalization allows of the gases which it is desired to heat or cool being brought into contact, without admixture, with a warmer or colder source. The former may, if desired, be the heat of the tars leaving the apparatus, or any other; this being immaterial. In the accompanying illustration, it is the flue conveying away the burnt gases. The most suitable source of cold seems to be atmospheric air, as it lends itself better to admission just where it is necessary by means of valves, as shown in the illustration, together with a ventilator for each regulator. Cooling by a current of water or otherwise is not, however, excluded.

The illustration is almost self-explanatory. The tar coming from the ordinary hydraulic main A passes through the temperature-regulating apparatus B, and feeds, by means of the taps C each of the compartments of the column D. After having passed through it, the tar flows by the outlets E into the collector F which is furnished with an outlet G for the removal of the surplus H and I are the two gas-temperature regulators, J and K are their ventilators, L is the gas-flue, and M the optional inlet of cold air The course of the gas is indicated by double arrows; that of the re-heating or re-cooling fluid by the single ones.

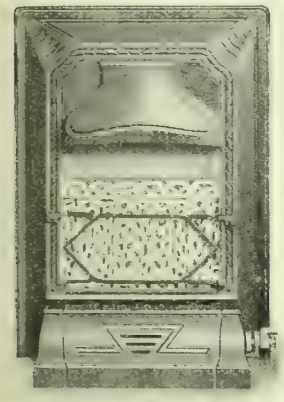
The William Young Memorial Lecture Fund.—We learn from Mr. Alexander Bell, of Peebles, the Hon. Secretary and Treasurer of this fund, that it now amounts to £640.

IN KEEPING WITH THE TIMES.

Seen at the London Show-Room of Fletcher, Russell, and Co.

If there is one firm who should be in the very forefront in the making of advances in gas heating, that firm is Messrs. Fletcher, Russell, and Co., Limited; for we think no one will deny that they were the pioneers in gas heating. Many of us remember personally Mr. Thomas Fletcher; many of those now in the gas industry only know of him by name, and as an ardent worker in this particular direction of gas heating. He entertained a robust belief in the great possibilities that there were in gaseous fuel, and in it eventually rising to a position of no mean eminence among the necessities of human life. By his gifts, his research, his foresight, he built up for the firm a reputation for, within the limits of knowledge and opportunities of the time, providing the means of usefully and economically employing gas for heating purposes. But it is long since Thomas Fletcher left for ever the ranks of the industry's workers in the cause of progress. He left behind for the firm an excellent reputation for good workmanship which they have ever maintained. But for a time, it must be confessed, the trace could be detected of a little conservatism in certain respects. Had he who made the gas-heating branch of the Company's business what it was, been with us in these times when the gas-fire is booming, when we seem to be on the threshold of great things in connection with it, when, too, the gas-supply industry is considering seriously the question of the supply of B.Th.U's. at the cheapest possible rate instead of illuminating power, think anyone who knew him that he would not have been in the very van in meeting the situation and prospects which must be clearly defined to-day to every observant gas man. His instinct was such that it would not have allowed him to lag behind in the march of progress.

There are those in the firm who fully appreciate all this; and they are at the helm to-day. And Fletcher, Russell, and Co. are moving in keeping abreast of the requirements of the times. This is seen in looking round their London show-rooms; for there are observed fires which, for both appearance and efficiency, should meet popular taste and demand. We may specially refer to the "Palermo," "Borneo," and "Tokio" fires as types. Here we have got away from the old highly ornamental casings, with scroll, floral, and other decoration making convenient lodgment for dust.

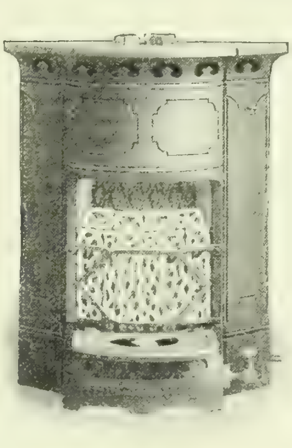


The "Palermo" Fire.

The "Borneo" Fire.

That form of casing has had its day. There is art in the design of an external casing that presents a plain, high-finished surface, with simple ornament and graceful outline. Look at the pictorial presentments of the new fires mentioned; and there is illustrated the meaning, if words do not suffice. These three appellants for consideration and favour are made with 10-inch fires; and the "Palermo" and the "Borneo" with also 13-inch fires. And every vital part of the 10-inch series is interchangeable; and the same is the case with the 13-inch fires. The more the use of gas-fires spreads, the greater becomes the importance of interchangeability in connection with maintenance. The fenders are kept in position by lugs fitting into slots. The burner can be removed by merely lifting it up and pulling forward, after disconnecting from the gas supply. The fire-clay lining is built up in parts that allow of easy replacement and, what is also of importance in the most vulnerable parts, of free expansion and contraction. The fire-bars are also easily removed. Mentioning fire-bars, it will be noticed that these have been reduced to the minimum, and pleasing designs have been introduced. The firm are not converted yet to the use of the barless fire. They point out that people speak of these slight bars as though they were terrible obstacles to the radiations of the fire; whereas, as a matter of fact, they represent superficially a very small proportion of the incandescent fuel surface, and they are not themselves by any means cold when the fire is in service. Therefore, from whatever ground their use is regarded, the firm submit that the reasoning advanced for the omission of the bars from the structure of the gas-fire is not sufficient, more especially if, in any whit, safety is sacrificed.

Then as to the burners of these new fires, they are of Messrs. Fletcher, Russell, and Co.'s patent non-lighting-back type. The firm have always had a good reputation for gas-fire burners, and that reputation is being maintained by those that are fitted to the new fires. The burners are also furnished now with gas and air adjusters; and while rendering a good duty, they are economical. Proof as to the efficiency of the burner and of the means of regulation is found on examining the fires in use; and the brightness and cheerfulness of the fire presented also suggest that the firm have obtained what they have been long searching for—a good material for the elongated form of "fuel" which is now the order of the day in shallow fires, and for permitting free combustion up the centre of the fuel. The method, too, of manufacturing the "fuel" also tends, it is claimed, to give it a brighter appearance. In this series of fires, we like the simple construction and the good, clean work put into them; users (with us) will like the elegant appearance and the economy; and gas companies and other authorities purchasing will not disapprove of the low prices. The elegant appearance of the fires reminds us that the majolica enamels of the firm have not been deposed from the high esteem gained over long years for durability, beautiful surface finish, and an unexcelled range of colours—a range that enables the fires to meet any scheme of room decoration. The demand for a dull black or art black surface, too, has caused the firm to work up to a high standard of finish in that regard. But withal, the demand for the Berlin black finish with its lustrous surface does not die out. From the illustrations, it will be seen that the "Palermo" and the "Borneo" fires are particularly suitable for drawing-rooms; while the "Tokio" is specially suitable for bedroom or nursery purposes.



The "Tokio" Fire.

The "Floresta" Radiator.

The last-named fire is fitted with a boiling-burner on top, which is removable (by simply lifting up and dropping in position again) for cleaning. Not any of the stoves takes up much room—their depth from front to back being only 6 inches, except in the case of the "Tokio," which is 6¼ inches deep.

If anyone, however, wants a similar fire to those described, but of a more ornate pattern, the "Athena" may be taken as a good example. Then for halls, shops, and such like, there is the "Floresta" radiator, about which a few words may be said. As the flame in this is a luminous one (an argand burner being employed), there need be no cavilling by anyone, not even by Home Office inspectors, regarding their use without having chimneys attached. The "Floresta" reminds us of the firm's "Floral" radiators. It is on the same principle, save that the flame is visible (which is for cheerfulness rather a recommendation). It is fitted with a ruby chimney, and copper reflector—and, in short, one experiences quite an air of comfort on looking at it. Each single tube radiator is an entity—self-contained in all respects; and pretty and pleasing effects can be obtained by grouping back to back, making (for instance) a cluster of four, for setting in the centre of a hall, shop, or elsewhere. For this purpose, the group can be finished by using special stands and coronas. Or, again, they can be arranged in rows in any number; stands being employed for this purpose.

We ought not to omit mention of the extensive range of gas water-heaters that the firm have made. As we look along the lines of examples, it is impossible to conceive of any purpose in which hot water is required that the firm would have to confess their inability to meet. If one wants a small water-heater for a small household, here it is; if one wants a boiler for a large circulating system, with draw-offs in bath-room, in lavatories, over sinks, and elsewhere to any number, here it is; if one wants a pressure water-heater, without leather or rubber diaphragms to perish or get out of order, here it is; or if one wants a boiler strong and (so to speak) everlasting for use in the factory, garage, or elsewhere, here it is. And looking over all critically, it is seen that, in the advances to economy and convenience, the firm are absolutely in line with requirements.

But there we must leave the many interesting features to be found in what the firm are now offering, though the sketch here only represents a light survey of the large extent of production in which the firm engage, and in connection with which they have set their faces towards still larger expansion.

CARBONIZATION QUESTIONS.

[Paper and Discussion at the Meeting of the Midland Association of Gas Managers last Thursday.]

It will be remembered that at the meeting of the Midland Association of Gas Managers in March (see "JOURNAL," March 8, p. 659), a paper was read by Mr. Alfred T. Harris, of Market Harborough, on "Carbonizing Systems and Results;" but the discussion was postponed until the autumn meeting, which was held last Thursday. On this occasion, Mr. J. S. Lucking, of Clay Cross, read a paper on "Carbonizing in Bye-Product Coke-Ovens, and Some Experiences in Utilizing Surplus Gas Therefrom for Lighting Purposes." This was illustrated by some lantern slides. The paper and the one by Mr. Harris were then discussed together—the opening of the discussion being confided to Messrs. Thomas Glover, Samuel Glover, and J. Ferguson Bell. These gentlemen submitted prepared communications, which we reproduce after Mr. Lucking's paper.

CARBONIZING IN BYE-PRODUCT COKE-OVENS AND EXPERIENCES IN UTILIZING THE SURPLUS GAS FOR LIGHTING PURPOSES.

By J. S. LUCKING, of Clay Cross.

There has during the past few years been a great deal of useful discussion on the subject of the carbonization of coal for making gas for domestic and power purposes; and it appears that a great deal must yet be done before we reach finality on this most important subject. Controversy still rages round the different systems now in use; and whether we are in future to carbonize in horizontals, slopers, verticals, or chamber settings, is still engaging the minds of our most skilful gas engineers. Splendid results are being obtained from all the systems mentioned; and it is very difficult indeed to say at the present time which of them is the best all-round system. Without doubt, locality has a great deal to do with the question, as the system suited to one place might not suit at all where different conditions prevail.

The writer having had the opportunity for the past six years of observing the working of a coke-oven recovery plant, ventures to submit a few brief remarks upon this method of carbonizing, trusting that they may be of sufficient interest to claim attention, and also be the means of carrying the discussion above alluded to a little further.

Some six years ago, the Company of whose gas undertaking the author has the honour to be in charge, decided to have erected a battery of thirty-four bye-product coke-ovens; and these were afterwards increased to fifty of one of the latest and best types [the type in this instance being that known as the "Simplex," Messrs. Fabry and Linard's patents] in connection with their collieries at Clay Cross. These ovens are similar in appearance to many other types, being narrow chambers, 21 inches wide at the charging end, and 23 inches wide at the discharging end. They are 32 feet in length, by 7 ft. 6 in. high. In the division walls, flues are formed, which are really the combustion chambers of the ovens. Gas is admitted into the flues at each end and also on the top. A space is provided round the gas-nozzle for the admission of air for its combustion. Other ports are also provided for the same purpose on the top of the flues.

The ovens are charged every thirty-six hours with 8 tons of washed and crushed slack. Before being put into the ovens, the slack is compressed into a solid cake of convenient size by an electric rammer, or, to give it its more familiar name, a "stamper." It is then carried into the oven on a steel sole-plate, which is withdrawn when the charge has fully entered the oven. The end doors are then put on and luted-up.

The gas is taken off through a hole in the top of the chamber, which communicates with an ascension pipe by which it is conveyed into the hydraulic main (in this case, a dry one). Each ascension pipe is provided with a valve, which is closed during the charging and discharging periods. The discharging is accomplished by the aid of an electric ram, which pushes out the coke clear of the oven chamber. It is then quenched; and, after cooling, it is picked up by hand and loaded into trucks. The gas is conducted through a series of coolers and scrubbers, tar-extractor, through the exhausters, and forced through more scrubbers, and freed almost entirely from ammonia. It is then led directly back to the ovens, to be used for heating-up purposes. Any surplus gas is blown into the air.

The waste heat from the flues is used to generate steam in Lancashire boilers. This steam is used for the purpose of generating electricity for the compressor and ram, and for the coal crushing and elevating plant.

The bye-product oven plant is, of course, designed primarily for the production of good metallurgical coke from a very small class of coal, and as much ammonia as is possible. These two residuals (as gas managers term them) occupy the chief place in the coke-oven manager's mind; and the gas is a detail to which he gives very little attention, so long as he has sufficient to properly maintain the temperature of his ovens. There is, of course, the tar, which equals nearly 60 per cent. less than we usually get in gas-works practice. This tar is also thinner than gas-works tar, where high heats are maintained.

The costs per ton of carbonizing at these particular ovens are approximately as follows :—

	£	s.	d.
Coal (as per district prices)			
Wages, including sulphate making	0	1	0
Stores, acid, &c.	0	0	6
Repairs to plant	0	0	2
Total . . . . £			
For sale—			
Coke, 12¼ cwt. (as per district prices) . . .			
Sulphate, 32 lbs.	0	3	1¼
Tar, 5 gallons.	0	0	6¾
Total . . . . £			

There is still the surplus gas, which, from the observations I have taken, should, with good management, equal at least 2500 cubic feet per ton of coal used; or from a battery of fifty ovens a daily quantity of 605,000 cubic feet of gas could be obtained, of about 14-candle power.

The following is an analysis of the gas :—

Carbon dioxide	0·5	per cent.
Carbon monoxide	9·0	,,
Heavy hydrocarbons	3·0	,,
Hydrogen	47·7	,,
Methane	26·2	,,
Nitrogen	13·0	,,
	100·0	,,

Calorific value, 550 B.Th.U.

The writer, wishing to make something out of this surplus gas, obtained permission to take some of it to the gas-works to mix with the gas from the retorts, and send it out on to the district for use. Accordingly, a Körting's steam-jet exhauster was installed at the coke-ovens, and a 6-inch main laid between the gas-works and the ovens—a distance of some 450 yards. I first admitted the gas direct into the hydraulic main, but found that, owing to the gas not coming over in uniform quantities, we had trouble with our exhausters. I then tried it between the Livesey washer and the scrubber. This answered very well as far as the exhausters were concerned; but it upset my scrubbing arrangements, and carried forward nearly all the ammonia that was in the retort gas. At last, I decided to take it in at the inlet to the purifiers. There it gives very little trouble. It deposits some naphthalene at the outlet of purifiers and in the meter inlet and outlet pipes; but I never find any beyond there. It appears to deposit the whole of it almost at the moment that it leaves the purifiers.

In the retort-house, we lowered our heats so as to make a richer gas; and by mixing the two at the rate of 50 per cent. each, we can send out gas of 16-candle power. At times, when the oven gas has been extra good, we have sent into the gasholder as much as 60,000 cubic feet to the ton of coal carbonized in the retorts. This would appear to be a very happy position to be in. But sad to say for my peace of mind, coke-ovens are not worked so regularly as retorts; and we have to keep as many retorts heated up as will make the full quantity of gas required, owing to stoppages at the coke-ovens for various purposes, such as cleaning out the plant, &c. When the ovens are stopped for three or four hours, it is often thirty-six hours or more before there is any surplus gas. This is a serious drawback to using oven gas for gas-works purposes. The difficulty could, of course, be overcome by putting in a gasholder large enough to carry the ovens over the period of stoppage. Had I foreseen this difficulty, I should not have been quite so eager to have this surplus gas; for it has caused me many very uneasy hours, as the stoppages usually occur at some inconvenient time for the gas-works, and there is rarely any warning given.

The gas, so far as quality is concerned (owing to the careful regulation of the exhauster at the ovens, so as to keep the pressure in them at level gauge), is fairly regular; and it is very rare indeed that it falls below 14-candle power. It contains a larger percentage of sulphuretted hydrogen than retort gas, some of which is owing to the waste gases from the sulphate plant being returned into the gas after it leaves the scrubbing plant. Consequently, purification (which is done by lime only) costs more with oven gas than with retort gas only.

To sum up. My experience of the past six years has been that all the advantages of a supply of oven gas are counterbalanced by the disadvantages I have indicated; and the only satisfaction I have had is that of having made use of something that was going to waste, and so saving coal for future use. I am firmly convinced, however, that coke-ovens could be made to supply gas for domestic and power purposes if arranged more upon gas-works lines, and were ample storage provided. And I venture to predict that the day is not far distant when a great deal of gas will be made in this way and utilized for these purposes.

The PRESIDENT said he would first read a communication from Mr. Thomas Glover, of Norwich, and then he should ask Mr. Samuel Glover and Mr. J. Ferguson Bell to read their contributions to the discussion.

Mr. Thomas Glover's Written Contribution.

Progress in carbonization has been greater during the last five years than in any period of similar length since Murdoch first distilled coal at Smethwick. Not only have there been great

developments in the mechanical appliances placed at the gas-makers' service, but our knowledge of the conditions necessary for the most advantageous treatment of coal during distillation has increased greatly; and some of our old ideas (to which we clung with persistence) have been shown, by recent experience, to be either entirely wrong or have been modified to a great extent.

The early designs of the Bueb vertical retorts provided ducts or outlets for the gas throughout the length of the retort; but, by experiment, it was found an advantage to take the gas from the top, and allow it to pass upwards through the inner core of uncarbonized coal. This proved to be not inconsistent with a high yield, provided the walls of the retorts were kept at a high temperature. The high yield obtained under these conditions, together with the oily nature of the tars, pointed unmistakably to the fact that too much importance had been attached to the value of the heated duct, through which gas, in an ordinary retort, has to pass on its way to the ascension pipe.

Experiments with heavier charges and longer periods in horizontal retorts—first, I believe, put into practice by Mr. Sydney Shoubridge, at the South Suburban Company's works—showed clearly that there is a gain by reducing the free space above the charge and thus giving the gas less time-contact with the heated walls and for the overcracking, by radiant heat, of the nascent hydrocarbons. Improved coke, thinner tar, less naphthalene, fewer stopped pipes, and high makes per ton, were the results which followed the use of heavy charges and longer periods; and it is no wonder that this is now the regular practice in quite a number of works.

The practicability of filling and discharging retorts was only made possible by the introduction of the newer forms of stoking machinery—more particularly of the "projecting" and the "ram-discharging" type.

The introduction of this type of machinery, and the knowledge that full retorts did not detract from the production of high makes per ton, made it possible for me to experiment with a modified form of coke-oven setting. The setting and the mechanical appliances necessary for working it have already been described, and the results obtained have been published; so that it is only necessary for me to give you some impressions and facts obtained by working this form of carbonizing plant over a period of two or three years.

Each chamber is entirely filled, except at the ends, where the charge tails-off at its natural angle. The period for distillation is twelve hours; and the charges are completely carbonized and push out readily. The mass of coke is quenched by high-pressure water jets, and is removed by a conveyor. The core of coke on being pushed out splits in a vertical line down the centre, and is denser and greyer than ordinary gas-works coke, but not so massive nor so dense as coke produced in larger ovens at the collieries. The coke from poor coking coal is greatly improved by this method. The make of gas per ton is equal to, and frequently exceeds, that which is obtained in the best ordinary retort practice.

The experiment with these chambers was made with a view to seeing if the cost in wages could be reduced by charging and discharging larger quantities at one operation; also to produce a better quality of coke from poor coals, and, generally, to prove whether carbonizing in bulk was advantageous or otherwise, from a gas-making point of view.

Experience shows that the cost of carbonizing is not reduced below that where good machinery and ordinary retorts are used. The chambers, and the installation generally, must be larger to materially affect the wages. The coke is undoubtedly improved where a market for harder coke exists. The gas-making results are quite satisfactory.

The system is not quite so flexible as the ordinary retorting system, and is, therefore, rather disadvantageous in this respect. It is more adapted to large works than to those of moderate or small size.

These observations as to flexibility and adaptability would apply in a much greater degree to the use of larger chambers; and, in my opinion, installations such as are in use on the Continent could be used with advantage only in large works, removed some distance from residential portions of the district of supply. The volumes of steam and smoke produced are likely to constitute a cause of complaint.

Many works are situated in the midst of the district to be supplied, and as purveyors of smokeless fuel and as ardent smoke abatement advocates, it should be our earnest endeavour to make our works as smokeless as possible. This will only be done by continuous carbonization; and it is to be hoped that those responsible for developing this system will be able to prove that all the advantages of good gas making and good coke and other residual production can be accomplished with a reduction of mechanical operations and also with a total abolition of smoke and steam.

Remarks of Mr. Samuel Glover, of St. Helens.

I appreciate very highly the honour you have done me in asking me to open the discussion on the important subject of carbonization, which was brought before us (as members of the Association), in the first place, by the reading by Mr. Harris of his paper recounting his experiences with his setting of eight retorts arranged in accordance with the general principle of what are known in the gas industry as "Love's Forty-Fives," and which has been presented to us to-day in another aspect by the interesting communication by Mr. Lucking.

To help me to study the subject more intelligently from the point of view of these two gentlemen, I have visited both of the works in the conducting of which the data for these papers has been gathered; and I should like to be allowed here (on behalf of our Institution and myself) to thank Mr. Harris and Mr. Lucking and the Managing-Director of the Clay Cross Company for the helpful way in which I was met, and the thorough manner in which I was allowed to follow out my examination of the process of carbonizing carried out on their works.

Many of our members know how thoroughly Mr. Harris studied the system of inclined retorts he adopted, and with what care the setting was erected, tested, improved, and worked, and the results which were obtained; and Mr. Harris informs me to-day that this same setting is still at work and is very much in the same condition as it was at the time of my visit.

I was very much impressed, however, not for the first time, with the inherent weaknesses of the "slopers," some of which were apparent after Mr. Harris had done his best with the forty-fives and worked the bed for only a short time.

> The uneven heating of the several retorts in the one setting—a vital fault, and this after Mr. Harris had removed the centre disturbing factor, the "bull's-eye" of the setting.
>
> The irregular lengths of time required to burn-off the charges, owing to the above-mentioned uneven heating.
>
> The severe strain put upon the retorts and their setting when heated and worked in this manner tends to distortion of the retorts and disintegration of their settings.

This leads, as a natural consequence, to considerable interference with the even charging and the easy discharging of the retorts.

These and other defects discount very largely, in my opinion, the advantages claimed for the system of inclined retorts. They may be considered, however, to have been a step in the right direction, and to have been in some works (where they have been carefully designed and constructed) an advance on old-fashioned horizontal settings with hand charging.

Consideration of the possibility of a supply of lighting gas from coke-ovens used as subsidiary to an ordinary gas-works has been before this and kindred institutions on previous occasions; and I rejoice with you that we have lived to see the day when we have had the experiences of doing this related to us by a man who has done it.

We are thankful to Mr. Lucking for coming forward and giving us the benefit of his experiences, and to the Clay Cross Company for granting the necessary permission, as these experiences throw another gleam of light on the pathway we are travelling along in trying to arrive at truth about the relationship of these things to our work as carbonizing engineers.

I quite agree with Mr. Lucking's conclusions. The output of gas from coke-ovens is controlled by the rise and fall in the demand for coke and not in the demand for gas. This arrangement will not, therefore, keep-step with the needs of the carbonizing engineer who is responsible for a public gas supply. No; such an one might parody Tennyson's "The Brook," and say:

> Ovens may come and ovens may go;
> But my pure steam must flow on for ever.

The communication which we have had to-day from Norwich confirms our idea as to the want of flexibility in any system of ovens or chambers; and it suggests that we should look for a cleaner as well as a more flexible process of carbonizing gas coals in our cities and towns. Coke must be the first consideration where ovens are used. We cannot, however, slacken in our endeavours to find the best methods of carbonizing the ever-increasing quantity of gas coals we have to handle. The demands upon our skill are more pronounced than ever. The coal carbonizing engineer must clearly realize that it is his duty to treat whatever coal he handles in such a way as to get the greatest total measure of value from each ton—that is, not only in gas of the most efficient illuminating and heating value, but also in tar and its products—ammonia and cyanogen compounds; while producing coke of good quality useful for both domestic and manufacturing purposes. He must do all this at as low a cost as possible, and with as little public nuisance as possible; for there is a distinct and growing agitation demanding that while we are making so much smokeless fuel for other people to use, we should not make such a smoky and dusty atmosphere ourselves, in the neighbourhood of our manufacturing stations.

What, then, is being done? Since the advent of the full retort, we have heard a good deal about the rehabilitating of the horizontal system; and to get the best possible work out of this system is quite right and proper in face of the capital charges still standing against it. But even when it has been rehabilitated all it can, it will still be the same old "prodigal son" making great demands for its level support, and upon the power required to get anything into him—and more to get anything out of him. And to-day, notwithstanding all that has been done to improve the education of the carbonizing engineer and also to improve the horizontal and inclined settings with which the bulk of the work is still done, one is continuously hearing of, and seeing in works inspected, stopped ascension pipes, pitched-up mains, and the use of all kinds of fantastic bridge-pipes and dip-pipes to help to overcome the evils set up in the irregularly heated and irregularly charged retorts, the insides of many of which are at the end

of each charge festooned with decomposed hydrocarbons. The gas-coal carbonizer has even yet with the old (and even with some new) systems of carbonization sadly too little control of his make of gas per ton of coal, and of the quality and quantity of liquid hydrocarbons he will make per ton of coal. Nor has he sufficient control of his operations to provide a steady suitable quality of illuminating power and regular calorific value; and these important points cannot be controlled merely by "putting on the exhauster." Nor can the proportion of retort carbon be controlled; and this is one of the most costly products of our inefficient retorting systems.

None of these important factors of our daily output can be efficiently controlled by the most efficient intermittent carbonizing process, in all of which the product is a hash made up of firsts, middles, and dregs.

I am fully persuaded—after years of experience, and many more years of study, during which I have been associated in my work with some of the best men in the profession, have travelled far, and received visits from earnest students from the five Continents of the globe—that the future is to be met by means of the British system of carbonizing gas coals in vertical retorts worked on the continuous system. It is a system which, in the opinion of the large number of experienced coal carbonizers who have seen it, most nearly approaches the ideal, in the regular and natural way in which the coal is distilled—giving a constant stream of gas, of regular quality, both as regards illuminating power and calorific value, with a minimum of dust, and an absence of steam and smoke. There is no red coke to slake—in fact, entire absence of slaking of coke; the heat of the coke having been returned into the setting. There are no black mouthpiece ends of coke; but all the continuously discharged coke is beautiful steely grey lustrous coke. There is a minimum of space required for a given output; the condition of the stoker's duties is so altered that he is no longer a stoker in the ordinary sense, and with the possibility of reducing the working costs per ton from the 2s. 6d. we used to pay in the old days to (possibly) 2½d. per ton when adopted on a large scale. Mr. President and Gentlemen, I hope we may all be there to see it.

[Mr. Glover then called attention to some samples of coke from the St. Helens vertical retorts, as well as a sample of the tar and distillates. There was also on view a sample of the coke from the Norwich chambers.]

Mr. J. Ferguson Bell (Derby) read the following:

Certainly we are all indebted to Mr. Harris for bringing before us, in a most admirable paper, his experiences with semi-vertical retorts, or inclines set at 45°, instead of the usual angle of about 32°; and all will join the author in sincere regret that Mr. Love, the pioneer, was not spared to bring his system of semi-vertical retorts to a greater degree of perfection, as evidently they were not all that could be desired, or the Directors of the Guildford Gas Company would not have replaced them with a new bench of horizontals operated by machinery.

We must not, however, judge too hastily, as I understand the inclines set at an angle of 45° erected by the late Mr. Love at Guildford were more or less of an experimental character; and it is hardly to be expected that success would attend a first effort. But Mr. Love was a man to whom difficulties were only obstacles to be overcome; and I feel assured that, had he lived, we should have seen and heard more about semi-vertical retorts. Therefore, I am extremely glad that so practical and experienced a carbonizer as Mr. Harris has taken them up; and I trust that further experience will enable him to demonstrate that they are an advance on ordinary inclines, which, though much favoured a few years ago, are generally admitted to be inferior to horizontal retorts operated by the later forms of stoking machinery.

Inclines during the past few years have practically stood still as regards improvements, whereas horizontals have advanced; and we shall all be glad if Mr. Harris is able to restore them to favour again, by setting them at a steeper angle, and filling them up with heavier charges. Mr. Harris has, in my opinion, wisely adopted full-depth regenerator furnaces; but it is unfortunate that he was not able to experiment with retorts longer than 11 feet, which must increase the fuel account besides the capital charges per ton of coal carbonized and unduly reduce their productive capacity.

Mr. Harris's trouble with excessive back-pressure in the retorts (more especially the bottom ones) could no doubt have been remedied, or at least very considerably reduced, by charging with coal of an even mixture—I mean small and large coal equally mixed—the plan often adopted when charging verticals.

With the steeper retorts, I shall be glad to know if Mr. Harris is at all troubled with an excess of tarry matters at the bottom ends of them.

I am not prepared to endorse the author's criticism in respect to verticals, which, it appears to me, have come to stay; and when it is remembered that the intermittent vertical system has only been before us a comparatively short time, while the continuous and almost continuous vertical systems are of much more recent origin, some numbering only a few months—seeing the success they have already achieved, I think it unwise to pass too severe strictures upon them, although in my opinion there is no necessity for scrapping horizontal retorts, as by the modern method of filling them up, most of the advantages of verticals may be obtained.

In Germany, when enlargement or modernization of carbonizing plant is under consideration, attention is almost always exclusively confined to the relative merits of the Dessau vertical retorts or Munich inclined chamber ovens; and a brisk controversy is now being carried on by various partisans of the two systems. Horizontal retorts operated by machinery and continuously worked verticals, it seems, at present possess little or no attraction in Germany. And it must be admitted—perhaps in consequence of gas coal being much dearer there than in this country—that our German *confrères* are skilled technicians; also that their carbonizing results are tested and tabulated in a very much more accurate and precise manner than is generally adopted here, and that they are quicker to adopt newer methods.

Bearing in mind the large number of illustrations of Dessau verticals, and more recently inclined chamber ovens that are at work, and are being erected on the Continent, they appeal to me for further investigation and anxious thought, to approach this most important matter of the best system of carbonizing with an open mind—that is, if there is any best system.

I am inclined to think the various systems, all of which will perhaps be found better suited to one town or district than to another, will in time prove their special adaptability.

There is no shadow of doubt in my mind that Dr. Bueb's vertical retort system is a good one. Much credit is due for the careful investigations, experiments, and technical skill of a high order, extending over several years, before the Bueb vertical retort installations were brought to their present state of perfection. It is to the honour of Dr. Bueb, Herr Körting, and the colleagues who collaborated with them, that we have the vertical-retort system. They proved its success; and I think it only right to give honour and credit to whom due. While saying so much for the Dessau system, I am glad in this country at any rate that we are not satisfied to accept it or any other system wholesale, and adopt the "rest and be thankful" attitude. This is due perhaps to more independent temperament, which makes us unwilling to accept things as they are. We want to improve upon them, with the result that independent experiments are carried on. This may not be in an economical sense sound; but the gas industry, like most others, owes its success to individual efforts, and I hope they will continue.

Hence, the possibilities of the vertical system being proved, others in this country have set to work, with the result that we now have a choice of several good vertical systems.

Mr. Harold Woodall and Mr. Duckham are pioneers in the continuous vertical system, carried on in the face of difficulties, most of which, if not all, I believe, are now overcome. Another well-known carbonizer, Mr. Samuel Glover, of St. Helens—in conjunction with Mr. West, who deserves great praise for his mechanical genius in inventing stoking machinery—has a very successful vertical system. When at Glasgow some three weeks ago, I had the privilege of inspecting an installation of Mr. Alexander Wilson's vertical retorts. It much impressed me; and I believe more will be heard of it.

However, for many years, most of us have carbonized our coal in horizontal retort settings. They have served us well; and, by filling them up, most of the advantages claimed for verticals may be obtained with greater elasticity, as light, heavy, or filled retorts may be adopted.

I hold no brief for any system of carbonizing; but I may perhaps claim to be one of the pioneers of filling up horizontal retorts, which has been designated by Mr. Browne, of Vauxhall, as a "rehabilitation" of the horizontal retort.

Mr. Carpenter, the Chairman of the South Metropolitan Gas Company, and Mr. Shoubridge, of Sydenham, are able to show splendid carbonizing results; and no doubt many others can justly claim to be pioneers of the system of filling up retorts, by increasing the weight of the charge, with corresponding longer period of carbonization.

In 1905, at our Cavendish Street works, Derby, we were working 5 cwt. charges of 4 hrs. 48 mins. duration, or five charges per diem. The retorts at this works are 21 in. by 15 in., ◯ section, by 18 feet long. The average make of gas from small ordinary Derbyshire gas coal is 10,300 to 10,500 cubic feet per ton. In 1906, we adopted 6 cwt. charges of six hours' duration, with the result that our make increased to 10,800 cubic feet per ton.

In 1905 and 1906, we were much troubled with stopped ascension pipes. In 1907, the weight of charge was further increased to 8 cwt. in eight hours; and the production of gas increased to 11,000 cubic feet per ton.

From 1907 to 1910, the weight of charges has been gradually increased to 12 cwt. in twelve hours, and more recently up to 14 cwt. in fourteen hours, which completely fills the small retorts from end to end. The make of gas has increased to 11,500 or 12,000 cubic feet per ton, depending upon the quality and grade of coal carbonized. I am not prepared to state if carbonizing with retorts filled from end to end is better, so far as make of gas is concerned, than with charges leaving a small space of 3 or 4 inches above the top of the coal to form a duct for the gas.

During the past five years, our illuminating power has decreased from about 17 to 16 candles—No. 2 burner. But the calorific value has remained practically constant—being an average of 145 to 150 calories gross, or 130 to 135 calories net, per cubic foot.

In any attempt to increase the volume of gas made per ton of coal used, special care should be taken to see that it is gas of good quality that is being produced—not a mixture of coal gas pl[illegible] furnace or other non-combustible gases, which are no use to the consumer, and are harmful diluents. There was a valuable paper

read by Dr. Davidson, of Birmingham, at the last meeting of the Institution of Gas Engineers, in which the deleterious effect of 1 per cent. of different non-combustible constituents in calorific value and illuminating power are given with gas of 540 B.Th.U. of 16-candle power.

	Calorific Value.	Candle Power.
CO_2 = ..	− 1 per cent. ..	− 3·5 per cent.
O = ..	− 1 ,, ..	− 3·0 ,,
N = ..	− 1 ,, ..	− 2·6 ,,
Air = ..	− 1 ,, ..	− 2·7 ,,

These figures are well worth bearing in mind—that the gas is being sold by volume.

There is no doubt that, by filling up the horizontal retort, the coke made is of better quality—being more dense, harder, and of better colour; and much less breeze is produced. Especially is this the case with coals that produce a soft, friable coke.

There is a decided increase in the quantity of ammonia recovered—due largely, I believe, to less disassociation taking place in the retorts.

If ammonia is subjected to a temperature of 500° C., 1·6 per cent. by volume is decomposed. If the temperature is increased to 600° C., then 18½ per cent. is decomposed; and at 700° C., one-half of it by volume is split up when passed through a heated tube. No doubt this rate of decomposition is retarded by the mixture of the other gases present, as the ammonia seldom if ever exceeds 1 per cent. by volume—the quantity generally being from 0·5 to 0·95 per cent. by volume.

In our own case—due largely, I believe, to filling up the retorts—we have during the past three months sold just over 28½ lbs. of sulphate of ammonia (centrifugal dried) per ton of coal carbonized, which is very much higher than was obtained when we were working five-hour or six-hour charges.

I find the space above the coal in the retorts—◯ section, 22 in. by 16 in., which is the size at our Litchurch works—is as follows:

8 cwt. charges	8½ inches.
10 ,, ,, ...	7 ,,
12 ,, ,, ...	5½ ,,
14 ,, ,, ...	3⅞ ,,

And from these figures, I calculate the average velocity of the gas travelling in the free space above the coal in the retorts:

8 cwt. charges,	8 hours	9 feet per minute.
10 ,, ,,	10 ,, ...	12 ,, ,,
12 ,, ,,	12 ,, ...	17 ,, ,,
14 ,, ,,	14 ,, ...	31 ,, ,,

The result of this increased velocity of travel of the gases inside the retorts, along with probably a lower average temperature of the coal carbonized, due to the increased thickness of charge, is indicated by the average temperature of the issuing gases at the bottom of the ascension pipe, at a point 1-inch above the socket of the mouthpiece, taken by means of a standard (nitrogen filled) direct-reading mercurial thermometer:

For 8 cwt. charges, the average is	885° Fahr.
10 ,, ,, ,, ,,	709° ,,
12 ,, ,, ,, ,,	617° ,,
14 ,, ,, ,, ,,	451° ,,

The temperatures on the furnace side are, on the average, 150° hotter than on the other side. The average temperature of the gases coming away from an 8-cwt. charge is almost double that of a 14-cwt. charge. Thus it will be evident that decomposition and chemical changes take place in a much greater degree with the lighter charges of shorter duration.

Coal gas is not diathermic. It readily absorbs radiant heat, and is easily heated by conduction, which shows that, although the temperature of the gas at the bottom of the ascension pipes is (say) for twelve-hour charges an average of 600° Fahr., at the dip-pipes, before entering the hydraulic main, it is generally only 120° to 130° Fahr.—cooling no less than 480° in 22 feet.

This very much lower temperature of the gases entering the ascension pipes no doubt accounts for the freedom from stopped pipes which is the general experience of all who have adopted heavier charges with a correspondingly longer period of carbonization.

Another very important matter is that with filled retorts the sulphur compounds (CS_2), which are so difficult to deal with, are much less than with light charges.

The tar produced is very much thinner—the specific gravity coming down (in round figures) from 1·200 to 1·100.

The naphthalene present in the purified gas is now less than it used to be; this reduction being due to filling up the retorts with longer period of carbonization.

We must thank the Clay Cross Company for laying before us the results of their working. I do not think that in England there is much hope for coke-oven gas being distributed, unless the towns happen to be pretty near the collieries.

Discussion.

Mr. W. A. Sapey (Tamworth) remarked that they had heard a lot of technical discussion on retorts and carbonization; but he should still like to ask a few questions in regard to the matter. A few years back at his works they had direct settings of retorts, and they decided, when modernizing their plant, to still keep to horizontal retorts. With these horizontal retorts they could make between 9000 and 10,000 cubic feet of gas per mouthpiece. After listening to all they had heard that day, he could not see where the advantage would come in of making any change in the case of small gas-works. For instance, Mr. Bell talked about having full retorts. In a works of his (Mr. Sapey's) size, this was impossible unless they had machinery. With horizontal retorts, Mr. Langford was making 12,900 cubic feet, and selling 12,100. In view of these figures, he (as representing a 50 million cubic feet works) would like to know where would be the advantage of making a change from horizontal working. According to a certain advertisement in the "Journal of Gas Lighting," the largest make in the country was from horizontal retort working. In view of this, where did the vertical retort, continuous or otherwise, come in? He had his retorts filled as much as possible by hand labour; but when they had 5 or 6 cwt. of coke to pull out, the men had something to say about it. Without machinery, it was impossible for small works to get the results that were heard of from the larger works.

Dr. Rudolf Lessing (London), invited by the President, said he did not know, after what they had heard from two practical men, that he had any remarks to offer that would be of value. In his opinion, the gas industry might be congratulated upon the state of affairs in connection with the question of carbonizing at the present moment. There was certainly to-day no danger that things in this respect would again drop into a groove—the protagonists of the various carbonizing systems would see to that. He thought it might be taken that the gas profession would not accept to-day any one system of carbonization; and they now brought their experiences and beliefs as derived from their practices to bear against each other—certainly to the benefit of the industry as a whole. There was no doubt whatever that the advent of the vertical retort had had a lot to do with the developments, during the last four or five years, in carbonization for gas making. If the vertical retort had only demonstrated the advisability of heavy charges, or full or practically full charges, in horizontal retorts, it had done something beneficial. This was a great point in the cause of progress. From the theoretical point of view, it could not be doubted that the vertical retort, and especially the continuous vertical retort, was the right thing. On the other hand, it had to be considered that there were conditions, such as were mentioned by the last speaker, due to the size of the works, and conditions, too, relating either to the capitalized value of the older works or to the cost of the newer carbonization systems, that would compel adherence to the old system of horizontal retorts. The rehabilitation of the horizontal retort in favour had been made possible by the vast improvements that had taken place during the last few years in charging machinery; but giving all credit to the improvements in charging machinery, he must hold that to the pioneers of the vertical retort was due the merit of having demonstrated how it was possible to make better use of the horizontal retort. When they heard such excellent results as those Mr. Bell had put before them, both now and in his Institution paper last year, it was impossible to avoid the conclusion that it would take a very good system to beat these results. As to intermittent or continuous vertical charges, the theory was, as he had said, in favour of the latter. The progress that had been made in Germany with the intermittent system was hardly due to the superiority of the system as such, but to the way the question was tackled over there; and to the attention, the energy, the money, and the skill bestowed upon the working out of the details of the system. Then as to the continuous practice, whether it would be the Woodall-Duckham system or the Glover-West, or the semi-continuous retort (of which he had reason to believe they would hear more at the next meeting of the Institution from the President, Mr. Alexander Wilson), that would hold its own in the matter of superiority, remained to be seen. It might be that success would favour the semi-continuous one, in which the retort was working on a continuous principle, without any mechanical appliances, which were not desirable things in a plant that had to be kept at high temperatures. One could do away with these things by merely working the continuous system as it were intermittently—that was to say, by partially charging and discharging by hand so many times per shift. As he had already remarked, it was not possible at the present juncture to decide which of the systems was the best. The "best" depended upon the soundness of the system from both the engineering and the chemical points of view; and as to how it was handled and worked. What had occurred in the case of the horizontal retort only showed what proper handling and skilful working could do in the matter of enhancing results. So much for carbonization generally. They had to discuss, also, the paper read that day on coke-oven practice, and its bearing on the gas-supply industry; but he might discourse at great length on some of the problems connected with large space carbonization in chambers and in coke-ovens, because exactly the same condition of affairs prevailed in the working of coke-ovens as it did in the working of large retorts or chambers. The horizontal ovens were the usual ones in nearly every country; they had also the newer vertical ovens, and they were well on the way to the continuous vertical oven. There was also the inclined oven for gas-works. He believed the principles underlying these were practically the same, with qualifications of course, as those obtaining in the case of retorts. With regard to the question of supplying gas from coke-ovens to gas-works, this was more or less an economical matter. Technically, he thought there was no difference in the gas made in coke-ovens (that was when made as it should be made) and in gas-works. The only fundamental difference was that the coke-oven manager had to direct his attention to the making of good coke as well as the saleable bye-products, whereas the gas

manager must of necessity (he was forced to do so by his statutory obligations) devote his skill and attention chiefly to the gas part of his product. The question of utilizing coke-oven gas had been tackled to a very large degree on the other side of the Atlantic (he believed the Americans were the first to take advantage of it) in every branch of possible application, so that it was comparatively easy for them to purchase the gas wholesale from the coke-oven plants. In Westphalia, too, residual plants had been adapted in their practice. The procedure followed there was to take the rich gas that came off during the first period of distillation, and divert it into the gas-supply channel, while the poor gas, on the other hand, was used for heating the ovens. He was glad to find that, in this country, things were moving in this direction also. They had in the present session of Parliament a scheme promoted for utilizing gas for town lighting from the coke plant of the Earl of Ellesmere at Little Hulton; and, as Mr. Lucking demonstrated to them, this had been done already, with fair commercial success, elsewhere. The question of the stoppage of coke-ovens through miners' disputes and other labour difficulties, and consequent interference with the gas supply, was a serious one; and therefore before any scheme was adopted, there must be absolute certainty that the use of the gas as an economic factor would not be interfered with. There was one little matter that struck him some time ago; but it could hardly be called utilization of gas, because the quantity of gas required for it would have scarcely any bearing on the output of either gas-works or coke-ovens. In connection with the early endeavours in relation to air-ships, some two or three years ago, he thought it might be a good thing to follow on the production of gas as now made with the decomposing of the succeeding gas, so far as it was decomposable—that was to say, crack the gas up into hydrogen, with the small impurities of nitrogen and carbon monoxide, and make a gas suitable for filling air-ships and balloons. It would, from a strategic point of view, be desirable to have a large number of stations distributed all over the country from which the military air-ships could draw their supply. The question would be less one of the purity of the gas than the convenience of the supply and utility. He had obtained protection for one device by which such a gas could be made, though he did not expect a great commercial value from it.

Mr. T. Berridge (Leamington) remarked, regarding the rivalry of the vertical retorts, chamber settings, and horizontal retorts, that he did not think it could be said that one system was better than the other. In connection with all these processes, what they had first to consider was their individual conditions, and how a certain type of setting could be adapted to meet their own particular needs. They were grateful to Mr. Bell, Mr. Glover, and others, who were pioneers in the working of different systems, for the experiences and hints with which they had from time to time favoured them. In several of the small works with which he was connected, they were getting results as good as the best he had yet seen. In one or two of these works, they were making over 13,000 cubic feet per ton of coal, and were actually getting paid for over 12,000, and that a good $15\frac{1}{2}$-candle gas. What they did was to charge the retorts all at once. They also had an apparatus in the retort-house, so that they could easily alter the retort-house governor, and give variations in the pull (there was a jet photometer against the apparatus regulating the pull, which was reduced as the jet photometer went down) to maintain the jet photometer at a proper point. They were enabled to work 2 inches pull immediately they had charged the retorts, 1 inch in an hour's time, $\frac{1}{2}$ inch in two hours' time, and a level gauge during the other portion of the charge. Anybody in charge of small works who worked in this way, and without any seal, could make 13,000 cubic feet of gas per ton. With reference to the filling of retorts, of course, in a large works they could not watch the pull so well as in small ones. When he adopted charging machinery, he started with eight-hour charging and 10 cwt. charges; and he soon found that, without any seal, the main began to pitch-up and the ascension-pipes to choke. It looked like coming to a standstill. But he telephoned to Mr. Bell; and his advice was to go on to twelve-hour charges and put on $\frac{1}{2}$-inch seal. He was quite right; and the mains stopped pitching and the ascensions stopped choking. They began to make 12,000 cubic feet of a higher illuminating power gas, and so were able to do away with cannel, while simultaneously making a very good coke. Recently they had put in some of Mr. Thomas Glover's chamber-retorts; and they were going to work very well.

Dr. W. B. Davidson (Birmingham) said he should like, in the first place, to ask Mr. Glover whether he could, by any system of retorting practice, produce a coke which was at the same time porous and light and suitable for domestic purposes and, by making perhaps some slight alteration, obtain a coke suitable for metallurgical purposes. He (Dr. Davidson) did not think it was possible. Mr. Glover seemed to him to be a bit of an idealist. They were all idealists in a sense; and certainly most of them would no doubt favour a project of British enterprise and genius in making a selection of a retorting system. What he wished to point out clearly, if he could, was that in using heavy charges—although they might have the advantage of doing away with stopped pipes, getting a thinner tar, realizing a better coke, possibly reducing the fuel used, and most of all diminishing labour costs—they never got, in his experience, nor in that of Mr. Bell, a better yield of gas. It was quite a misconception to think they did. He considered it was a very common delusion that, with heavy charges, they increased the capacity for gas making of the retort-house. He was strongly of opinion that the yield of gas depended on the size of the retort and on the temperature; and beyond a certain limit one could not go. In other words, there was a limit beyond which one could not do better with heavier charges than with moderately light ones. He found this with their test plant in Birmingham. They could carbonize 26 cwt. per 24 hours, but not more, at a temperature of 1900° to 2000° Fahr. If he carbonized 9 to 12 cwt., he got no better results; and Mr. Bell's own figures of last year and this year proved just the same thing. It had often been stated that certain results were wonderful, and that an increase (say) of 20 to 30 per cent. in gas was obtained. He thought this was distinctly erroneous. Mr. Bell reminded him that there might be a considerable increase in the calorific value. Taking the gas production on the calorific basis, certainly this had been found on large-scale experiments. The question of carbonizing was a very puzzling one. Slight differences in the size and shape of retorts made a large difference in results. He knew of one retort-house where the charges were $9\frac{1}{2}$ cwt., and they were burned off in eight hours in large retorts. In this case, the sulphur compounds were 50 per cent. more than they were in smaller retorts carbonizing $6\frac{1}{2}$ cwt. in six hours. It was a remarkable difference. Dr. Lessing had said that theoretically the continuous system of retorting was the best. Most of them he imagined would say so. For his own part, he had been looking into the matter; and considering Dr. Bueb's own statements, he found that, in verticals as a whole (this applied to continuous as well as to intermittent retorts), there was a loss of the gas production on the illuminating power basis, due to the scrubbing of the gas by the red-hot coke. Of course, in the continuous system, most of the gas was given off at the top of the retort, and this portion was not scrubbed by the hot coke. But, as Mr. Harris had pointed out, carbonization was not completed until the coal got nearly to the bottom of the retort; so that a large portion of the gas must get scrubbed, and this was prejudicial to the hydrocarbons. He believed it was pretty well admitted now that vertical retorts were not very successful on the illuminating power basis. The great secret of success in carbonizing was burning off completely, and this was what was done especially well in the Dessau vertical retort. The coal was carbonized very thoroughly; and towards the end of the period of carbonization, there was exceedingly little volatile matter left in the coke. It was very misleading nowadays to bring up old carbonizing results to prove that this or that system had been a great success, because he could affirm, from their own experience in Birmingham, that they could increase the gas production by at least 15 per cent. by simply getting proper retort temperatures, and making no other alteration at all. In his opinion, the matter of retort temperatures was one that had been much neglected by most gas engineers. He should like to point out, with regard to the figures in the analysis of the gas given by Mr. Lucking, that the 13 per cent. of nitrogen illustrated what was regarded by the advocates of the vertical retort system as a serious blemish of the chamber oven retorting system. It was said, and he thought with truth, that chamber ovens were more liable to leakage, and that the large increases of gas which were given, and the results educed, were due to the introduction of furnace gases or waste gas. The other day he had an experience with retorts which were not properly covered with scurf, and were working with a level gauge, or certainly less than 1-10th inch pull. He got 23 per cent. of nitrogen and 6 per cent. of carbonic acid—that was to say, over 29 per cent. of the total gas was really furnace gas.

Mr. Harold E. Copp (West Bromwich) congratulated Mr. Harris on his paper. When one got hold of a new idea, and read a paper on it, one was apt to take a rosy view of it, and try to convince his hearers that the millennium had been reached. Mr. Harris did not do this. He gave straightforward experiences, and recounted his failures, as well as his successes. Mr. Harris mentioned two objections to the continuous vertical system; and he (Mr. Copp) was rather surprised to find that Mr. Glover had not taken notice of the points. The author said that separate charging and discharging mechanism was necessary. That was clearly not so in the Glover-West system, in which there was no charging machinery. Then Mr. Harris also thought that the continuous movement of the coke in the retort would have a breaking effect on the coke. This could not be so, as surely the coke must move as it were in the mass. At the end of the paper, Mr. Harris said most of the improvements that had been made were, in his opinion, due to the better conditions allowing free and steady passage of gas from retorts. He (Mr. Copp) thought this statement hit the nail on the head; that it was the *crux* of the whole thing. In the last issue of the "Journal," there was a leading article, in which some interesting particulars were given as to how much less coal was carbonized by statutory gas undertakings in the last year covered by the Board of Trade returns compared with the previous one. Some 12,446 tons of coal less were carbonized (though there had been an addition to the undertakings making returns), and no less than 63,066,000 cubic feet more gas were made. He (Mr. Copp) would like to know how much of this was due to improvements in carbonizing, and how much to the increased facilities granted by Parliament. Dr. Davidson had remarked that to quote make per ton without referring to illuminating power was a vanity. He did not exactly use these words; but that was what he meant. He quite agreed with him. In the works for which he (Mr. Copp) was responsible, he succeeded in realizing something approaching the results obtained by Mr. Bell. But unfortunately he had to supply gas of

an illuminating power some 4 candles higher than the majority of the undertakings in this country. If they made a simple rule of proportion sum, and calculated a make of 11,500 cubic feet to the ton at 4 candles higher than the great majority of gas undertakings in the country were supplying, he thought it would be found that he was approaching some of the best results obtained in vertical retort working. Furthermore, with heavy charges, by discharging the coke in closed vessels and slacking it in closed vessels, and preventing any access of air to the coke, he produced a coke very nearly as good as that exhibited by Mr. Glover.

Mr. W. J. R. Baker (Great Malvern) congratulated Mr. Harris on his spirited work with Love's 45° retorts. He was rather sorry the author had only 11 feet retorts in comparison with the usual 20 feet ones. But working out the figures, with his 11 feet retorts he got 8606 cubic feet per retort, which was equivalent to 15,740 cubic feet with 20-feet retorts. In his own case, he obtained 17,500 cubic feet. Another point was that Mr. Harris had tried five charges per 24 hours. He (Mr. Baker) had also tried this number, but not with the same success as with four charges. He had also tried filling the retorts, but was limited by his charging apparatus to 7 cwt. charges. He agreed with Mr. Glover that, if the bull's eye were taken out where it existed, better results would be obtained; and he would further say this, that the sooner they all got their results on to a common basis with calorific power, the better both for the profession and for outsiders. They were apt to hear of so much per ton being obtained from this and the other works, with the result that the outsider or the committee man took it as the ground on which to compliment or condemn the gas engineer of the particular undertaking in which he was concerned. It would be a good thing if they could get some concordant experiments made with hortizontals, verticals, inclines, and Love's 45's. This would enable them better to judge of whether they should go to horizontals with machinery, to inclines, or to those "drawing-room like" conditions of which Mr. Glover had spoken with verticals. They could with the proper information before them see which would best suit the conditions of their particular works.

Mr. W. W. Townsend (Hereford) said there seemed to be no doubt that a greater yield of gas was obtained from fully-charged retorts, whether horizontal or vertical, compared with partially filled ones. The usual explanation was that, with the filled retorts, the constituents of the gas were not cracked-up by contact with the heated surface of the retort, or exposed to the radiant heat of the free space above the charge. But if this were so, how could the increased yield be accounted for? A greater volume of gas was obtained by decomposing the hydrocarbons into hydrogen and carbon; and the fact that with filled retorts the yield was greater, and the illuminating power lower, appeared to indicate that the gas had been cracked-up to a greater extent than it was with light charges. It seemed to him that the probable explanation was that, with fully-charged retorts, it became possible to work with higher heats and to crack-up the gas to a greater extent, because the temperature of carbonization with light charges was limited by practical considerations—the trouble of choked pipes and pitched mains being the principal. With full charges, on the other hand, it became possible to carbonize at a much higher temperature, because the carbon set free by decomposition of the hydrocarbons was filtered out of the gas in its passage through the coke—thus improving the appearance and quality of the latter. He should be glad if the author or other speakers could throw any light on this subject.

Mr. Baker further asked whether, after his longer experience, Mr. Harris had had any additional trouble with the discharge of Love's 45's.

Mr. F. J. Ward (Knowle) said he had quite lately gone into the question of large charges; and there was no doubt that with some coals they were a great advantage. They were not so with all. Taking Derbyshire coal, for instance, heavy charges were a considerable advantage. The coke was much harder and firmer, the tar was thinner, and the ascension-pipes were always clear. Taking the case of a heavy Yorkshire—a (so to speak) fat—coal, the results were not nearly so good. He could produce more gas per ton of coal with a medium charge of Yorkshire coal than he could with a large charge. With Derbyshire coal, he could produce more with the large charge. One speaker had said that it was possible in small works to produce 13,000 cubic feet of gas per ton of coal carbonized. He (Mr. Ward) could bear that out. For the last six months, he had produced 13,000 cubic feet per ton, and of such a quality that his consumers were perfectly satisfied, and so was he. The quality tested by a jet photometer—which some people said was unreliable [laughter]—was about 15 candles; and the calorific value was 530 B.Th.U. net. He could produce this regularly. Then another speaker mentioned the difficulty of hand-drawing retorts heavily charged. He (Mr. Ward) confessed that it appeared to be hard work; but, in reality, it was not so. When they took the hundredweights of coal carbonized, the expenditure of power incurred was not more than it was in the case of smaller charges. He himself stoked on a great many days, and so knew of what he was speaking. And he was prepared to say there was no more expenditure of power taking it per hundredweight of coal carbonized. In gas-works of his size, making only 10 millions per year, machinery was out of the question. It was his intention to still go on with large charges when he was using coal such as Derbyshire; but when using Yorkshire, he altered his system. With retorts 21 in. by 15 in. by 8 ft. 3 in., he put in 4¼ cwt. charges, and produced 13,000 cubic feet of gas per ton. He might also say that he had adopted an arrangement of anti-dips. He had broken the top pipe in the centre, and allowed the bottom portion to drop away during the time the gas was being evolved from the coal.

Mr. A. J. Harrison (Padiham) said, as some of the members were no doubt aware, they had lately opened new gas-works at Padiham; and inclined retorts had been installed. But according to some of the speakers, it would appear they had taken the wrong course in doing so. They were eighteen months considering what type of retorts they should put down. He could say that, after three weeks' working (which, of course, was not long), he was perfectly satisfied with the results he was getting from the inclines. It was a question whether it was possible to instal vertical retorts economically on a works making under 100 million cubic feet per annum. If it were possible, were the better results claimed for the verticals going to meet the extra capital charges over and above the inclined or the horizontal system? He took it for granted it was also impossible to put in horizontals and machinery in a works making under 100 million feet per annum. There was just one other point that had often struck him. They heard much about heavy makes, but they heard nothing at all about what gas was being sold. Was the proportion of gas sold through the consumers' meters in the same ratio as the increase in make? He found from published analyses that probably 90 per cent. of gas where it was cheapest in the holders was from low yields per ton. It was an open question whether the extra make above 11,500 cubic feet was really worth the candle. He should like some idea as to what was the minimum make that would allow of horizontals with charging machinery or verticals being installed in any particular works.

Mr. W. C. Jones (Brierley Hill) inquired whether anyone could inform him as to the cost of repairs and upkeep of vertical retorts, together with the cost of installation, for gas-works with a make of 100 millions per annum. One question Mr. Harrison had asked was if the sales of gas through the consumers' meters had any relation to the increased make. He (Mr. Jones) might say that for six years his make had averaged 12,500 cubic feet, with a calorific value of 550 B.Th.U.; and their sales per ton had increased at a greater ratio. Of course, everybody knew that the loss of gas in Brierley Hill was heavy, owing to subterranean workings; but it was now at a point to which they never hoped to get it a few years ago. It was under 10 per cent.

The President said the discussion had travelled widely over the field of carbonization; and he was sure the report of it would be read with great interest. It had been a discussion that would bear comparison with any that had taken place at a District Association meeting for some considerable time past.

Mr. Glover asked whether he might be allowed to speak first in reply to the discussion, as he desired to leave early in order to catch his train home.

Mr. Harris said, before Mr. Glover replied, there were one or two points to which he desired to refer. Mr. Glover had spoken of uneven heating; but if he read the paper carefully, he would see that he (Mr. Harris) said that now that the centre retort had been cleared out, he did get even heating. But they were not able to carbonize so much coal in the bottom retorts as in the upper tiers; whereas in probably nineteen out of twenty horizontal settings, if they took the charge out immediately it was burnt off, it would be found that they were able to carbonize more coal in the bottom retorts than in the middle tier. He saw no reason why, when he reset his retorts, he should not get equal heating throughout. He was sorry they had not learned more about the vertical retorts from Mr. Glover, who had spoken in such a strain that they could almost fancy they were in dreamland. [Laughter.] Certainly they had had nothing to the point. He (Mr. Harris) had raised several questions in his paper as to pressure, formation of carbon, and other matters, and had hoped they would have had a little information on these points.

Mr. S. Glover said he did not come to the meeting to read a paper on vertical retorts; but he could promise Mr. Harris and everybody else who was looking for further information that they should have it, and that presently. Mr. Bell had suggested that the German system of vertical retorts was at the bottom of the English system of continuous working in vertical retorts. He (Mr. Glover) should like to correct that, because the English system of continuously operating vertical retorts was being worked at long before the German system was anything like the success that it was at present—so far as it had attained a measure of success—in carbonizing gas coals.

Mr. Bell: Was that for gas making?

Mr. Glover: Yes. He did not think that either Messrs. Woodall and Duckham or anyone else would allow that they were inspired to develop the English system by what the German workers had done, because those who had studied both systems held that the German system did not suit the ideas, or the needs, of the English gas engineer, who had to produce a good illuminating quality of gas. Dr. Lessing contended that the horizontal retorts still held the field. He (Mr. Glover) was much puzzled to know which field it held. He also remarked that it was still possible, if horizontal retorts were properly handled and skilfully worked, to get a good duty from them. Horizontal retorts held the field in numbers; but he did not think the large percentage of them would do so for any long time. The continuous vertical system was the one that would hold the field in future, and that in an increasingly larger degree as each year went by. There appeared to be some slight misconception on

Dr. Lessing's part as to the discharge of coke from the Glover-West system. The discharging of the coke was continuous into the bottom hopper; and it was only the releasing of the hopper door to allow the coke to drop out that was done at intervals. Dr. Davidson honoured him by speaking of him as an idealist. He accepted it as an honour; for surely the gas-engineering profession needed its idealists. Dr. Davidson asked whether he could at the same time produce a porous soft coke and a hard dense coke. He thought Dr. Davidson had asked him to do something that he must disclaim to be able to do. But he did claim that they had, in their continuous system, manufactured a coke which was valuable for use for both domestic purposes and in some manufacturing operations; and it was much sought after. They had heard about the results that had been obtained from full horizontal retorts. Those who were getting them were inclined to forget the days through which they had come; they forgot that the horizontal retorts had not been making the gas they could have done had they been differently charged. There had been a great deal of decomposition of the gaseous and the liquid hydrocarbons that had not been recorded either on the station meters or the consumers' meters, or in the gallons of liquid hydrocarbons sold to the tar distiller. The value of any carbonizing process was not fully gauged until the liquid products were taken into account. The continuous vertical retort gave a higher candle-foot value per ton of coal carbonized than any other system; and that was the ultimate point at which they had to look. If they took the quantity of gas and the illuminating power, and multiplied it together, they got a total higher result by their continuous system than by any other. It was possible that the radiant heat part of a horizontal retort might be at just the right point when it came to the question of high illuminating power per ton of coal carbonized. But the proportion of radiant heat in an unevenly charged retort was likely to be excessive; and in a partially charged retort, the radiant heat might be too much. This would lead to irregular results. It was quite possible that vertical retorts could be adapted to works of 100 million cubic feet capacity—in fact, the possibility of doing this had actually come about at the present time. The cost of repairs for continuously worked vertical retorts would surely be less than in any other system, because the retort did not carry the charge, and it had not the burden of any charging or discharging machinery. It would also last longer than any other system of retorts, because of being continuously charged and so continuously heated at the proper temperatures, which was not the case where violent changes were produced by dumping coal into intermittently charged retorts.

Mr. Harris, in reply, said Mr. Glover had referred to the question of uneven heating and irregular charges. He ventured to say these were conditions that did not obtain in the majority of works to-day. It was an easy matter to keep horizontal retorts evenly heated throughout; and if they had stopped ascension-pipes, it was due to local circumstances, and not to the fault of the carbonizing system. With reference to Mr. Bell's remarks, he suggested that he (Mr. Harris) could overcome the difficulty of back-pressure by grading the coal. It was purely a question of the character of the coal. Mr. Ward, in his experiences with light and heavy charges in horizontals, had hit the nail on the head with regard to the trouble with back-pressure in the bottom of the vertical retorts, when he said that, in using Derbyshire coal, he had no difficulty in working heavy charges, but when using rich Yorkshire coal he did experience difficulty; and he found it was not to his advantage to continue heavy charges with the latter. The conditions of the intermittent vertical retort were such that, with a certain class of coal, they might always be subject at some period or other of the charge to back-pressure in the lower mouthpiece. During the earlier part of the charge, they had a central core through which the gas would travel; but when the core became fluxed, there was no other outlet than through the incandescent coke itself. He was of opinion that certain coals would never lend themselves to carbonization in intermittent vertical retorts. He thought Mr. Bell had explained this, when he said that he had done better in his horizontal retorts by leaving a little space over the top of the charge. With regard to his (Mr. Harris's) severe strictures of vertical retorts, they were honest; and the reason he put his view in plain language was to try to elucidate by discussion facts which were not in their possession to-day. Mr. Bell said that any of the systems were best under certain conditions. He agreed with him. But he was in exactly the same position as before he read his paper. It was all like a Chinese puzzle; and he did not know which was the right system and which the wrong. With regard to the increased yield of ammonia, he was glad to say that he had felt a benefit in this direction. There was no doubt there was a larger yield of ammonia with heavy charges as compared with light ones. Mr. Berridge had given them some figures which would set them all thinking; but he did not fancy it would be practicable to carry out his idea of charging the retorts all at once, except in very small works. He was extremely obliged to Mr. Copp for his remarks; and as to Mr. Baker's question regarding the discharge of the retorts, he did not, from his additional experience, think there would be any more trouble after longer use than now in running down the charges. Mr. Townsend had asked a question as to the results obtained from heavy charges; but he thought Mr. Townsend had at the same time answered himself.

Mr. Lucking said there was really nothing for him to reply to. He had given his little experience as to the use of surplus gas from coke-ovens, as he thought it would be of interest to the members. He happened to know of a company who were going in for a Provisional Order in connection with the supply of coke-oven gas; and it was made a condition that the company should take the whole of the surplus gas and pay 1s. 6d. per 1000 cubic feet for it. He did not know whether his experience would stop any other brother gas manager from doing anything of this kind. If it did, he should be satisfied his paper had been useful.

Mr. Bell said, with reference to the criticism of Mr. Glover, he was glad to know, on the authority of Dr. Lessing, that Messrs. Woodall and Duckham were among the first in connection with the pioneering work associated with the vertical retorts. He had been under the impression that their German friends were the first. But it was not a matter of great importance, because, if they were not the first, they had been the means of bringing verticals to great success, and, in doing so, had exercised much technical skill. Therefore they were indebted to them for bringing these retorts forward. One gentleman had asked the size of works in which they could introduce machinery. In considering this matter, they had to take into account the local conditions of the works before arriving at any conclusion. Dr. Davidson had referred to the yield of gas with heavy charges. He (Mr. Bell) had never claimed that if the cubic feet were multiplied by the candle power there would be a larger product; but if they multiplied the cubic feet by the calorific value, they did get a valuable result from the use of heavier coal charges. The heavier charges had enabled them to get a higher make of gas per ton of coal carbonized of 14 to 16 candle power gas tested by the "Metropolitan" No. 2 burner; and such a gas was the most suitable for general distribution. With inverted burners, he had found that gas of higher illuminating power was rather prejudicial than beneficial. He was glad indeed to see Mr. Ward present giving experiences from his own practical work. Those who did retort-house work themselves were the ones who could speak with greater authority than those who merely went into the retort-house from time to time and looked on.

The President moved a vote of thanks to Mr. Harris and Mr. Lucking for their instructive papers.

Mr. Berridge seconded the motion, and it was heartily passed.

Mr. Harris replied on behalf of the authors.

Calculating the Hydraulic Modulus in Portland Cement.

In the "Journal" for the 30th of August, it was mentioned that the British Standards Committee had recently published a revised specification for portland cement. It is laid down therein that the proportion of lime to silica and alumina shall not exceed 2·85 per cent., with a minimum of 2 per cent. The calculation of this ratio from the analysis is a somewhat elaborate process, occupying from five to ten minutes, according to the experience and the skill of the calculator. With the view of obviating this labour, and ascertaining at a glance whether or not the chemical composition of a portland cement comes within the limits of safety prescribed by the specification, Mr. D. B. Butler, Assoc. M.Inst.C.E., F.C.S., who is at the head of the well-known firm of Henry Faija and Co., has arranged, in conjunction with his former Chief Chemist (Mr. G. J. Fenwick), a diagram, by the use of which the determination can, it is claimed, be made in the short space of fifteen seconds. The diagram, of which Mr. Butler has sent us a copy, is ruled off with the percentages of lime and silica as ordinates and abscissæ respectively; the former being on a sliding-scale beneath the latter. All that is necessary to determine the hydraulic modulus in cement is to move the zero of the sliding-scale to correspond exactly with the percentage of silica, and, at the point where the vertical line above intersects the horizontal line corresponding to the percentage of lime, follow an oblique line on the diagram upwards to the right, and the required percentage will be found at the top. It will thus be seen that no chemical knowledge is required—that, in fact, the diagram, being based on the slide-rule method, can be used by an ordinary clerk. It is mounted on stiff cardboard (22 in. by 17 in.), and published by Messrs. John J. Griffin and Sons, Limited, of Kingsway, W.C., at the price of 2s. 6d. net.

Corrosion of Cast-Iron Pipes by Fresh Water.—In the course of a paper by Mr. T. Steel, read at a meeting of the Sydney Section of the Society of Chemical Industry, and given in the current issue of the Society's "Journal," he mentioned a case of cast-iron pipes becoming badly corroded by the action of fresh water. The pipes were those of an ordinary Green economizer—an arrangement of cast-iron pipes placed in a boiler flue for the purpose of heating water by means of the waste heat of the furnace gases. These pipes, within a moderate number of months of their installation, became greatly corroded—so much so that only a thin outer shell remained. The inner part of the metal had become transformed into a thick layer of plumbago-like material, easily separated from the unaltered iron. Originally the pipes were ½ inch in thickness. When removed, owing to their giving way the residual shell varied from $\frac{3}{16}$ inch to less than $\frac{1}{16}$ inch; while the layer of altered metal was about ⅜ inch. The water while being heated was under boiler pressure—about 60 lbs. per square inch and its temperature would vary from about 60° Fahr. on entering to 300° Fahr. on leaving. There was no noticeable difference in the degree of corrosion of the pipes due to this range of temperature

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Gas Exhibition, and an Address by Mr. Stanley H. Jones.

There was a large attendance of members and friends at the opening meeting of the London and Southern District Junior Gas Association for the present session, which took place on Saturday at the new meeting-place—the Westminster Technical Institute, Vincent Square, S.W. The programme was a comprehensive one; and those who arrived at three o'clock in the afternoon and remained until ten at night, found that they had none too much time to see all that there was to be seen and hear all that there was to be heard. The features of the meeting (which was held in the large lecture hall) were an extensive exhibition of gas appliances and scientific apparatus in connection with the industry, an address by Mr. Stanley H. Jones, and various practical demonstrations. These latter were: Gaslight and Coke Company's Apprentices at Benches, Mr. P. J. Smithers; Calorimetry, Mr. J. G. Clark; Laboratory Experiments, Mr. J. H. Singleton (Messrs. Fletcher, Russell, and Co.); Lacquering and Metal Colouring, Messrs. W. Canning and Co.; Microscopical Comparisons between the Flora of Coal Measures, Past and Present, Mr. H. Austin. Microscopes were lent by Mr. Clark and Mr. Austin; and the former gentleman also showed and explained other scientific apparatus. There were excellent specimens on view of the apprentices' work after twelve months' workshop training. The material needs of visitors were amply catered for; and the President (Mr. L. F. Tooth), the Council, as well as the Organizers of the meeting (Messrs. H. Rothwell and P. J. Smithers) are to be congratulated on the complete success of the programme in every particular.

The Westminster Technical Institute is becoming quite a large centre for the educational side of the gas industry. Messrs. Rothwell, Smithers, Bevis, and Coghill take an elementary practical class there three nights a week, and the pupils number 150; while Mr. J. G. Clark is giving two lectures a week in the higher grade, to a class which includes about 35 names. There is an excellently equipped laboratory in connection with Mr. Clark's course, where calorimeters, photometers, and other necessary apparatus, can be used under proper conditions. Mr. Clark makes a great point of what he alludes to as "utility" calorimeters—instruments which show the actual usefulness of different appliances to the gas consumer. The radiation calorimeters for testing gas-fires and grillers which Mr. Clark described in his paper before the Association last April were carefully inspected by the visitors, as well as a number of other appliances.

THE EXHIBITION.

There was really so much to see in the exhibition, that even after a careful inspection it was impossible to be sure that one had not missed something; and therefore should anything interesting that was on view not be mentioned here, the omission, it will be understood, is not from design, but by accident. It was obvious that an immense amount of labour must have been entailed in getting everything arranged; but if the trouble taken was great, the result achieved was great also.

In glancing at the exhibits, it is, perhaps, fitting that the lighting department should be dealt with first—if only for the reason that before reaching the building the eye was caught by a large Chipperfield intensified gas-lamp which was lighting up the entrance. Then on going up a few steps, it was seen that the staircase was lighted by Messrs. Thomas Glover and R. & A. Main with one of the Glover high-pressure inverted burners, with which the makers have secured an illuminating power of 65 candles per cubic foot testing with Tottenham 14-candle power gas. The burner was in operation without the aid of any lamp casing whatever. The firm also had on view samples of meters, "D. S. O." fires, and numerous models of cooking and heating appliances for restaurants, &c., together with a Woodall-Moon mantle shocker and Jones's naphthalene force pump. The James Keith and Blackman Company had fitted up an electrically driven compressor connected with 1500-candle lamps which lighted the hall; and Messrs. W. Sugg and Co. also showed in action high-pressure lamps and a hot-air engine compressor. Both firms, in addition, displayed numerous other of their specialities.

There were tasty little groups of Bland lights about the exhibition, among the many varieties of smaller lights that were in action. The Crown Lamp Company, too, were well represented with inverted burner lamps, &c.; and special attention was drawn to their "Briton" globe holder, which automatically fastens the globe, holding it securely in position without pinching it. There are three spring clips in the gallery; and by merely raising the globe into its proper position, these clutch it under the rim. To take out the globe, all that has to be done is to raise one of the clips. The firm's lamps are fitted with simple and easily adjusted air and gas regulating arrangements; and another feature is a dust-trap, with which all are provided. In the "Liliput" lamp, the light is entirely enclosed; and being wind-proof, it can safely be used in the most exposed places. It is very neat; and the gas consumption is given at $1\frac{1}{4}$ cubic feet per hour. Clark's sealable main-cock can be sealed either open or closed; and another speciality of the Crown Lamp Company is Colbran's anti-vibration ball joint. The space allotted to Mr. William Edgar contained inverted lamps, and a serviceable form of gas-flasher, besides the "Edgar" patent prepayment gas controlling apparatus. This is suitable for hotel bed and sitting rooms, &c., as, on the insertion of a coin or token, it gives a predetermined quantity of gas—either in a continuous supply or at intervals. Edgar's seal screw main-cock can be sealed in any position; and the plug cannot fall out. Messrs. Podmore and Co. made a good display of their well-known recuperative intensified lamps; and attractive specimens of gas-fittings were shown by Messrs. Falk, Stadelmann, and Co., Messrs. George Hands and Co., Messrs. Hodge and Co., Messrs. J. & W. B. Smith (who drew special attention to their "Silva" lamps), and Mr. L. F. Tooth (bracket with concealed pneumatic tubes). Messrs. Ingram and Kemp had a board mounted with various fittings made from the solid rod. Messrs. C. H. Kempton and Co. made a varied show with "N.I.C.O." burners, various gas-fittings and lighting devices, mantles in different stages of manufacture, inverted lamps, &c. Collections of burners were lent by Messrs. Bray and Co. and Mr. P. J. Smithers.

The Voelker Lighting Corporation had a very complete little exhibit in a case to illustrate the manufacture of mantles. There was everything there—ramie grass, cerium, and thorium, right up to the finished mantle. Mr. P. G. Somerville had a stand on which he showed the Gaslight and Coke Company's system of non-collodionized mantles. There were examples of the various stages from the ramie to the completed mantle; and members could see both the stockings and the burnt-off mantles.

Automatic lighting and extinguishing devices were strongly represented—by the Distance Lighting Company (with the "Bamag" apparatus), the Horstmann Gear Company, the Pneumatic Lighting Company, the Telephos Domestic and Street Lighting Company (with the Telephos system and A. E. Broadberry's apparatus for lighting and extinguishing street-lamps), and the Auto-Lighter. There was to be seen at the stand of the Pneumatic Lighting Company a metallic action dry governor in miniature. The Horstmann atmospheric bye-pass is a useful little article to which attention was drawn; and it was shown that the blue flame does not easily blow out. At the same time, it does not soot the mantle. A strong point in favour of this form of atmospheric bye-pass is that it can be readily cleaned by removing the atmospheric sleeve. Corrosion is guarded against, when desired, by the provision of a jewel gas orifice. This bye-pass is suited to any class of burner, for use inside or outside the mantle.

There was also a large gathering of gas heating apparatus. Clark's Syphon Stove Company had on a revolving stand some of the appliances with which their name is identified—including the new "Motex" heater. There were specimens of the Davis Gas-Stove Company's new barless fires, the steamless radiator, the luminous radiator, and the latest type of "screwless" cooker. Messrs. Fletcher, Russell, and Co., in addition to many laboratory appliances, &c., had in operation an automatic cut-off gas-heated steam-boiler for use with radiators. When there is 1 lb. pressure of steam on the radiator, the gas is automatically cut off—leaving only a pilot-light burning. The Imperial Stove Company displayed two new pattern gas-fires, with a section of a stove fitted with their patent burner and regulator. A gas-fire fitted with an advertising flashing device was exhibited by the Richmond Gas Stove and Meter Company, in addition to the "Avon" water-heater, the "Daisy" greenhouse heater, and a selection of their fires and other appliances. Messrs. Wilson and Mathiesons called attention to their circulator and other specialities, including the Reed radiator with its luminous flame, and a kettle in a casing which is stated to boil a gallon of water with 4 cubic feet of gas. It is a handy thing for restaurants and other places where boiling water is likely to be wanted quickly. Messrs. Ewart and Sons' geysers, Messrs. Davey and Roberts's coke-heated circulator, and Mr. T. Potterton's "Victor" automatic gas-heated hot-water supply apparatus completed this section of the exhibition.

There were meters in glass cases from Messrs. George Glover and Co.; and the discount meter of the Rotary Meter Company was also on view. Messrs. Tilley and Co. showed the Peebles prepayment gas-meter actuated from a distance. The idea of this is to enable the consumer to keep the meter cash-box in a safe place—not necessarily near the meter itself. When a penny is placed in the box, the action of a pneumatic tube opens the valve of the meter. Particulars of Messrs. Tilley's high-pressure gas lighting system may be put aside for a separate article in our next issue. Messrs. Harper, Phillips, and Co. showed a Brockway-Phillips gas ventilating-fan; Messrs. Alldays and Onions, their "Empire" high-pressure gas-burners and blow-pipes and their "Empire" blowers and exhausters.

Messrs. W. Canning and Co., at a fully equipped stand, gave practical demonstrations of lacquering, &c. This is a branch of work to which the firm devote much attention. Another process which could be inspected was electrolytic cleaning for taking all grease off metal. The Hotton Lighting Company had a big selection of malleable iron fittings, as well as some samples of the new alloy "Miralite," which can be cast, drawn, rolled, spun, turned, screwed, brazed, welded, &c. It takes a fine polish, and is said not to tarnish. It resists sea air and acid. An ingenious arrangement was exhibited by Mr. Tooth, in the shape of an ordinary alarm clock arranged for turning off (say) shop window lighting at a predetermined time. The unwinding of the alarm at the time for which it is set is made to shut off the gas-tap.

Models, photographs, &c., were shown by: Messrs. Babcock and Wilcox, the Bryan Donkin Company, Messrs. Clapham Bros., the Economical Gas Apparatus Construction Company, Mr. A. R. Griggs, Messrs. Head, Wrightson, and Co., Messrs. W. J. Jenkins and Co., Messrs. Parkinson and W. & B. Cowan, Mr. Tooth,

Messrs. C. & W. Walker, Messrs. George Waller and Co., Messrs. Willey and Co. Mr. Samuel B. Chandler, a member of the Association, whose washer-scrubber "bundles" have before been referred to in our pages, had on view a model of his invention. This "bundle" is composed of sheets of metal punctured by orifices of a "ragged" nature, forming liquor-holding devices, effectually cutting up the gas, lifting the liquor, and bringing the gas and liquor into intimate and close contact one with the other. The serrated edges of the metal form a very convenient means of lifting the liquor, and are of great utility in that they create a continual shower of drops through which the gas passes. The sole makers and licensees are Messrs. Head, Wrightson, and Co.

Other displays that may be noticed were those of Mr. T. Bugden (gas-bags), the British Mannesmann Tube Company, Messrs. J. J. Griffin and Sons (Boys calorimeter and Smith radiometer), the Lead Wool Company, Messrs. Pitkin and Co. (Pitkin-White pyrometer for measurement of high temperatures), and Messrs. Ready and Sons (small fittings and brass goods).

During the evening, there was a sitting, at which Mr. Stanley H. Jones, the Engineer and General Manager of the Commercial Gas Company, delivered an address.

The President (Mr. L. F. Tooth, of the Commercial Gas Company), on taking the chair, dealt briefly with the past, present, and future of the Association. He pointed out that from about 20 members nine or ten years ago, the number had gone up to 150; and for the progress made he said they were indebted to their Past-Presidents—Mr. W. Grafton, Mr. W. Upton, and Mr. W. J. Liberty. He wanted to make it quite clear that the exhibition that day had been arranged from an educational point of view. The whole of the work in connection with it had been done by Mr. Rothwell and Mr. Smithers. As they had seen, the apprentices which came under Mr. Smithers's charge had given a demonstration that afternoon, and had shown the advantages of being properly trained. He then called upon

Mr. Stanley H. Jones, who delivered the following address on

THE DEVELOPMENT OF GAS MANUFACTURE, DISTRIBUTION, AND USAGE.

Gentlemen—Let me first say how warmly I congratulate you on the excellent demonstration in this hall of what can be done with gas, and on the many interesting things to be seen.

When your President asked me to address the Association, I felt considerable hesitation about the matter. For one thing, speech-making is not much in my line; and it seemed to me that perhaps I could not very well tell you juniors anything you did not already know. However, after a good deal of thought, I felt I could not refuse, and so decided to give you, to the best of my ability, a description of what my experience has been, in comparatively recent years, of gas manufacture, distribution, and usage. It is difficult to put fresh ideas before you. These are enlightened days; and there is a feeling that one may be only repeating ancient history attempting to tell you anything new.

I will speak on the general aspect of the gas industry. It must, I think, strike anyone who contemplates the growth of our industry how interesting the question of coal distillation really is. I think the general public do not quite realize what an extremely interesting process it is. We produce the gas; and after taking the gas, we produce the residuals which bring us profit, and which are of benefit to the community. There is nothing practically in the manufacture of gas as I know it which can be said to be anything but useful to the public. We have the coke, which is an essential to many of the great industries—for example, in cement manufacture; and then there are the liquids, in the shape of tar and ammonia, which are applied to various uses that are absolutely necessary to the present conditions of life. It must, I think, be an intense satisfaction to us one and all to feel that we are associated with an industry which is so extremely interesting from an economic point of view, and at the same time so beneficial to the general public.

Turning to the question of the production of gas from coal, we find that the quantity made per ton to-day, owing to modern developments, has reached a startling figure. We have quantities of 12,000 and 13,000 cubic feet per ton, due to modern invention. Some ten years ago, a make of 10,000 feet per ton was considered good working, and one was not accustomed to hear of anything more than this. To-day, however—owing, firstly, to the standard of illuminating power having been lowered and to the institution of a reasonable and fair method of testing—we have been able to produce, as I have said, our 12,000 cubic feet per ton, and perhaps a little more. The introduction of improved methods of carbonization of coal in retorts by means of generator and regenerator furnaces, has rendered possible the heating of the retorts to a much higher temperature than formerly with a greatly reduced consumption of fuel; and the revolution in the methods of charging and discharging those retorts by various forms of mechanism, by means of which they can be completely filled with coal, has also increased the quantity of gas made per ton of coal.

Then it will be noticed that this larger production has a very remarkable effect on the gas-coal market. The price of coal is of great importance, of course, to gas undertakings; and I have just been going into some figures relating to this matter. Referring to the Company with which I am connected, it appears that we have, during the last twelve months, attained a stage at which we find we shall reduce our coal consumption no less than 5 per cent., owing to the installation of modern appliances and machinery. Now this 5 per cent., calculated on the coal consumed in connection with the gas supply of London and the suburbs, I conclude would mean a saving of something like 150,000 tons of coal annually; and I feel that this will have a lasting effect in keeping the price of coal at a more moderate figure. Then we know it was thought the passing of the Miners' Eight-Hours Act would mean an increase in the price of coal, and it did increase the price at the time, owing to disturbance of the labour market. But in the result, it has been found that no less than 10 per cent. more coal has been put out by the collieries than before. This fact, taken in conjunction with the 5 per cent. reduction in the quantity used which I have referred to in connection with my own Company, is bound to have a very marked bearing on the question of coal prices in the future; and, of course, this means that gas can be produced cheaply.

Now I pass on to another phase of manufacture—to the question of purification, which until about five years ago was a very troublesome matter in the Metropolis. Then the abolition of sulphur testing was brought about; and a great boon this step has proved. The late Sir George Livesey strove for years to remove from the Metropolitan Gas Companies the worry of the unnecessary test for sulphur. The imposition of this test involved the extravagant use of lime for the extraction from each 100 cubic feet of gas of a few grains of carbon bisulphide. Sir George demonstrated the interesting fact (which is most probably known to you all) that in the air of a room where no gas is being burnt, there is, for all practical purposes, as much sulphur as in a room where gas has been burning for some hours. This was proved to the satisfaction of Lord Rayleigh. The purification of gas used to be a very considerable item in the cost of manufacture. But in London we have been relieved of the restrictions to which I have referred; and for this our thanks are due to Sir George Livesey. There is another point, too, on the manufacturing side of the question, in connection with which the abolition of lime purification has had a very beneficial effect on the working: The use of lime caused considerable back-pressure, owing to its density; and I estimate that the relinquishing of this material for purification purposes reduced the back-pressure in the purifying plant of gas-works about 50 per cent. This is a most important point, as it renders the risks of gas purification very much less than formerly.

There is another feature in connection with manufacture which I should like briefly to touch upon, and that is the question of the bearing the daylight consumption of gas is having on the works side of the gas industry. The extraordinary increase in this direction has done away with the necessity for gas undertakings to rely, as they used to do, upon what I may term rather extensive gasholder storage. The constant output during the day largely absorbs the production of gas; and the increase in the consumption that takes place when darkness arrives, is a comparatively small matter. Some fifteen or twenty years ago, the daylight consumption was extremely small; and gas undertakings then had to find storage for practically sixteen hours' make out of the twenty-four. The extent to which the daylight consumption has grown will be gathered when I mention that in fifteen years my Company have increased their day output over 100 per cent.; and we have been able to do this without any extension in the way of storage accommodation.

Nowadays we have found it necessary to increase pressures very substantially. In fact, they are practically double what they were fifteen years ago; and a satisfactory feature about this is that it has been effected without any increase in the unaccounted-for gas.

Returning to the question of manufacture, I am going to mention carburetted water gas. My Company have largely employed this for the past ten or twelve years, with very beneficial results. A carburetted water-gas installation possesses an extraordinary attraction from the fact that on a very small ground space and at a low capital cost, you can produce a large quantity of gas in a very few hours, which cannot be done with coal retorts. The prejudice against carburetted water gas, I think, may well be discounted nowadays, because for years it has been working most satisfactorily. Among other advantages, in my Company's district we find that carburetted water gas has had a most useful effect in connection with the naphthalene question. Years ago, we were greatly troubled with naphthalene; but now we have carburetted water gas, naphthalene has become practically speaking a thing of the past.

Then as regards the developments of the uses of gas, one of the most remarkable things in this direction which my Company have experienced is the growth of the use of gas for engines. A few years ago, we estimated that we were selling no less than 10 per cent. of our gas for engine purposes; and we are still doing good business in this direction. In many places, the internal combustion engine is ousting steam. We found it profitable to give the users of gas through engines substantial discounts off the price of gas. We give up to 20 per cent. discount; and we find that it pays. We have also applied the same system with great success to the consumers of gas through other appliances for trade purposes. The various uses of gas in our district include: Annealing, assaying, coffee roasting, japanning, plate bending, soldering, tempering, tinning work, &c. This is a branch of business which is rapidly growing; the application of gaseous fuel to the refining of metals being the latest development of

magnitude within my experience. The field of trade use is one where gas can, in my opinion, successfully hold its own; and it is a business that will mean a lot to us in the future.

The extraordinary growth of business in the shape of the consumption of gas through coin-meters, while necessarily calling for capital outlay, has resulted in the opening up of a branch of business that is one of the most secure a gas undertaking can have. The electrician has no chance, in my opinion, against the coin-meter; and I think that throughout the country the business in this direction is most satisfactory. The consumption of gas in my Company's district through prepayment meters has increased most marvellously. At present, the coin-meter consumers outnumber the ordinary consumers by more than three to one; and they are still increasing. It was told by a house agent the other day that he could not let houses now in which there was not a penny-in-the-slot meter fitted.

The use of gas for cooking and heating stoves is a factor which perhaps should not be put second to any other. I find the dinner-hour consumption of gas—from 12 to 1 o'clock—to-day is 300 per cent. greater than it was fifteen years ago. As regards heating-stoves, I believe that the Gaslight and Coke Company are doing wonderfully well in their district. My Company do not possess a residential district which largely takes heating stoves, so that I cannot speak so well from my own experience in this matter. But undoubtedly the prejudice which has been felt about gas cooking and heating stoves has been largely removed. It has been lately stated that a Medical Association have decided to use gas for the lighting of their premises, instead of electricity; and if you have the doctors to back you, you ought to be all right.

A most notable feature about our industry is the manner in which we have had to undertake business which originally was considered quite outside our duties. We have, in effect, become nothing more or less than big ironmongers. We have to provide apparatus and give skilled advice; and I think the makers of the different gas appliances are beginning to regard us as their best friends. The consumer, I think, feels safer in the hands of the gas undertaking than he does in those of anybody else. He knows who to put the blame on if anything goes wrong. This feature of our business I, for one, think is only as it should be.

We who are associated with the gas industry have now to work on more scientific lines than originally. We have to make our standard of knowledge of a higher grade, and be prepared to come forward and speak and advise when called upon to do so.

I do not know that I have much more to say. The few figures I have given to-night I hope will be of interest. To some of you they may be new; to many they are probably familiar. Your President, I am happy to see in the chair; and I congratulate the Association on electing him. Mr. Tooth is very well known to me. He is a gentleman whose career I am intimately acquainted with, and have followed with a good deal of interest. I believe he is one of those whose names will go down into gas history. He will no doubt have some good things to tell you—particularly in connection with smelting by gas—when he addresses you, as he is going to do, at a subsequent meeting. I believe that you are to visit my works during the session; and I can assure you of a warm welcome.

VOTES OF THANKS.

Mr. T. F. CANNING (Ilford) proposed a very hearty vote of thanks to Mr. Jones for his address, which he remarked was a fitting sequel to the one given by his father, Mr. H. E. Jones, on "Labour," two years ago. He thought that they, as a Junior Association, must consider themselves fortunate in having so many distinguished names among their patrons. It was a great thing to them that gentlemen like Mr. Jones should be so generous in coming forward and giving them their experience.

Mr. J. G. CLARK (London) seconded the vote.

Mr. A. F. BROWNE, on being called upon by the President, made a very interesting speech in supporting the vote of thanks. He said he felt sure that the members, like himself, had been greatly encouraged by the progress that Mr. Jones had told them was taking place in the East-end of London. They must congratulate him as the Chief Executive Officer of the Company to whose great prosperity he had testified that evening. He agreed that there never was a time when things looked brighter for gas. Gas engineers would be wanted with an even larger all-round knowledge in the future than they had possessed in the past. Whether the number of gas engineers who would be required in the future would be larger than at present, he would not say; but he was absolutely convinced that, as far as the distribution department was concerned, though there were large numbers of men now engaged, in the future many more would be needed. It was the distribution department with which the future of the gas industry was bound up. There never was a time when he felt more certain of the successful future of gas, or when he felt more disposed to congratulate on their choice those young men who were fortunate enough to be turning their attention in this direction.

Mr. H. AUSTIN (London) also supported the resolution, and said he was pleased to hear Mr. Jones speak of the penny-in-the-slot meter. The growth of this system was an indication of the thriftiness of the people. They desired no bills at the end of the quarter, but to pay for their gas before they had it. Mr. Jones had spoken hopefully of the coal market. Well, he was very pleased to hear of this bright outlook, because he was a co-partner. The employees of the Company with which he was connected took up stock to a greater amount than their bonus. The bonus came to about £38,000; and they were taking over £40,000 worth of stock. Stock coming on the market was thus taken by the workers; and this made the stock keep at a wonderfully steady level.

The vote having been carried with applause,

Mr. JONES acknowledged it, and said Mr. Canning had referred to the address his father delivered to the Association some two years ago. He (Mr. Jones) had omitted to say that his father had sent a message. He had sent his kindest remembrances to the members, and wished continued prosperity to this very go-a-head Association.

Mr. D. J. WINSLOW (Lea Bridge) moved, and the HON. SECRETARY (Mr. S. A. Carpenter) seconded, a vote of thanks to the visitors—coupling with the proposition the names of Mr. A. F. Browne, Mr. J. W. Buckley, and Mr. J. M. Campbell.

Mr. BUCKLEY, in response, said that in his experience he had never seen assembled in so small a space so much food for gas men—not only from the manufacturing, but also from the distribution point of view. He agreed with the great importance of the distribution department.

Mr. CAMPBELL, one of the founders of the Association, also replied. One had only to look at the programme, he said, to see that the success of Mr. Tooth's year of office was assured.

The PRESIDENT said that, though Mr. F. W. Goodenough was not present, he would like to thank him for all he had done for the Association. He was a gentleman upon whom they could always rely for support.

On the proposition of Mr. F. AINSWORTH (Ilford), seconded by the HON. TREASURER (Mr. J. Hewett), the organizers of the exhibition were heartily thanked for the time and trouble they had given to make the meeting a success.

Mr. H. ROTHWELL, in reply, said that the President also had done a great deal towards keeping everything up to the mark.

The proceedings concluded with a vote of thanks to the exhibitors, which was proposed by Mr. P. J. SMITHERS, and acknowledged by Mr. WRIGHT, of Messrs. W. Sugg and Co.

Illuminating Engineering Society of America.

The Fourth Annual Convention of this Society, of which Mr. E. P. Hyde, of Cleveland, is the President, was to be held last Tuesday and Wednesday at Johns Hopkins University, Baltimore. The following papers were read: "Value of Illuminating Engineering to the Manufacturer," by Mr. V. R. Lansingh; "Practical Value of Illuminating Engineering to the Central Station," by Mr. J. F. Gilchrist; "Value of Illuminating Engineering to the Commercial Man," by Mr. W. J. Serrill; "Illuminating Engineering Sheets for the Calculation and Recording of Data," by Mr. J. S. Codman; "Central Station Illuminating Engineering Department Work and Methods applied by the Denver Gas and Electric Company," by Mr. C. F. Oehlmann; "The Relations between Pressure and Light Output with Various Gas Lamps and Burners," by Mr. Norman Macbeth; "Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light Sources," by Messrs. J. G. Felton and E. J. Brady; "Some Spectral Luminosity Curves Obtained by Flicker and Equality of Brightness Photometers," by Dr. Herbert E. Ives; "An Unrecognized Aspect of Street Illumination," by Mr. Preston S. Millar; and "Effect of Light on the Movement of Lower Organisms," by Professor S. O. Mast. Following the Convention, there will be a course of 36 lectures on the science and art of illuminating engineering, the subject and scope of which have been proposed by the Society and approved by the University.

Society of British Gas Industries.—We learn from the Secretary (Mr. Arthur L. Griffith) that the autumn meeting of the Society will be held at the Waldorf Hotel, Aldwych, on the 22nd inst., at five o'clock—Mr. H. J. Balfour Browne, K.C., the President, in the chair. A paper on "The Society of British Gas Industries: What it Has Done, and what it Can Do," will be read by Mr. Fred. J. West, the Chairman of the Council; and it will be followed by a discussion. In the evening, the members will dine together in the hotel.

"Gas-Works Directory and Statistics" for 1910-11.—We have received from the publishers, Messrs. Hazell, Watson, and Viney, the above-named directory, which has now reached its thirty-third year. The contents, which occupy 22 pages more than in the issue for 1909-10, have been revised to August last; and the Editor acknowledges the assistance given to him by the officials of the various undertakings, which has enabled him to present the latest figures available. As usual, the statistics are preceded by the lists of the Chairmen, Managers, Engineers, and Secretaries, as well as of the Technical Associations connected with the gas industry. The price of the book is 10s. 6d. net.

Manchester and District Junior Gas Association.—The second lecture of the series arranged to be held in the Manchester University, of which particulars have already been given in the "JOURNAL," will be delivered on Saturday afternoon by Mr. Dugald Clerk, F.R.S., M.Inst.C.E., Hon. Member of the Institution of Gas Engineers; his subject being "The Phenomena of Explosions in Gas and other Internal-Combustion Engines." The chair will be taken by Alderman R. Gibson, the Chairman of the Gas Committee of the Manchester Corporation. No one is more competent than Mr. Clerk to deal with the subject named; and therefore it is to be hoped a large audience will avail themselves of the opportunity of hearing him.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas-Heating Research Committee.

Sir,—The Gas-Heating Research Committee, thinking that there may be members of the industry who would be interested in a further discussion of the work which has been carried out in the Fuel Department of the University of Leeds during the past two years, propose to hold a conference on Wednesday, Nov. 9, at 2.30 p.m., in the University buildings.

Mr. E. W. Smith will give a summary of the work which has been carried out, and a short account of the questions involved.

The subject will be open to general discussion.

The Committee wish to convey through your columns an invitation to gentlemen representing gas undertakings and gas-stove manufacturers to be present on the occasion.

Arrangements will be facilitated if those who propose to attend will send an intimation to Professor Bone, at the University.

Arthur Smithells,
Chairman of the Committee.

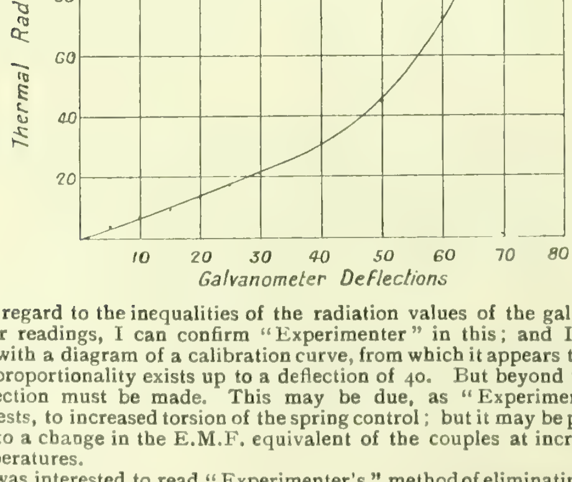
The University, Leeds, Oct. 28, 1910.

The Testing of Gas-Fires.

Sir,—I have read with interest "Experimeter's" letter in your last issue. Referring to the last paragraph but one, it appears that he is quite convinced that the absurd results given by the thermopile are due to the varying distances. As pointed out in my last letter [*ante*, p. 206], I cannot quite agree with this view. It appears to me that so long as the width of the fire does not exceed the diameter of the hemisphere, the varying distances are of no importance. My reason for thinking so is as follows.

A source of radiation is enclosed in an imaginary hemisphere which intercepts the whole of the radiation. The radiation is distributed over the surface, and if this surface is divided into a number of small sections, and the intensity of the radiation on each section measured, then the total radiation over the whole surface could be calculated. If expressed mathematically, it would appear as follows: If R be the intensity of the radiation upon a section dA of the hemisphere, then the total radiation on dA would be $R.\,dA$. If the whole surface be explored in this way, then $\int R.\,dA$ would be the total radiation on the hemisphere.

From the foregoing, it appears that the length of the path of the rays is of no importance, nor is it essential that the source of the radiation should be at the centre of the hemisphere; the only important condition being that the hemisphere should intercept the whole of the radiation. Of course, if the source of the radiation is eccentric with the hemisphere, the distribution would not be symmetrical; but the integral value $\int R.\,dA$ would be the same. The difficulty is to accurately measure the intensity of the radiation. I consider the thermopile fails to do this; and "Experimenter's" results bear me out. I think he is quite right in abandoning the conical hood, and in taking the centre of the pile as the centre of the instrument. But from his results it would appear that there are some other sources of error, perhaps at present unknown.



In regard to the inequalities of the radiation values of the galvanometer readings, I can confirm "Experimenter" in this; and I give herewith a diagram of a calibration curve, from which it appears that a fair proportionality exists up to a deflection of 40. But beyond this a correction must be made. This may be due, as "Experimenter" suggests, to increased torsion of the spring control; but it may be partly due to a change in the E.M.F. equivalent of the couples at increased temperatures.

I was interested to read "Experimenter's" method of eliminating the conduction error in the radiometer. It is, I consider, quite correct, and is similar to a method I have adopted myself.

I shall be interested to hear later on the results of "Experimenter's" endeavours to improve his apparatus. But I am of the opinion that a purely calorimetric method is desirable; and it is along these lines that my own apparatus has been devised.

Oct. 28, 1910. J. G. Clark.

Automatically Lighting and Extinguishing Public Lamps.

Sir,—Referring to the letter from Mr. Arthur H. Francks in your last issue, I would suggest that his disclaiming any "intention of booming any individual lighter" is somewhat disingenuous, having regard to his so strongly advocating the advantages of the "apparatus invented by Mr. A. E. Broadberry" [*vide* his letter in the "Journal" for the 11th of October], and his use of synonymous terms to those appearing in the advertisement of this apparatus, in order to express his admiration—viz., "working parts easily accessible and outside the gas supply." This gives point to a remark made by another of your correspondents in regard to statements which "emanate from interested parties, and constitute advertisements for a particular manufacturer or apparatus," as, though Mr. Francks is not apparently interested in the apparatus he so strongly recommends, there will no doubt be some suspicious individuals who will assume the contrary, and think he "doth protest too much."

I much regret that Mr. Francks "cannot share 'Contributor's' enthusiasm for the apparatus mentioned" by me, when arranged to light at a high pressure and extinguish at a low one. But I am relieved to see that when it is arranged to "extinguish at a high pressure, which is at the same time lower than that required for lighting," it "is certainly an improvement."

With regard to the former arrangement, I would remark that, inasmuch as, when the gas-bell rises in the "Eureka" apparatus (for lighting) it is automatically relieved of weights, it follows that less pressure is required to keep the bell up than to actuate it in the first instance, and that it will only fall (for extinguishing) when a certain low pressure has been reached; for example: Lighting pressure 50-10ths, extinguishing pressure 20-10ths. In these circumstances, it would not be necessary for the gas company to "maintain a comparatively high pressure right through the early hours of the morning." With regard to the arrangement of the "Eureka," which meets with the approval of Mr. Francks, the following example may be given: Lighting pressure 50-10ths, extinguishing pressure 40-10ths. In either case, the range may be varied by adjusting fixed and movable weights.

With reference to the apparatus Mr. Francks recommends, which only operates when a "sharp increase" is given, "irrespective of what the initial pressure may be at the time," is it not within the bounds of possibility that such "sharp increases" may be given several times a day or at night (particularly in manufacturing centres) owing to the shutting-down of gas-engines, &c., by large consumers, with the result that the apparatus will operate when not desired?

I regret having had to take up the cudgels; but, the apparatus I mentioned having been directly named and compared with apparatus (difficult to identify) said to have been "tried, condemned, and banished from this country twenty-five years ago," I feel I am compelled to do so.

Oct. 26, 1910. Eureka.

A Flourishing Lincolnshire Gas Company.

The report presented at the recent annual meeting of the Louth Gas Company showed a profit on the year's working of £3480, and a balance of £3829 on the profit and loss account. It was decided to pay dividends of 14¾ per cent. on the original capital, 11¾ per cent. on the new (1877) ordinary stock, and 5 per cent. each on the "A" and "B" stocks. Out of the £1792 left, £1098 is carried forward. A reduction of 2d. per 1000 cubic feet in the price of gas was also determined upon; making it 3s. 8d., less 15 per cent. discount, or about 3s. 1d. net. A further 10 per cent. is allowed for gas used for power and public lighting. The average make of gas per ton of coal increased from 10,478 to 10,647 cubic feet; while the unaccounted-for gas was only about 4 per cent. of the make. The gross cost of gas into the holders in the past year was 1d. per 1000 cubic feet less than in the preceding twelve months; and the net cost, after deducting the income from residuals, was less by more than 3d. per 1000 feet. The gross profit had materially increased, and, according to the Chairman (Mr. B. Hall, J.P.) probably constituted a record in the history of the Company. By special resolution, the shareholders acknowledged the valuable services of the Engineer and Manager (Mr. J. A. Young); it being the general opinion that the continued success of the Company was largely due to his painstaking interest in it.

Position of the Coalite Companies.—The following letter, sent by a correspondent from the Stock Exchange, appeared in the "Financial News" last Friday: "In view of the many adverse comments that have recently been made in the Press concerning the prospects of the British Coalite Company and Coalite Syndicate, and the accompanying very severe fall in the prices of the shares of these concerns, it would be interesting for shareholders to hear what the Directors have to say on the subject of the Companies' finances and the things they were on the point of achieving at the time of the last general meeting. The reticence that has been shown with regard to the latest debenture issue is rather disquieting; and it is as well that it should be known at once whether this important matter was arranged satisfactorily or not."

Good Results at Tipton.—A Birmingham paper states that at the last monthly meeting of the Tipton Urban District Council, the Gas Committee reported that the Mond Gas Company had re-arranged the connection at the works dealing with the supply of town gas, with the result that there was no chance of a repetition of the accident by which Mond gas found its way into the mains. The analysis of gas accounts just published showed that the Council's gas-works occupied a very high position, excelling those of their neighbours in working results and cost of manufacture—in fact, it stood among the first dozen in the country for efficiency and good working. A communication had been received from the General Purposes Committee stating that it was the intention of the Council to ask for a reduction of 25 per cent. in the charge for street lighting. The Committee gave the matter long consideration, and ultimately deferred it for a month.

REGISTER OF PATENTS.

Distilling Coal in Vertical Retorts.

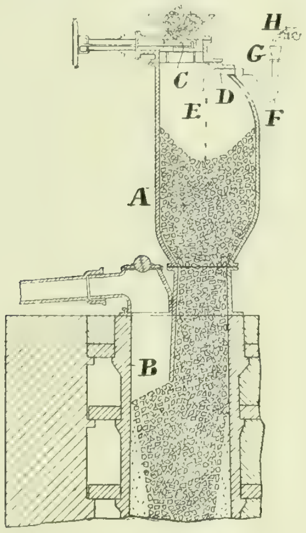
GLOVER, S., of St. Helens, and WEST, J., of Southport.

No. 20,309; Sept. 4, 1909.

This invention relates to the continuous distillation of coals in vertical retorts for the production of coal gas; and it has for its objects "to aid the descent of the charge through the retort, to improve the quality of the residual coke, and to prevent stoppages by tar and other thick deposits in the gas off-take pipes."

When the coal is distilled in vertical retorts, the patentees point out, the heat imparted to the coal through the walls of the retort first carbonizes the outer portion of the charge which is in immediate contact with the sides of the retort; and the heat has to penetrate the charge in order to carbonize the centre or core of the charge. It is obvious that the centre or core of the charge does not become completely carbonized until it has travelled some distance through the retort. According to this invention, the coal, immediately before it enters the retort, is treated in such a manner that the tarry mass in the core will be more fluid, and the heat, in consequence, will have a quicker and more even effect on the charge during its descent through the retort.

In carrying out the invention, a small percentage of water (varying in quantity to suit the physical condition of the coal) is added to the coal at a point immediately prior to its entry into the retort. The tar formed from this moistened coal is much thinner than with dry coal, and therefore spreads itself throughout the upper portion of the charge, whereby it is more readily split up into permanent gases of high illuminating power. The tar driven off with the gas from the retort is thinner, and its fluidity enables it to pass through the take-off pipes without the risk of blocking-up as with thick and heavy tars. "The thorough and complete dissemination of the thin tar among the coal improves the texture of the coke, and so improves its quality."



Glover and West's Treatment of Coal in Vertical Retorts.

The illustration is a section of the upper end of a vertical retort, the retort mouthpiece, and the hopper through which the coal passes on its way to the retort—the coal being supplied to this hopper from a main store or bunker.

The coal is fed downwards through a hopper A into the retort B; and the hopper is itself fed through a coal-valve C situated to one side of the centre line of the hopper. The drip-pipe D passes through the side of the hopper and ends in a downturned portion E, which is near the centre line of the hopper. The outer part of the pipe D is bent to form a seal F, which prevents the exit of gas. It has a funnel-shaped open end G. A number of such pipes in a bench of retorts are fed from a common feed-pipe H.

By this construction, the core of the charge can be wetted as desired, while the hopper can be fed continuously without interfering with this wetting.

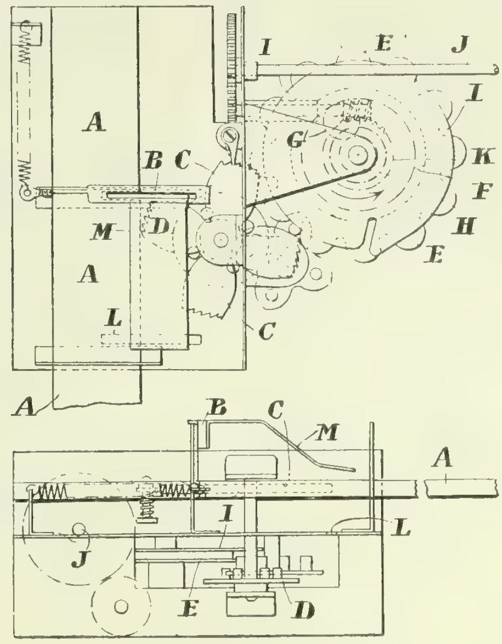
The inventors say they are aware that in the manufacture of water gas in continuous vertical retorts the water to be decomposed has been introduced into the top of the retort. Their invention is not concerned with this, but "in supplying water in small quantities to facilitate the descent of the charge in the retort in the manufacture of coal gas, and to effect other improvements in such manufacture."

Prepayment or Coin-Freed Gas-Meters.

FRANCKLIN, H. J., of Forest Gate, Essex.

No. 24,447; Oct. 25, 1909.

This invention has reference more particularly to the type of mechanism wherein a coin is introduced through a slot in a slide-bar and caused to actuate a disc or toothed wheel, with sun-and-planet motion, and a cam-plate which serves to actuate the opening and closing of the supply valve or switch. The patentee makes use of the known arrangement in which the planet wheel is mounted on a stud extending from a cam-plate, and rotates in both directions round a sun wheel and spindle, upon which is mounted the coin-operated disc or toothed wheel, and of another known arrangement in which the planet wheel meshes with an internally toothed ring fixed concentrically to, or integral with, the coin-rotated disc or toothed wheel. The coin is introduced into a slot in a hand-actuated slide-bar as described, and is caused to engage one of a series of radiating arms or levers extending from a boss by moving the slide-bar longitudinally, and to actuate through pin-and-wave wheels the sun-and-planet gear, for use in connection with the arrangement of parts to be described.



Francklin's Coin-Freed Gas-Meter.

A is a sliding-bar provided in a portion of its length with a slot which, when the slide is in its normal or inoperative position, coincides with a coin-shoot B, which serves for the introduction of (say) a penny into the mechanism for enabling it to be actuated when the slide-bar is moved. The coin falls into, or engages with, the slot, and when the sliding-bar is withdrawn or moved longitudinally, it causes the coin to rotate one of a series of radiating arms or levers a definite amount for operating gearing.

The radiating arms C, extending from a boss, are mounted on a pin on a pin-wheel D, which engages with a disc, provided with projections for engaging with the pin-wheel. The disc is also provided with pins which engage with a member E, having an edge provided with teeth for engaging with the pins and mounted on suitable brackets on the framing of the mechanism.

The member E is provided with internally toothed gearing F, which engages with a planet wheel G, geared with a sun wheel H. When the member E is rotated through the radiating arms C, being operated by the coin, the internally toothed gearing F rotates the planet wheel G, and this, owing to its gearing with the sun wheel (which is held against rotation), causes the cam-plate I to be rotated in the direction indicated by the arrow and operate the valve, so as to enable a supply of gas to be obtained.

In this way, the valve is operated from the open to the closed position, or *vice versâ*, and when either of these positions is obtained, the valve is no further affected by the cam-plate I, except that the means for engaging with the notched projecting portion also serves to stop the cam-plate travelling beyond the normal zero position.

When a coin has been introduced into the shoot B, and the mechanism actuated as described, a definite supply of gas is obtained—governed by the movement of the cam-plate I, by means of the radiating arms and interposed gearing. While the supply thus obtained is being used, the operating mechanism of the meter controlling the supply, which is connected up with the rod J, is rotated; and this rotation through gearing is transmitted to the worm wheel K, fixed to a spindle, through which the sun wheel is rotated, and causes the return of the planet wheel G and the cam-plate I to the zero position.

The coin is released from the slot in the sliding-bar A, after it has been moved by the slide over the slot L, provided in the upper surface of the coin receptacle (not shown). To ensure the coin passing into the slot, a spring M is provided for pressing it through when it arrives in this position.

Connecting Branch Service Pipes with Mains.

JOHN RUSCOE AND CO., LIMITED, and KENYON, G. H., of Hyde.

No. 29,199; Dec. 14, 1909.

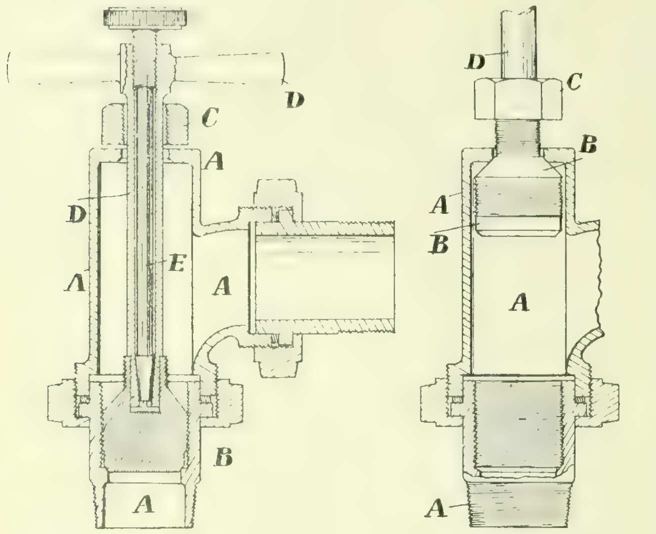
This invention, relating to means for connecting branch service pipes with (say) gas and water mains, forms an improvement upon patent No. 676 of 1905.

According to this prior invention, a screw valve, closing the main below the branch outlet, is capable of being unscrewed by means of a key, when it is carried by pressure of the fluid, combined with the operation of the key, to a seating above the branch outlet, where it is screwed into position after having thus, by its transfer, opened communication between the main and branch pipes.

In carrying out the present invention, the screw thread of the upper seating is dispensed with and a prolongation of the valve is provided, which projects through the top of the casing when the valve is in the upper position. The projecting extension of the valve is so formed as to be tightened up against its seating without interfering with the key connection. The prolongation and its accessory thus provide for the support of the valve in the upper position; and the valve may be

secured while temporarily held in place by means of the key, which, in some cases, may not need to be removed from the apparatus.

A is the pipe connection between the main and branch, formed with a screw thread to secure the valve B in the lower position. The special prolongation or extension of the valve, which projects through the casing, is screwed to take the nut C. The key D, suitably formed for engagement with the valve B, is split at its extremity, so as to be capable of being expanded by a plug E, which is passed into the interior of the key.



Ruscoe and Kenyon's Main and Service Connector.

In operation, the nut C is passed on to the barrel of the key, which latter is then inserted into the casing, and caused to engage the valve at the lower seating. By means of the screw on the plug E, the plug is advanced within the key to expand the extremity, whereby the valve and key are connected. The valve is then unscrewed and raised; being so held while the nut C is screwed down over the prolongation. The key may then be contracted and withdrawn, and a cap F be screwed into the top of the nut to protect the top of the valve.

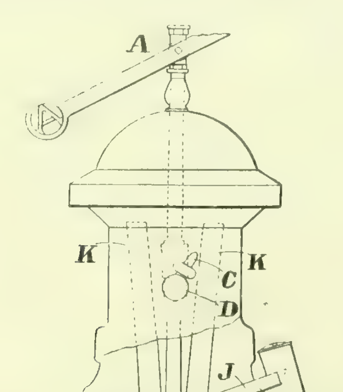
Lighting Gas-Lamps.

Burch, A. R., of Bombay.

No. 851; Jan. 12, 1910.

This invention, relating to means for lighting gas-lamps or lanterns, has particular reference to apparatus in which an ignition tube passes from the inside to the outside of the lantern and is disposed so that, when the gas is turned on, an explosive mixture is formed in the tube whereby the gas may be ignited without opening the lantern.

The invention is especially applicable to lamps of the enclosed inverted incandescent mantle pattern. It consists of a small chamber on the outside of the lamp and a conduit making communication with the burner just above the mantle, so that when the gas is turned on and a mixture of air and gas issues from the burner, a portion of this mixture passes through the conduit into the chamber. On the application of a light in the chamber, the flame travels back to the burner, and ignites the main flame in the lantern. No bye-pass flame is necessary. The chamber has an opening in the top, protected by wire gauze, in order that sufficient air shall be present to make a slightly explosive mixture, and that the light inserted shall not be smothered.



Burch's Gas-Lamp Lighter.

As shown, gas enters by the cock A, which is operated by a lever. D is the gas-regulating nipple, and C the regulator of the air supply. The products of combustion escape by a chimney K into the upper part of the lantern. The chamber L (fixed outside the lantern) has its lower opening in the reflector, which is pierced for the purpose, or can be fixed outside the edge of the reflector. It communicates with the burner chamber M by means of the passage J, which is set at an angle of 30° with the horizontal—one end being a collector—in the form of an inverted trough, and the other being a bevelled end, projecting into chamber L. When the gas is turned on, and a light is applied up the chamber L, so that it reaches the bevelled mouth of the conduit J, the flame travels to the burner and the lamp is lighted without opening the lantern.

Purifying Coal Gas after the Extraction of Ammonia.

Fabry, R., of Sheffield.

No. 7766; March 31, 1910.

In order to recover ammonia direct from coal gas in the form of ammonium sulphate, it is necessary (the patentee points out) that the gas be brought in intimate contact with an acid lye of ammonium sulphate, of suitable temperature and acidity, after the gas has been deprived of most or all of its tarry components. This has hitherto been carried out in two different ways, which mainly differ by the temperature at which the gas comes in contact with the acid lye of ammonium sulphate and by the amount of water vapour in the gas which condenses during the treatment of the latter.

The first existing method aims at producing ammonium sulphate with very little or no condensation whatever of the water vapour contained in the hot crude coal gas. It consists in cooling the hot crude coal gas not more than is strictly necessary to effectively remove from it the tarry matters which it carries in suspension before passing the gas, at a temperature still above that of its water dew-point, through a saturator wherein it is brought into intimate contact with an acid lye of ammonium sulphate. Practically the whole of the fixed ammonia is then contained in the coal gas entering the saturator; and this fixed ammonia, being converted into ammonium sulphate by the free sulphuric acid present in the acid lye of ammonium sulphate, the weaker acids—such as sulphurous acid and hydrochloric acid—which were originally combined in the fixed ammonia, are liberated and escape from the saturator together with the coal gas, the nature of which becomes thereby acid and highly corrosive. In this method the temperature of the acid lye in the saturator is generally maintained by applying heat to it by steam-coils, steam-jackets, and the like.

The second existing method consists in cooling the coal gas more or less below the temperature of its water dew-point, in order that a suitable portion of the water vapour contained in the gas may condense and retain all the fixed ammonia. The gas is thereupon freed from its tarry components by means of a tar-separator of suitable description, and subsequently passed through a saturator containing an acid lye of ammonium sulphate which is maintained at the most suitable temperature either by heating the lye by means of steam-coils, steam-jackets, and the like, or by superheating the coal gas above the temperature of its water dew-point previous to its passing through the saturator.

The last method aims at retaining practically the whole of the fixed ammonia before the saturation of the coal gas takes place; but owing to the highly volatile nature of the ammonium chloride which constitutes the bulk of the fixed ammonia present in the crude coal gas, the result obtained is still imperfect, and the gas escaping from the saturator still contains an appreciable amount of hydrochloric acid—especially so when the gas is not cooled down to the atmospheric temperature before being forced through the saturator.

The object of the present invention is to purify the coal gas after the extraction of its ammonia in such a way that "the treated gas is perfectly free from injurious acids—such as sulphurous acid and hydrochloric acid—even when such gas is forced through the saturator at a temperature approaching that of its water dew-point."

For this purpose, the hot crude coal gas (coming from coke-ovens or gas-retorts) is treated as follows: The hot crude coal gas is first cooled down to or below the temperature of its water dew-point by means of suitable air-cooled or water-cooled condensers. Owing to this cooling, a certain amount of the water vapour originally contained in the coal gas condenses, together with a portion of the fixed ammonia. In order to reduce the condensate to a strict minimum, without impairing the efficiency of the process which constitutes the present invention, the cooling is so regulated that about two-thirds of the total ammonium chloride present in the crude coal gas is condensed by such cooling. The tar is then separated from the gas, after which the coal gas (free from tar but containing practically all its free ammonia and about one-third of its original fixed ammonia) is forced in the usual way through a saturator containing an acid lye of ammonium sulphate, and preferably covered with some non-conducting material in order to prevent as much as possible the loss of heat by radiation or convection.

In this saturator, the free sulphuric acid present in the acid lye of ammonium sulphate combines with the free and with the fixed ammonia present in the coal gas, and forms fresh quantities of ammonium sulphate in crystals, which finally settle at the bottom of the saturator and are extracted by means of a steam-ejector or of a compressed-air ejector.

The acid lye of ammonium sulphate in the saturator is, as usual, maintained at the most suitable acidity by a continuous or intermittent flow of sulphuric acid containing as a rule about 20 per cent. of water for the purpose of avoiding the extra cost of more concentrated acid.

The gas issuing from the saturator—and which is now deprived of free and fixed ammonia but containing injurious acids (such as sulphurous acid and hydrochloric acid) arising from the decomposition of fixed ammonia through the free sulphuric acid present in the acid lye of ammonium sulphate in the saturator—is then forced through a washer, in which it is brought in intimate contact with the spent ammoniacal liquor issuing from a distilling column hereafter referred to, for the purpose of neutralizing the sulphurous and hydrochloric acid by means of the surplus free lime contained in such spent ammoniacal liquor.

In this distilling column, the condensate or ammoniacal liquor arising from the partial cooling of the hot crude gas and containing a portion of the fixed ammonia originally contained in the gas is treated with steam and milk of lime so as to convert the fixed ammonia into free ammonia, which escapes from the distilling column in the form of ammoniacal vapours, together with the bulk of the steam used for

distilling the condensate. The ammoniacal vapours are mixed with the hot crude gas so as to reach ultimately the saturator and be transformed therein into crystals of ammonium sulphate.

It is a well-known fact, the patentee points out, that ammoniacal liquor cannot be treated efficiently with milk of lime unless the quantity of lime used for such treatment is about double that which is theoretically required to decompose the fixed ammonia. He takes advantage of this necessary surplus of free lime which has to be present in the spent ammoniacal liquor to neutralize thereby the sulphurous acid and the hydrochloric acid present in the coal gas issuing from the saturator without incurring any additional expense for obtaining such neutralization, or increasing the minimum quantity of noxious effluent produced by the process.

If preferred, the process may also be modified in that, the gas being less cooled-down, the condensate arising from the cooling is reduced or even entirely done away with, in which case the washer receiving the coal gas issuing from the saturator will be fed with fresh milk of lime in sufficient quantity to completely neutralize the sulphurous acid, the hydrochloric acid, and the other injurious acids present in the coal gas issuing from the saturator. "Altogether no appreciable advantage is, however, obtainable by such modification, as it is exceedingly difficult to avoid any condensation whatever of the water vapour contained in the hot crude coal gas without impairing thereby the efficient separation of the tarry components of the crude coal gas."

APPLICATIONS FOR LETTERS PATENT.

23,965.—Gunning, J., "Gas-flasher." Oct. 17.
23,975.—Riddell, W., "Conveying coal." Oct. 17.
24,018.—Westphal, C., "Retort-furnaces." Oct. 17.
24,035.—Wilton, G., "Treatment of gas." Oct 17.
24,061.—Kunick, G. H., and Painter, W. W. E., "Incandescent burners." Oct. 18.
24,086.—Mackenzie, J., "Quenching, screening, and loading coke." Oct. 18.
24,091.—Forth, C., "Pipe-couplings." Oct. 18.
24,118.—Miller, L. S., "Pumps and exhausters." Oct. 18.
24,131.—Reimers, G., "Condensers." Oct. 18.
24,138.—Drehschmidt, H., "Production of ammonium sulphate with impure acids." Oct. 18.
24,152.—Podmore, A. E., "Inverted burners." Oct. 18.
24,159.—Siemens Bros. and Co., Ltd., "Meters for water and other liquids." A communication from Siemens and Halske Akt.-Ges. Oct. 18.
24,160.—Schroeder, F. W., "Jointed pipes." Oct. 18.
24,170.—Marshall, B., "Gas steam radiator." Oct 18.
24,192.—Jack, W., "Liquid meter." Oct. 19.
24,268.—Benson, R. S., and Head, Wrightson, and Co., Ltd., "Coke and coal washing machines." Oct. 19.
24,269.—Benson, R. S., and Head, Wrightson and Co., Ltd., "Washing coal and other granular material." Oct. 19.
24,283.—Ernst, E. U. G., "Gas-producers." Oct. 19.
24,339.—Hersey, M. H., "Incandescent burners." Oct. 20.
24,348.—Upton, T. A., "Preventing the blockage of gas supply in holes in gas-burners." Oct. 20.
24,385.—Palmer, W. V., "Prepayment meters." Oct. 20.
24,393.—British High Power Gas-Engine Company, Ltd., and Neustadter, D. D., "Controlling the flow of a plurality of fluids to a common point." Oct. 20.
24,406.—Masters, R., "Charging and discharging gas-retorts." Oct. 21.
24,424.—Keith, J. & G., "Controlling the ignition and extinction of gas-lamps." Oct. 21.
24,466.—Sugg, W., and Co., Ltd., and Mattock, W. G. H., "Automatic gas-lighters." Oct. 21.
24,491.—Veeckmans, P., "Regenerative furnaces." Oct. 21.
24,493.—Anderson, D., "Gas-lamps." Oct. 21.
24,503.—Currey, L. E., "Carburetting air." Oct 21.
24,509.—Pearce, R. F., "Collection of matter suspended in gas." Oct. 21.

Application for Restoration of Lapsed Patent.

A. J. Lyon and G. F. Whitmore have made application for the restoration of the patent granted to them for "Improvements in apparatus used for lighting," No. 4383, bearing date March 2, 1905.

Bursting of a Water-Main in the Edgware Road.—As the result of the bursting of a water-main last Friday afternoon, the Maida Vale portion of the Edgware Road was flooded for a distance of more than a quarter-of-a-mile. For nearly an hour the water continued to flow, covering in many places the whole width of the road. Considerable damage was done by the water in the basements of several shops, as well as to the road, which in several places was torn up, and much inconvenience was caused.

Stockport Corporation and their Coal Supply.—When the minutes of the Gas Committee of the Stockport Corporation were brought before the Town Council for confirmation at their meeting last Wednesday, Alderman White said he noticed that the Committee had been buying more "spot" lots of coal. It seemed to him that if this went on they would be having cheap gas. He should, however, like to call attention of the Council to the fact that the Town Clerk had told them that by the Improvement Act of 1837 they could not go on "spotting." It was contrary to law. The Town Clerk said he did not remember having made this statement. Alderman White said he understood that they could not buy above a given quantity of coal without contract. Mr. Fearnley, the Chairman of the Gas Committee, in reply, pointed out that this matter was dealt with at the last meeting, and the Council did not object to the Gas Committee doing the best they could in the interests of the ratepayers; and this was what it amounted to. The matter then dropped. The minutes of the Committee included the following purchase: "Twenty waggons of Pilsey silkstone gas nuts, at 9s. 3d. per ton."

LEGAL INTELLIGENCE.

ACTION IN REGARD TO THE SELAS SYSTEM.

In the King's Bench Division a few days ago, Mr. Justice Lawrance and a Special Jury had before them the case of *Selas Gesellschaft v. Wolf and Another*, in which the plaintiff (a German) Company sought to recover a balance due upon an account under an agreement by which the defendants were employed to manage for the plaintiffs the sale of certain patent gas-making apparatus in England. Defendants admitted the plaintiffs' claim at £3553, but they set up a counterclaim to recover substantial damages for breach of an alleged agreement to employ them as Managing-Directors of a new Company, and to give them a certain share of profits. Plaintiffs disputed that any such agreement was made, and said there were only negotiations which were never completed. This left the onus upon the defendants of proving the contract they set up.

Mr. J. R. Atkin, K.C., and Mr. R. B. Murphy appeared for the plaintiffs; Mr. Gore Browne, K.C., and Mr. Raymond Asquith represented the defendants, Mr. Otto Wolf and Mr. Norman Banbury, gas engineers, carrying on business as Messrs. Bever and Wolf in Bradford.

Mr. Gore Browne, in opening defendants' case, said the plaintiffs were a German firm formed for the purpose of working a clever and valuable invention for the distribution of compressed gas and air together, which produced a better light and effected economy at the burner. The price of the apparatus in England was about £150. Defendants acted as agents for the plaintiffs from 1903. Plaintiffs were desirous of selling the English patent; and when the new Patents Act was passed, compelling foreigners to work English patents in England, it became an urgent question. Defendants said that the plaintiffs offered, on a sale of the patent being effected to a company in England for £50,000, to give them £8000, or 8000 £1 shares in the company, as well as a salary of £750 a year for managing the business, and 10 per cent. commission on the profits. They accepted the offer without reservation; and it was this contract they sought to enforce. They complained that when a company was being formed in England plaintiffs sought to impose on defendants unreasonable obligations which they could not possibly accept and which were not included in the original agreement.

Evidence having been given by Mr. Wolf and Mr. Banbury, it was arranged that the Jury should be discharged, and the case tried by his Lordship alone.

On the resumption of the hearing, Mr. Atkin submitted that the defendants had not made out any case as to the alleged agreement. Further, he urged that if there was any agreement it had been determined, and that there had been nothing further than negotiations for its renewal.

Mr. Gore Browne maintained that there had been an express offer made by the German Company, and the defendants had accepted it. They had adhered to the agreement, and it was the plaintiffs' Solicitor who in drawing up the formal agreement had departed from it. Further, he maintained that in any case Messrs. Bever and Wolf were entitled to 8000 shares in the new English company, whenever it might be formed, in recognition of their work in introducing the apparatus into England and pushing the sales.

His Lordship reserved judgment. This he delivered yesterday; holding that the defendants had failed on the counterclaim to make out any completed agreement. He accordingly entered judgment for the plaintiffs on the claim for £3330, with interest and costs, and for the plaintiffs on the counterclaim with costs. He, however, stayed execution on the usual terms, in view of appeal.

A GAS-FITTER'S CLAIM FOR LEAD POISONING.

WANDSWORTH COUNTY COURT.—Monday, Oct. 24.

(*Before his Honour Judge* Harington.)

Lewis v. Wandsworth and Putney Gas Company.

This was a case in which Charles Lewis claimed £1 a week compensation for total incapacity owing to his being disabled by lead poisoning while in the employ of the Wandsworth and Putney Gas Company.

Mr. W. Addington Willis (instructed by Messrs. Benham and Meyer) appeared for the applicant; Mr. Harold Morris (instructed by Messrs. Sloper, Potter, and Gosden) represented respondents.

Mr. Willis, in opening the case, said that the applicant was a man 56 years of age, who entered the employ of the Wandsworth and Putney Gas Company as a fitter in the year 1875; and he had continued to work for them in this capacity since that time, down to December last. This employment of his involved the continuous use of lead in varying forms—red lead, white lead, and molten lead; and after 34 years' service with the Company, he found himself disabled by lead poisoning, and had to come to establish his right to compensation in the Court, where he regretted to say he was met with every possible objection that could be raised under the Act.

Mr. Morris, after some discussion as to amendment of the answer put in by the respondents, said: My friend need not bother himself about "serious and wilful misconduct," or with the question as to whether the applicant is totally incapacitated from work. My point is that the disease is not "due to the nature of the employment."

Mr. Willis (continuing) remarked that the certifying surgeon had given a certificate that the man was incapacitated by lead poisoning; and the respondents had not appealed from this. In fact, it would not be denied that he was so suffering. Perhaps the section of the Workmen's Compensation Act, 1906, was rather complicated; and he might refer to certain points. Section 8 provided that where the certifying surgeon appointed under the Factory and Workshop Act, 1901, for the district in which a workman was employed, certified that the workman

was suffering from a disease mentioned in the third schedule to the Act, and was thereby disabled from earning full wages at the work at which he was employed, and the disease was due to the nature of any employment in which the workman was employed at any time within the twelve months previous to the date of the disablement, whether under one or more employers, he should be entitled to compensation under the Act, as if the disease were a personal injury by accident arising out of, and in the course of, that employment. It was also provided that the disablement should be treated as the happening of the accident. Sub-section 2 read: "If the workman at, or immediately before, the date of the disablement or suspension was employed in any process mentioned in the second column of the third schedule to this Act, and the disease contracted is the disease in the first column of that schedule set opposite the description of the process, the disease, except where the certifying surgeon certifies that in his opinion the disease was not due to the nature of the employment, shall be deemed to have been due to the nature of that employment, unless the employer proves the contrary." In sub-section 4 it was stated that the date of disablement should be such date as the certifying surgeon certified as the date on which the disablement commenced; or, if he was unable to certify such a date, the date on which the certificate was given. Under sub-section 6, power was given to the Secretary of State to make orders for extending the provisions of the section to other diseases and other processes. In the third schedule, the second disease mentioned was "Lead poisoning or its *sequelæ;*" and the description of the process given in the second column was: "Any process involving the use of lead or its preparations or compounds." The Secretary of State had slightly extended, as he had power to do, this schedule, by an order which he issued on May 22, 1907, so as to include the "handling" of lead. Therefore, he submitted that what he had to prove was that the man was engaged in employment which involved the "use or handling of lead or its preparations or compounds." When he had done this, and proved that the certifying surgeon had certified the applicant to be disabled by lead poisoning, he would have done all he was called upon to do. It would then be for his learned friend to show that the disease did not arise out of the nature of the employment. This was really the only issue. The facts were that the man's employment right through all the years he had named was in connection with making joints of different sizes; and to do this work, and other things, he had to use red and white lead every day, as well as molten lead. Working with white or red lead was dangerous; but, above all, there was great danger in the fumes from molten lead. In districts where there were lead works, one knew how devastating were the effects on animal and vegetable life. Lead poisoning was a very insidious disease. It might come upon a man immediately, or by a gradual accumulation in the system; but there arrived a climax, and the climax in this case came in September of last year. In the year 1908, the applicant had a nervous breakdown; but it was not necessary to say that this was due to lead. In the following year, however, he did a considerable amount of lead work; and, principally in September, he was engaged for three weeks fixing a 24-inch main, which involved the use of a considerable quantity of lead. He was doing this work indoors, in the meter-house, where, in making the joints, he had to use molten lead. The place where he was working was up near the roof of the building, where there was no ventilation to permit the fumes to escape; and the molten lead had to be put by him into the sockets just under his nose. The effect of this work was that he developed lead poisoning; and he was taken home and laid up for two months. In November he went to the works, and was told to get a certificate from the doctor who was attending him—Dr. Howell (the local Medical Aid Club's Doctor, and also a Director of the Company). He obtained from him a certificate that he was suffering from lead poisoning; and this was given to the Company, who, however, did nothing. Later on, the applicant was able to resume his work; and he went on until December, still using lead. On Christmas Day, he was again taken ill; and he had not done any work since. He ought, if he had understood the legal aspect, to have gone at once to the certifying surgeon, who would have given him a certificate; but it was not until June 23 that he did so. Therefore he was limited in his claim to this date, which meant that his client would have to lose compensation for the first six months of this year. Lewis was attended in December by Dr. Miller, in consequence of Dr. Howell refusing to do so, as he was a Director of the Company. On May 30, the applicant wrote to Mr. H. O. Carr, the Engineer, asking what the Company proposed to do; and the reply was that the letter had been put before the Directors. Subsequently, on June 15, he had a communication from the Secretary (Mr. C. W. Braine) in which the writer said: "There does not appear to be any work carried out by the Company's workmen in which the use of lead should cause the disease from which you are suffering." Not "could" or "would," but "should."

His Honour: The only question is whether the applicant is totally incapacitated.

Mr. Willis: It is admitted.

His Honour: Then why do you want medical evidence?

Mr. Willis: To show the effects of chewing, which the respondents say he did. Many people will state that chewing is a deterrent—if he did do it. Then I must show that molten lead particularly would be likely to produce lead poisoning.

Charles Lewis, the applicant, was then called, and bore out the opening statement. He explained how the different joints were made, and said that in September, when he was taken ill, he was working on the 24-inch inlet and outlet mains of a 100,000 cubic feet per hour meter. He was using molten lead for the sockets, and was standing on a scaffold up in the roof. The lead was pulled up to him in a pot, and he took it out with a ladle, and poured it into the joint. There was very little ventilation; and there were fumes from the lead when pouring it in. He was in a position in which he could not very well get away from the fumes. He did not feel any effect from them at the time; but one day before leaving the works he was seized with pains in the stomach which gradually got worse. His wages were £2 0s. 6d. per week.

Cross-examined, witness said he had not recently done much lead mixing. The fitter's assistant would do it if not otherwise occupied. For the past five years he had been employed mostly on the works. The Company employed about 500 men, of whom about 200 went outside and the others were inside the works. Of those who were inside, sometimes one, and at others a dozen or more (but never much over twenty), would be employed on lead work. When he was engaged in the meter-house, the meter was being put up; but the walls of the house were filled in.

Mr. Morris: I suggest there was the iron structure; but the walls were not filled in. At the time you were doing the work, there was a good draught of air going into the house?

Witness: Yes. Continuing, he said he used red lead mixed with white lead, as a putty. Red lead came to the works in the form of a powder; but it was very heavy. White lead arrived in a thick creamy condition. The mixing of the two into a putty was left practically to the assistant. Then lead paint was used; and this was made with red and white lead and oil. This it was also the duty of the assistant to make. There were lavatories and wash-basins on the works; but he had no orders to use them. He was aware that it was necessary to keep his hands clean when using lead, and he did this by means of oil and waste—washing them subsequently. If he had some of the putty or paint on his hands, he admitted that it would be dangerous to put his hands to his mouth.

Mr. Morris: If a man chews, and in the process of chewing puts his hand to his mouth, I contend the poisoning arises, not out of his work, but from that habit.

His Honour: It seems somewhat far-fetched for the present.

Witness: I would not do it. Continuing, he said he had not chewed since 1908; and when he did do so, it was only once or twice a day. Loose shag was what he used, but he had not taken a pinch when he had lead putty or paint on his hands. He belonged to a sick fund connected with the works, and received 5s. a week from the fund.

Mr. Morris: And the Company add, as a voluntary payment, another 7s., making 12s. in all.

Mr. Willis: The contributions jointly made by employers to a sick fund should not be set off against any compensation awarded.

Mr. Morris: The 7s. a week which the Company pay has nothing to do with the fund.

Mr. Willis: If a man had scarlet fever or any other disease not arising out of his work, would he come on the fund?

Witness: Yes; if he subscribed.

Mr. Willis remarked that the Act said, if the certifying surgeon had given a certificate, and the disease was due to the nature of the employment, a man was entitled to compensation as if the disease were a personal injury by accident arising out of, and in the course of, the employment. The Statute said, not that it was an accident arising out of the employment, but that it must be deemed to be such. He scarcely appreciated the point brought forward.

His Honour: Neither do I.

Mr. Morris: I am saying this disease is not due to the nature of the work on which the workman was employed, but is due to his own habit of chewing tobacco. If you find the disease is due to a habit which the man exercises during the time of his employment, and but for that habit he would not have got the disease, then it is not "due to the nature of the employment."

Re-examined by Mr. Willis, witness said he never rolled tobacco and put it in his mouth when on a job. He had always been told that chewing prevented the fumes taking effect. The baths and wash-houses on the works, he thought, were put up for the stokers. He did not swallow the tobacco or the juice.

Dr. *R. F. Fraser*, the Certifying Surgeon for the district of Battersea, said he examined the applicant, and found him suffering from the results of lead poisoning. He reported the matter to the Home Office. The use of lead in the way here concerned would certainly be likely to cause poisoning, even supposing the man did not chew tobacco. The fumes from molten lead were very dangerous. Good ventilation would give a man a much better chance. One could get lead poisoning from absorption through the skin, by inhaling, or by swallowing. Sometimes it was very slow in action. For years the lead might be accumulating in the system.

His Honour: Is it necessary to call further evidence? Even if he did chew, the man says he never swallowed the tobacco or the juice; and if that was so, it would not get into the stomach. He says he did inhale, and he did get this stuff on his hands.

Mr. Morris said his clients had 500 workmen, and had carried on the business of supplying gas for very many years. Not only were those connected with the Company prepared to give evidence, but others would also say that there must have been something more than his ordinary employment to give this man the disease. A man might get poisoned from blue lead fumes, but not if there was proper ventilation. He would call someone to say there was perfect ventilation in the meter-house, because the house had not been built in, and part of the sides was open. Though the lead colic was ascribed by the applicant to the fumes during the work done in September, he (Mr. Morris) was going to ask whether it did arise from that cause. It could be got from lead putty or lead paint. Dr. Fraser apparently said poisoning could come through the pores of the skin; but his evidence would be that it could not be got in this way. It must be either by inhaling or swallowing. The white lead arrived in the form of cream; and the red was a heavy powder, which, if dropped, would not diffuse in the air. Further, his employment did not bring him into contact with the powder. It was some considerable time since he did any of the work of a fitter's mate. So inhaling might be ruled out. When the Board of the Company were confronted with the fact that they had medical advice that the man could not get this lead poisoning except by taking it into his mouth, they looked round to see if there was any explanation. There was every opportunity for the men to keep their hands clean, and Lewis was a very clean workman. If, in fact, a man was chewing while in a dangerous employment of that kind, and was taking in the course of his work pieces of tobacco out of his pocket, and pinching this tobacco when he had lead on his fingers, and was then putting the tobacco in his mouth with his hand, this would account for his getting lead poisoning where others had not. He submitted therefore that the poisoning was not due to the nature of the employment, but to the action of the man himself in doing something for his own personal use. Of course, it was in a sense due to the nature of the employment; but

what he was going to contend was that the fact of the lead being there was the *causa sine quâ non*, but not the *causa causans* of the disease from which he suffered. Was this disease due to the nature of the work in which the man was employed at any time within twelve months of the date of disablement? If it was found that during the preceding twelve months the man did not chew, or at any rate did not chew on the works, it must be due to the nature of the employment. If it was found he had been chewing on the works, then putting down the disease to the work he did with molten lead in September was incorrect, and really the cause of the disease was the tobacco.

Dr. *F. J. Wethered*, on the staff of the Middlesex and Brompton Hospitals, said he had studied lead poisoning. Ordinary pig lead poured on a cold material gave off fumes. It was, however, a question of ventilation. Assuming the ventilation was good, the chances of lead colic were very much lessened. Lead paint or putty on the hands would not affect a man through the skin as the applicant was affected. If he had paint or putty on his hands when he was chewing, he would, of course, be very likely to get it into his mouth.

Cross-examined: Chewing was very bad for the teeth.

Mr. WILLIS: Did you ever see a man with a finer set of teeth for his age than Lewis?

Witness said that, on the whole, his teeth were very good. They were not what he would expect in the case of an habitual chewer. A man might fail to get all the lead off his finger-nails, and in this way get it into his mouth with his food.

Mr. MORRIS said he would call more evidence on the point of chewing, as it might shorten the case.

John Hancock, foreman, stated that he had been with the Wandsworth Company for about ten years, and before that was for 25 years with the Commercial Gas Company. During all this time, he had never known of a case of lead poisoning among the men. When Lewis was working in the meter-house, the building was unfinished, and there were three or four openings, so that, of course, there was a draught. The highest lead joint was 2 or 3 feet from the edge of the roof, which was held up temporarily by a long iron girder. He had seen the applicant chewing in the workshop, but could not say whether he had chewed during the last two years, as Lewis had not been much at the works.

Charles Heath, for twenty years in the service of the Company, said he had known Lewis to chew. It was six or seven years since he was working with him; but he had seen him chewing after that.

His HONOUR: I feel no difficulty whatever in dealing with this matter. It is an admitted fact that the applicant is suffering from lead poisoning, and that he had been in the employment of the Gas Company for something like thirty years. The poisoning has been contracted during his work at the gas-works; but the contention of the respondents is that the poisoning is not due to the nature of the work on which he was employed. I am quite satisfied, after hearing the evidence, that it was due to the nature of the work on which he was employed. I accept the applicant's statement that he has done no chewing since 1908. I also accept his statement that he did not put tobacco into his mouth while engaged on a job. Therefore in my opinion (though I do not think it is quite material) the poisoning was contracted either by inhaling or by absorption—I think most probably by inhaling. Even supposing it had been contracted because he happened not to have his hands quite clean—although it is not necessary to decide this point—in my opinion that would not have deprived him from obtaining compensation.

The applicant was awarded £1 a week compensation, as from June 23 last, with costs on scale C.

ASSESSMENT OF THE FALMOUTH WATER-WORKS.

At the last Cornwall Quarter Sessions, the Falmouth Water-Works Company appealed against the assessment of their undertaking by the Falmouth Assessment Committee.

Mr. J. R. Randolph, who appeared for the Company, explained that the old assessment was £1730 gross and £1389 rateable value. This was raised to £2524 gross and £1966 rateable value; and the Company, while accepting the gross value, contended that the rateable value should be reduced to £1443. Mr. G. Humphreys-Davies gave evidence in support of the Company's figures. Mr. J. M. Hamilton, Secretary to the Company, said the total capital expended was £54,601. There had been an increase of £1234 per annum in the takings. Mr. Alfred Cox, the Manager, gave evidence as to the condition of the works; and Mr. B. W. Bryan, Water Engineer and Director of the Company, confirmed his figures. Mr. J. A. Henoke, for the Assessment Committee, contended that the appellants had failed to prove their case. Criticizing Mr. Humphreys-Davies's valuation, he said dams were not perishable, and therefore it was absurd to take anything from a sinking fund in regard to them. Mains, too, would last vastly longer than twenty years, the period which Mr. Humphreys-Davies fixed. Mr. A. Body, surveyor, of Plymouth, and Mr. R. J. Low, rating surveyor, of London, were called to support the Assessment Committee's valuation. Mr. Body said that in arriving at his valuation he had put down £17,000 for renewals in forty years, but as a matter of fact the Company had spent only £11,000 on renewals and repairs in thirty-eight years. Mr. Low, who was called in to advise the Committee as to the rating of special hereditaments, said that he arrived at a gross value of £2524, and a net value of £1966. The Court, of which his Honour Judge Granger was Chairman, reserved judgment.

Liability of Water Consumers to Repair Communication-Pipes.

At the Westminster County Court, a few days ago, his Honour Judge Woodfall heard a case in which Florence Batt, a married woman residing at No. 23, Old Kent Road, S.E., claimed £50 damages from the Metropolitan Water Board for personal injuries sustained through the alleged negligence of their servants in permitting to remain in a defective condition, in the highway of Amery Place, Lambeth, a stopcock box or other water apparatus. The plaintiff's case was that in passing along Amery Place her foot caught in an open stopcock box, which caused her to fall and sustain injuries principally to her knee. Mr. Percy Simner, who appeared on her behalf, contended that the Board were liable for the condition of the box, which was without a lid, leaving a hole in the pavement. He cited as authorities the cases of *Osborn v. Metropolitan Water Board** and *Chapman v. Fylde Water-Works Company*.† Mr. Ross-Brown, for the defendants, submitted that they were not liable to maintain or repair apparatus which was not their property. There was a statutory obligation on the owner or occupier of the dwelling-house for whose convenience the stopcock box and communication-pipe were supplied to maintain them in proper repair. He relied mainly on sections 8 and 19 of the Board's Charges Act of 1907, and the judgment of Mr. Justice Phillimore in the action brought by Miss Stacey against the Gaslight and Coke Company, the Metropolitan Water Board, and others, tried in January last.‡ His Honour, in giving judgment, reviewed the facts; and, dealing with the arguments of Counsel, said he had arrived at the conclusion that the Board's Act of 1907 placed the obligation of repairing this apparatus on the owner or occupier, who had now power to open up the roadway if necessary for the purposes of repair. The Act applied, in his opinion, not only to new but to existing communication-pipes. He therefore gave judgment in favour of the defendants; but said that in the event of the plaintiff appealing with success, he would save the parties the expense of a new trial by assessing the damages at £30. On the application of Mr. Ross-Brown, his Honour gave the defendants the costs of the action.

* See "JOURNAL," Vol. CIX., p. 444. † *Ibid.*, Vol. LXIII., p. 813; and Vol. LXIV., p. 147. ‡ *Ibid.*, Vol. CIX., p. 185.

Complaint as to the Condition of a Gas-Testing Place.

At the Spelthorne Petty Sessions, on Monday last week, the Sunbury Gas Company were summoned, at the instance of the Sunbury Urban District Council, for failing to keep in repair and working order the place at their works for testing gas, and for not affording facilities to the Council's gas examiner for testing the gas supplied to the district. Mr. Attenborough, who prosecuted, said for some time there had been good reason to complain of the gas supplied to the people of Sunbury, and on the 11th of October an examiner visited the testing-place at the gas-works, and found not only the apparatus but the room in a dirty and neglected state. The examiner was engaged for four hours before he could complete his test; and, so far as he could make out, instead of the gas being 15-candle power, it was only a little over 9 candles. The inference from this state of things was that the Company were supplying gas to the public without taking the trouble to test its quality. Mr. P. Edgerton, one of the London County Council gas examiners, deposed to having visited the place, and finding it so dirty that, instead of making his test in one hour, it took him four hours. Witness, in cross-examination by Mr. Kenelm Preedy, who appeared for the Company, stated that during the whole of the time he had been gas examiner for the Council there had been complaints as to the state of the testing apparatus; and there was strong evidence that it had not been used for a long time. Mr. Preedy said he should show by the evidence he was going to call that every facility was given to the examiner for carrying out his test. Mr. T. Burtenshaw, a fitter in the employ of the Company, said the testing-room was littered rather than dirty. The photometer was dusty, but it was impossible to prevent dust getting into the room. Mr. Samuel Bark (the Company's Manager) denied that the testing-place was as dirty as was represented, and said he could have got it in order in ten minutes. He also said the Company tested the gas once or twice a week. Mr. James Foreman, official examiner to the Manchester Corporation, said he had examined the photometer, and with such slight adjustments as he always made a test could be easily carried out. The Bench thought the premises were not in a proper state when the gas examiner visited them; and they imposed a fine of £2 and £5 5s. costs.

Non-Provision of Cisterns to Closets.—At the Lambeth Police Court last Wednesday, before Mr. Hopkins, Mr. Francis Gillian, of Kellett Road, Brixton, was summoned by the Metropolitan Water Board for wilfully refusing or neglecting to comply with one of the regulations made under the Metropolis Water Act, 1871. Mr. Desmond Collins said the complaint was that there was no water-cistern attached to the closet at the defendant's house. Mr. Hopkins: Do you say the regulation is universally applied? Mr. Collins: All over London. Mr. Hopkins: And is also universally disregarded. Subsequently his Worship, turning to the Board's Solicitor, remarked: "You can't pick out the small householders and say 'We will treat you differently from the way that we treat our large customers.' There are hundreds of thousands of cases where the regulations are not complied with, and it is not attempted to enforce them." The defendant was ordered to pay the cost of the summons—2s.

Fire at Messrs. Willey and Co.'s Works.—Just before four o'clock on Thursday morning, an outbreak of fire occurred in the pattern-shop at the works of Messrs. Willey and Co., at Exeter. Within a short time of the report of the occurrence, the Fire Brigade arrived on the scene, and found that the origin of the fire was in the core-room, or casting-shop, that the place was fully alight, and that the flames had involved the pattern-shop, and were making their way towards the principal foundry. The buildings are mostly of corrugated iron, with open timbered roofs and glass skylights. The firemen checked the progress of the flames in an incredibly short space of time. We understand that the night watchman passed the place several times, but saw nothing to arouse his suspicions, until, in the early morning, when near the meter-shop, he discovered a bright light in the casting-shop, and soon the whole place seemed to burst into flames. The material loss in the building, &c., is put at about £2000; but the more serious trouble is in the replacing of the patterns, which, as a member of the firm said, were invaluable. It is thought that the fire was caused by the spontaneous combustion of plumbago or charcoal, of which there was a quantity in the building.

MISCELLANEOUS NEWS.

GAS COMPANIES' PROTECTION ASSOCIATION.

The Annual General Meeting of the Association was held on Monday last week at the Westminster Palace Hotel, S.W.—Mr. H. E. Jones in the chair.

The following is taken from the register of those in attendance, in the order of signature: H. E. Jones (*Chairman*); W. F. Cotton, of Dublin; Edward Allen, of Liverpool; D. H. Helps, of Reading; Thomas May, of Richmond; William King, Brentford Gas Company; R. O. Paterson, of Cheltenham; W. R. Phillips, of Hitchin; George Andrews, of Swansea; George Clarry, of Cardiff; S. Y. Shoubridge, of the South Suburban Gas Company; Hanbury Thomas, of Sheffield; H. Hart, of Canterbury; William Mann, of Brentford; T. H. Hazell, of Newport, Mon.; C. H. Batten, of Northampton; R. W. Edwards, of Aldershot; T. H. Duxbury, of South Shields; H. Kendrick, of Stretford; A. Easton, of Faversham; G. A. Eunson, of Northampton; F. W. Cross, of Lea Bridge; John T. Jolliffe, of Ipswich; Chas. W. Braine, of Wandsworth; H. A. Stibbs, of Portsmouth; W. W. Topley, of Croydon; E. Topley, of Tottenham; J. R. H. Jacobs, of Southampton; J. W. Buckley, of Hornsey; W. E. Roberts, of Hornsey; Stanley C. Sherrard, of Kingston-on-Thames; and Robt. Hall, of Matlock.

Annual Report of Committee.

The Secretary (Mr. Fred. E. Cooper) read the minutes of the last meeting, and the following report of the Committee:

The Committee herewith submit the revenue account and balance-sheet for the year ending October, 1910, and a report of the proceedings of the Association during that period.

The revenue account shows that the year's receipts were £512 18s. 6d., and the expenditure £488 13s. 9d.; thus leaving a credit balance on the year's working of £24 4s. 9d.

The balance-sheet shows that the Association's assets amount to £1992 3s. 6d., which is represented by £1690 16s. 2d. of 2½ per cent. consolidated stock at cost price—viz., £1522 11s.; balance at bank, £465 6s. 2d.; cash in hand, £4 6s. 4d.

It will be remembered that at the last annual general meeting, it was reported that the Committee were taking steps with reference to the promotion of a Bill enabling gas companies joining in such promotion to adopt the "Metropolitan" Argand Burner (No. 2) in substitution for the burner prescribed by such companies' Acts or Orders.

The Committee are pleased to report that, as a result of such action on their part, 47 companies, representing 49 undertakings, decided to join in the promotion of the proposed Bill.

A Committee, consisting of the members of the Committee of this Association and certain elected representatives of the companies promoting the Bill, was appointed to take charge of the conduct of the Bill during its passage through Parliament.

The number of companies joining in the promotion being so large, it was considered desirable to confer with the authorities of the House of Commons as to the mode of procedure to be adopted; and it was ultimately decided that three Bills should be promoted.

The Bills encountered considerable opposition, being strongly opposed in Committee in the House of Lords, in which House they were introduced, and subsequently on second reading and in Committee of the House of Commons. They now stand for consideration in the House of Commons, where notices for the rejection of the Bills at that stage have been given.

It is generally felt that opposition to the remaining purely formal stages of the Bills, after the unanimous decision of two Committees of Parliament that the preambles were proved, is to be regretted, and there is no justification for the vexatious delay and unnecessary expense caused by the continued opposition.

The Bills have the support of the Government; and, under all the circumstances, the Committee do not think there can be any doubt as to the result of the opposition on the consideration stage, and confidently anticipate that the Bills will eventually pass into law.

At the same time, your Committee appeal to every representative of the gas industry, whether interested as promoters or not, to use any influence they may have with Members of Parliament to secure their favourable support for the Bills at the further opposed stages.

Respecting the circular issued by the Inland Revenue authorities as to the future disallowance for income-tax purposes of depreciation on gas plant, referred to in the last report, the Committee have had considerable correspondence with the Inland Revenue Authorities and representatives of gas companies upon the subject. Ultimately a letter has been received from the Board of Inland Revenue stating that the Board considered the scheme referred to in that circular afforded the simplest method for allowing depreciation to gas companies, but that it was not the desire or intention of the Board by that circular to remove the question from the jurisdiction of the District Commissioners of Taxes who make the assessments.

It would thus appear that, while the circular in question is an emphatic direction to Surveyors of Taxes not in future to allow a deduction for depreciation, the District Commissioners are left at liberty to allow such depreciation if appeal be made to them to do so. The Committee consider this a very unsatisfactory position of the matter, and advise that companies should insist upon an allowance for depreciation being made as in former years.

The Committee have considered the Finance (1909-1910) Act, 1910, and the forms issued thereunder, as regards their applicability to statutory gas companies, as defined by the Act; and they are of opinion that Form 4 is not applicable to such companies, and that if they can be required to make any return upon the forms purporting to be issued under the Act (as to which, the question being *sub judice*, they express no opinion), the only form they can be required to fill up is Form 3.

The Committee are aware that steps are being taken by local authorities owning electrical undertakings for the promotion of a Joint Bill in the ensuing session of Parliament for the purpose of enabling such authorities to wire consumers' premises, and to supply them with electrical fittings, &c. The Committee are closely watching the matter with a view of taking such concerted action with reference thereto as may be necessary.

The only Bill adversely affecting the interests of gas companies introduced into Parliament during the present session was the Engines and Boilers (Persons in Charge) Bill, which, however, was not proceeded with.

The principal matters upon which the Secretary has been consulted during the last year are as follows:—

- Information to be supplied by gas companies for poor-law assessment purposes.
- Best mode of dealing with excess of profits.
- Right to demand supply of gas for "stand-by" purposes.
- Liability of gas company for gas explosion.
- Legality of collection by local authorities owning electrical undertakings of moneys due to contractors for electrical apparatus supplied.
- Gas company's right to damages in respect of breakage and excessive leakage of mains in colliery districts.
- Questions in reference to income-tax.
- Right of local authority owning electrical undertaking to let motors out on hire.
- Right of gas company to supply gas outside company's limits.
- Right of local authority to enforce bye-law as to depth at which mains should be laid.
- Supply of gas by local authority through meter situate within their limits, to house situate in gas company's area.
- Questions arising under Finance (1909-1910) Act, 1910.

The Committee are pleased to say that nine members joined the Association this year, which brings the total number of members up to 117.

The Committee record with regret that Mr. A. G. Snelgrove, who has been a member of the Committee since the formation of the Association, has resigned his membership in consequence of the absorption of the West Ham Gas Company by the Gaslight and Coke Company. In accordance with Rule 9, the Committee have appointed Mr. George Andrews, Engineer and Manager of the Swansea Gaslight Company, a member of the Committee in Mr. Snelgrove's place.

The following gentlemen retire from the Committee in accordance with Rule 9: Mr. William Belton (Shrewsbury Gaslight Company), Mr. W. F. Cotton (Alliance and Dublin Consumers' Gas Company), Mr. Thomas May (Richmond Gas Company), Mr. S. Y. Shoubridge (South Suburban Gas Company), Mr. Hanbury Thomas (Sheffield United Gas Company), and Mr. Corbet Woodall (Gaslight and Coke Company)—all of whom, being eligible, offer themselves for re-election.

Standard Burner Bills.

The Chairman said it became his duty to move the adoption of the report and accounts. He did not think that, in the whole history of the Association, the Committee had ever had quite such a strenuous period as they had passed through since the members of the Association last met. On that occasion the Committee obtained authority for that very important action, the promotion of a Bill for the alteration of the standard test-burner in the cases (as the event showed) of 47 different gas companies. All the members were in the habit of following the Technical Press in regard to these matters; and so they must have observed the struggles, battles, and successes in the fresh encounters with the old foe. He thought the Committee would have the sympathy, if not the gratitude, of the members of the Association for the time they had had. But even now it would not do for them to say too much, because they were not really through the woods with these Bills. Gas companies were not the most popular people in the world; and they had sometimes curious tribunals to face. Therefore to those who were fighting an uphill game, it was extremely satisfactory to find the decision of the House of Lords Committee (which was presided over by a most capable gentleman, who went thoroughly into the matter) was given by them with absolute unanimity in connection with this act of justice—for it was really nothing less—to the companies concerned. In the House of Commons, too, they had a most persistent and exhaustive inquiry into the whole matter. The Chairman of the Committee showed infinite patience and great perspicacity throughout the proceedings; and the individual members of the Committee were quite as careful as their Chairman. Some of the evidence that was tendered, however, was almost painful to listen to, because the *bona fides* of gentlemen who conducted gas undertakings were attacked. At any rate, it was painful to him, a veteran in the gas industry, to listen to it; for in the course of his long career, he had not had experience of this sort of thing. However, the decision of the Commons Committee was in favour of the Bills; but after that, they had the unusual spectacle of private members in the House delaying the further progress of the Bills, and asking for additional alterations or the entire rejection of the measures. But, thank goodness, the British Parliament and British methods had not yet descended to irregular guerilla tactics of this sort; and the Government were bound to stand by the Committees to whom the House referred the Bills. The House of Commons must be loyal to itself; and he had not a shred of doubt himself that, when the House came, in cooler moments, to consider the decision of the Committee who sat to hear the case for and against the Bill, and who gave it every possible attention (as was shown by the voluminous report of the evidence), there would be no diverting or upsetting of the position of the matter as it now stood. The Committee of the Association trusted that the question might now be considered to be disposed of. They must not, however, be too certain; and it would be well for the members to individually urge upon their parliamentary representatives in every town the extreme iniquity of continuing to impose upon the 47 companies concerned a condition of things that had been removed from the larger and most important gas undertakings in the kingdom, and which represented a good proportion of the total of undertakings. This was a small argument which might convince any impartially minded man on the subject.

Income-tax Allowance for Depreciation.

Then the report dealt with the question of income-tax allowance for depreciation. He had had some special experience in relation to this matter; and he could reiterate what the report advised, that they should insist in going past the collectors, and go direct to the Commissioners. For he was sure when they went before the capable gentlemen who settled all these matters, and pointed out the very destructible character of the fittings, meters, and stoves, and particularly of the slot-meter fittings, and the amount of money that had to be spent to keep them in proper order, there would be no difficulty in satisfying the Commissioners that an allowance should be made in regard to these things. In the case of gasholders, 2 per cent. of their structural value was allowed for depreciation. It had been a fixed principle to allow this, because they were obviously things that must be depreciating, and could not be repaired year by year, and so had to be repaired once in (say) thirty or forty years. If they "stuck to their guns," he thought the Commissioners would listen to them, and it would be quite easy to assure them. If not, they must bring some specialized accountant to their aid, or perhaps the accountant of the company in question would

be able to show the Commissioners the logic of the matter, which was really an extremely simple one. In London there had been some correspondence on the subject. The great Gas Companies of London and the Brentford Gas Company, however, had their accounts specially audited by an auditor of the Board of Trade. He was a man of distinguished position from the Government office; and he was authorized to deal with these questions as a matter of principle, as well as a matter of accuracy of account. When the accounts had passed him, the Income-Tax Commissioners accepted the position.

THE LAND TAXES.

Regarding the land taxes, and the much-discussed Form 4, it was seen that, in one part of the Act, gas-works were exempted. There was only one connection in which gas companies would have to pay, and that was when, if ever, they sold a piece of land for which they had no further use at a higher price than they gave for it.

MISCELLANEOUS MATTERS.

As to the questions that had been addressed to the Secretary by members, their Secretary must be a gentleman of Machiavelian skill if he could satisfactorily settle all these matters as they should be, because the questions addressed to him seemed to reach in character from Dan to Beersheba. But it was merely for him to give his opinion as to how far they would have to defend their rights at law. In respect of the membership, they had increased their number by nine; and he thought it ought to increase very much more, having regard to the very useful work the organization had done in the past. There were the Sulphur and the Standard Burner Bills. If anyone had any doubts as to belonging to the Association, those doubts must be removed by a consideration of the advantages that had been conferred by the work accomplished by the Association. Therefore he hoped that by next year he would see the number go up very much beyond the 117 at which it stood now. Mr. Snelgrove having retired, the Committee remembered the very handsome and modest manner in which Mr. Andrews retired from the contest last year; and he thought they had been most wise in taking this opportunity of getting him to join their body. They were happy to see him in this position. As to the reelection of the retiring members, they were all stalwarts—all men whom it was a pride and a pleasure to meet and to be associated with. Looking at the names of those who retired, and who were offering themselves for re-election, it would be agreed that they had a good Committee. The greatest gas man in the world—Mr. Corbet Woodall—happened to be (through alphabetical arrangement) at the bottom of the list. [Laughter.] At the top was Mr. William Belton, of Shrewsbury. Then there was Alderman W. F. Cotton, of the Alliance and Dublin Consumers' Gas Company, who had had a good struggle and fight over the standard burner, and had won. Then there was Mr. Thomas May, Mr. S. Y. Shoubridge, and Mr. Hanbury Thomas, who at Sheffield sold the cheapest gas in the country—or rather there was one other authority who claimed to sell cheaper, but perhaps it was not as good. Then there was Mr. Woodall, who he regretted was unable to be present. He was a gentleman who figured in the conspicuous position of Governor of the largest Gas Company in the world. He never failed when anything had to be done, or money spent, to acquire anything useful or proper for gas companies. He was always in the right place, and acted in the right way, and got his Company to move in the proper spirit in all matters in which progress was concerned. With these remarks, he desired to move the adoption of the report and accounts.

Alderman W. F. Cotton (Dublin) seconded the motion.

Alderman Hart (Canterbury) remarked, regarding the series of questions answered by their Secretary, that he did not know whether or not it would be advisable that they should have in the report in future some of the answers that were given. To say the least, they would be enlightening to those belonging to other gas companies. He did not know whether it would be prudent or discreet to publish the whole of the answers; but he simply threw out the suggestion.

Mr. T. H. Hazell (Newport) suggested the publishing of the Committee's report, together with the balance-sheet, a short time before the meeting, so that any particular question that might have been asked by any particular company in connection with their own special affairs could, possibly advantageously, be dilated upon by those present at the meeting. He did not know whether there were any difficulties in the way; but he could readily see that the report would be far more interesting to the members who attended the meeting if they had the privilege of reading it beforehand, and so placing themselves in a position to discuss it. He also commented on the fact that the investment in Consols in the balance-sheet had not been written-down; and, proceeding, he expressed gratification at the course taken by the Committee in appointing Mr. Andrews a member of the Committee, after the handsome attitude he adopted at the last meeting. There were one or two matters in the report in regard to which the expressions used might have been a little more forcible. Perhaps, however, the Committee were wise in not giving full expression to their feelings in respect of the famous circular issued by the Inland Revenue Department. The circular was absolutely illogical; and they had no right to issue it. It was issued to the collectors; while the whole matter rested with the Commissioners themselves. It was a positive fact that the circular was issued without any discussion with, or obtaining information from, any representatives of gas companies. What was done was to take the views of corporations owning both gas and electric light works as representing the views of gas companies throughout the kingdom. Therefore it followed naturally that depreciation was allowed for electricity works, but none at all for gas-works. Thus it was suggested that they should go on new lines altogether, and lines that meant more difficulty, with less satisfactory results. He also congratulated the Committee, the officials, and the local representatives of the Association concerned upon the remarkable success that had attended their efforts on behalf of the companies who promoted the Standard Burner Bills. It had been a complete success from start to finish; and the whole management of the matter reflected the greatest credit on those who initiated the movement, and those who were afterwards successful in carrying it through.

Alderman Cotton expressed the opinion that it would be a mistake to publish the correspondence with their Secretary, more especially seeing that any member who wrote to the Secretary on a particular subject could get the information he desired.

Mr. R. W. Edwards (Aldershot) suggested that, instead of printing the replies *in extenso*, they should be printed in abstract. He thought this would be of the utmost value to gas companies, and possibly at times obviate troubling the Secretary unnecessarily. With regard to the land taxes and Forms 4 and 3, he was rather surprised that some of the members had been troubled with Form 4. He had not been, as it was obvious that no gas company need be bothered by it. He also associated himself with the congratulations expressed in reference to the Standard Burner Bills. He hoped as they had gone on, so they would finish, and that those companies who were incorporated in the Bills would receive the justice which was their due.

Mr. H. Kendrick (Stretford) supported the suggestion regarding the publishing of an abstract of the replies of their Secretary to the questions addressed to him. There was one point in the correspondence that appealed to many of them; and it would be just as well if the members generally had the information in their hands as well as the members of the Committee and those companies who had applied for it. He referred to the question of stand-by meters. Many of them were taking steps of their own in this matter, which steps might not be legal if put to the test. Therefore, information such as that which had been given to one or two members by the Secretary would be very useful to others. He also complimented the Committee on the success that had attended their work during the past year.

The Chairman, in reply, said the Committee would take into the fullest consideration what seemed to be a general wish, that the report and accounts should be circulated a little before the meeting. He did not think the Committee would find much difficulty in doing something in this direction. As to the suggestion of Alderman Hart respecting the publication of the correspondence with the Secretary, it seemed to many of those present that the gist of it might be printed, though all the answers might not fit the circumstances of different cases. However, to that, too, he would promise the fullest consideration on the part of the Committee. The Committee were much obliged to the members for indicating the lines on which they desired to be better informed. He admitted, in reference to the remarks of Mr. Hazell, that they were a little out of the ordinary actuarial practice in not having their assets revalued. In connection with this matter, it was interesting to notice that, since the advent of a certain important gentleman as Chancellor of the Exchequer, while gilt-edged securities had gone down, gas stocks had gone up. However, the Committee would also take into consideration the question of the revaluation of the investments. There was this point upon the accounts, that had it not been for the special contribution towards the promotion of the Bills for the standard burner, the "profits" would have been £224 this year; and therefore the contingency of having to draw upon their reserve was rather remote. He hoped that some other gentleman would come to the front as Chancellor of the Exchequer, and that then England might recover her credit, and advance the position of these public investments. These were national funds; and what had happened to them was a deplorable thing.

The motion was unanimously adopted.

Re-election of Retiring Members of Committee.

Proposed by the Chairman, and seconded by Mr. J. T. Jolliffe (Ipswich), retiring members of the Committee—see report—were reelected.

Municipal Electric Wiring and Fittings.

Mr. Robert Hall (Matlock) said that perhaps it would be better that he should preface the remarks he had to make by suggesting that, although he was present mainly on behalf of another Association, he was entitled by the positions he occupied to attend the meeting. He was a Director of two gas companies, and was officially connected with three others; so that he came to the meeting full of sympathy, and with a good deal of knowledge of the gas business. The immediate purpose, however, for which he had come to the meeting was on behalf of the Incorporated Association of Ironmongers. Last year a Bill was promoted, one of the purposes of which was to enable corporations with electrical undertakings to provide free wiring and also to sell electrical goods at such prices as they thought fit. Now that was regarded by the members of the Association of Ironmongers as very prejudicial to them, because a great many of them were interested in the electrical industry, and were regularly employed in it carrying out electrical wiring, and so on. In towns where the members carried on this business, they felt it would be a most serious thing to them if the clause in the Bill went through. So his Association, in connection with the Electrical Contractors' Association, had opposed, and successfully opposed, the proposed power. It was a matter of surprise, and of some concern, to them that the clause, which was intended mainly as an attack on the gas industry, was not in any way opposed by the Gas Companies' Protection Association, or (for that matter) by any other gas organization. This year the Incorporated Municipal Electrical Association were promoting something on the same lines, and were bringing forward the same proposals, and some sixty corporations had assented to, and were supporting, the proposal. In all probability, therefore, the fight next session would be severer than before. The electrical people felt stronger on this question than they did a year ago, because, in the meantime, the Leicester Corporation case had been before the Courts. In that it was decided that corporations, unless they had special powers in their Acts, could not provide electrical fittings free or deal in them. This decision had spurred up the local authorities more than ever; and the result would no doubt be a more determined fight. The "common enemy" which the Municipal Electrical Association were fighting was gas. He therefore came before the Gas Companies' Protection Association that day with a good deal of confidence, asking that, if these proposals were brought forward again during the coming session, the Association should take their part in opposing them. The gas industry would be harder hit than any one. If the Ironmongers' Association could take up this question, surely it was the duty of an Association which was for the protection of gas companies to be in the forefront of the battle, and defeat what had been defeated before, and what, on the justice of the case, he believed would

be defeated again. As to the exact form the proposals would take, he was unable to say at present, because the Bill had not been published. There was no doubt whatever that, whether or not the wording was the same, the proposals would take the same lines as those of last session. His appeal really was that the Association should decide, on broad grounds that, if this proposal did come forward, they would take their part in opposing it strongly. The Association that he represented, and of which for the time being he was the President, really could not undertake to fight the proposals again single-handed. The Gas Companies' Protection Association were a far more wealthy body than the Ironmongers' Association, though not so numerous. They did therefore feel strongly that the burden ought to lie on this Association and not on the Ironmongers' Association. They, however, were ready to do their part and their utmost, and to use their influence in every town all over the country to resist the Bill; but they wanted at the same time to feel that the gas industry which was most affected should also take part in the struggle. He asked, then, that the Association should give some indication that, if the proposals took the form they did a year ago, the Association would take their part in opposing them.

The CHAIRMAN said he could assure Mr. Hall that the Committee needed no urging in any way in reference to this particular question. But it must be remembered that they were rivals in trade with the electricity supply bodies. Gas people were fighting for their gas; and the electricity people were fighting for their electricity. Gas companies were themselves doing "free wiring;" and Parliament had shown great disinclination to give them *locus standi* where they were opposing electricity suppliers in doing something similar to that which they were doing for gas. The effectiveness with which the Association could spend money on these lines was really much less than the effectiveness with which the Ironmongers' Association could spend money on their lines, because the members of the latter were private individuals, private traders, and ratepayers, and they were the sufferers. To show that the Committee did not need any urging in this matter, he might say that it had been discussed by them that day; and the Committee were prepared to take into consideration the whole question, and to take action in some shape or other as might suggest itself upon discussion. The matter was down for consideration at the next meeting of the Committee. The members needed no assurance that the Committee did see the evil, the mischief, and the impropriety of the rates being collected out of the pockets of the ironmongers, and then being spent in depriving them of the opportunity of making a living. There was the further consideration that, when the ironmongers or any other private traders made losses in their business, they had to bear them; but when local authorities made losses and mistakes (as they were constantly doing) in running their electricity undertakings, they simply made them good from the pockets of the ratepayers. This was a grievance that Mr. Alderman Cotton (Dublin) had brought before the Association from time to time. It was perfectly infamous the way gas companies were put to disadvantage in the matter of public lighting, and the way deficits were made good out of the rates; while in nearly every town next to the railway company, and perhaps in cases before the railway company, the gas companies were the largest ratepayers. The Committee were not ignorant in this matter, or adverse to taking any open course; but it was a difficult thing for gas companies, *quâ* gas companies, to get into opposition as ratepayers, because they were always liable to the imputation that they were rival traders. This was what was levelled at them in these particular oppositions, over which, by the way, some of the larger companies spent considerable sums of money. However, the Committee would give Mr. Hall's proposal every consideration.

Alderman HART said he had watched this matter with considerable dissatisfaction, because from the position he occupied he had seen how the electricity supply business was operated, and how the returns were bolstered up. The manner of doing business increased the taxation of the gas company, who in Canterbury were the largest ratepayers. They therefore felt that the Corporation did these things at their expense—at the expense of the shareholders, the gas consumers, and the ratepayers.

IRONMONGERS AND GAS COMPANIES.

Mr. HALL said there was another matter he should like to bring forward. It was as to the great desirability of gas companies more generally entering into a working arrangement with ironmongers such as had been done at Croydon, Southport, and other places.

The CHAIRMAN said he quite sympathized with Mr. Hall's object; but really that was travelling outside the orbit and limits of the objects of the Association. But before he sat down, he should like to tell the ironmongers this, that they had brought the position upon themselves so far as gas fittings and stoves were concerned. Until gas companies took up the business of the supply of fittings and stoves, all that ironmongers did was to show two or three fossilized stoves and a few antiquated fittings, and nothing more was done. If ironmongers had been more far-seeing, and had been broader minded, and had looked ahead, what had happened would never have occurred. He was associated with 32 gas undertakings; and he always wanted to see the gas-fitting they had to put into houses done by other people. They only wanted to get it done properly.

Mr. HALL said he had been spurred in regard to this question by what appeared in the Presidential Address of Mr. James W. Helps at the last meeting of the Institution of Gas Engineers. In that address, he indicated the desirability of cultivating better relations with ironmongers. Mr. Helps spoke with knowledge and experience; and that rather encouraged him to bring the matter forward on this occasion.

THE SCOPE OF THE ASSOCIATION.

Mr. T. H. DUXBURY (South Shields) asked whether there was an Emergency Committee in connection with the Association.

The CHAIRMAN: Yes.

Mr. DUXBURY: Thank you, Sir. Then can you intimate to-day the Committee's views on the grievance which has been lodged by the South Shields Gas Company?

The CHAIRMAN said the Committee felt every sympathy with the South Shields Gas Company in respect of certain representations made in South Shields, which did not fairly and properly give certain statistical facts connected with the London Gas Companies. But the Committee had no power or control over, or special knowledge of, those facts; and they felt they could not enter into correspondence with people in South Shields or anywhere else on such a matter. It was one of those domestic questions that must be dealt with locally.

Mr. DUXBURY said, in view of that answer, he was instructed to ventilate the grievance at the meeting, because his Directors did not consider the matter referred to was a local question.

The CHAIRMAN: Give us the principal heads of the grievance.

Mr. DUXBURY said that a letter appeared, among many other papers in the country, in the "Shields Gazette" from the Chairman of the Electricity Publicity Committee. That letter, he understood, was sent out to a very large number of newspapers throughout the country; and it inferred that London was to-day an electrically lighted city. The letter had been quoted in the Technical Press, and therefore many of the members present had seen it. The letter, as he had said, appeared in the "Shields Gazette;" and inasmuch as the South Shields Corporation had at the present time under consideration an improved lighting scheme for the main thoroughfares, the Gas Company considered the letter was apt to be to their detriment, because the inference was absolutely misleading. The Company therefore took steps to obtain figures to controvert the statement that had been made, and from them a reply was prepared to the letter. When this had been done, his Directors thought that perhaps the letter, dealing as it did on broad and general lines with the matter, could be sent from the Association to the local paper. Such a course would have had more weight than if the letter was sent by the South Shields Company or any of its officers. The statement was therefore forwarded to the Secretary with a suggestion that the Company would like the letter sent to the "Shields Gazette" officially from the Association. They had a courteous reply to the effect that the matter could not be dealt with, except by the express instructions of the Committee. But the Committee were not then meeting for about three weeks. Meantime, the Corporation were having a meeting; and it was essential that something should appear in the local paper. Therefore, the Company arranged for the letter to be published; and this had been done. The letter made no reference to the public lighting of South Shields whatever. The copy sent to the Secretary was typewritten; and he would have had nothing to do but to corroborate it.

The CHAIRMAN remarked that he could not see why Mr. Duxbury wanted to go about this business such a long way round. He got the particulars from London, had them in South Shields, and wanted them published in the Shields paper. Their Secretary could not add anything to the particulars.

Mr. DUXBURY: It was considered that the letter would have had much more weight coming from the Association than from the South Shields Gas Company.

The CHAIRMAN: If we dealt with such a matter as this, we might be asked to deal with a lot of correspondence.

Mr. DUXBURY: This was a general letter on a matter of general interest to the whole gas industry. Our grievance is that it would have taken the Committee three weeks to deal with this matter from the time we sent the letter; and, further, we think the letter, being on a matter of general interest to the members, might have been sent from the Association.

The CHAIRMAN: The Secretary says the period to the date of the Committee meeting was ten days, not three weeks; and the Committee considered the letter was quite outside the ordinary duties of the Secretary.

Mr. DUXBURY: The Secretary certainly did not tell me that in the correspondence.

The CHAIRMAN: Do you, gentlemen, think the Secretary should write letters to the newspapers on such topics as the public lighting of London. [SEVERAL MEMBERS: No, no.] If the Secretary had undertaken this, I should have wanted to know where the Association were drifting to.

Mr. DUXBURY: The letter from the Chairman of the Electricity Publicity Committee was published in almost all the principal towns in England; and I submit the Association ought to have helped the gas industry by sending out a letter controverting the statements.

The CHAIRMAN: All I can say is, the Committee do not agree with that view. This is a matter that must be left to the Committee.

Mr. R. W. EDWARDS observed that the matter raised by Mr. Duxbury must have produced the suggestion in more minds than his own as to whether the scope of the Association was wide enough to deal with all the matters that the members wanted it to take up.

Mr. H. KENDRICK: It seems to me the difference between Mr. Duxbury and the Committee is that he desires to make a national affair of this, while the Committee regard it as a local matter.

Mr. DUXBURY: The letter of the Electricity Publicity Committee was forwarded to newspapers all over the country; and an answer to it ought to have been sent out in the same way. I understand from you, Sir, that the Committee consider this matter to be outside the scope of the Association?

The CHAIRMAN: Yes, as to that particular work. If you wish the scope of the Association enlarged, you must give notice of it, and let us discuss it on some other point, but not on the point of a grievance.

Mr. DUXBURY: This is called the Gas Companies' Protection Association. My construction of this title is that, when a gas company are in trouble, they can apply to the Association for advice and help. I should have thought that such a simple matter as this could have been covered without extending the scope of the Association.

The CHAIRMAN: You may ask for any advice you think fit, but not request us to write letters to the general newspapers.

Alderman HART expressed the opinion that it was not a reasonable thing to require the Secretary to put his name to such a letter, however creditable and true, in the name of the Association; and he thought the Secretary acted wisely in saying that he must refer the matter to the Committee.

Mr. DUXBURY: It seems to me that if the scope of the Association does not cover what I wanted, it ought to be enlarged.

The CHAIRMAN: It is all a question as to what is the reasonable scope of usefulness of the Association.

The matter then dropped.

DANISH GAS COMPANY.

The Annual Meeting of the Company was held last Tuesday, at Millbank House, Westminster, S.W.—Mr. Corbet Woodall in the chair.

The London Agent (Mr. H. G. Warren) read the notice convening the meeting; and the Directors' report and accounts were taken as read.

Financial and Working Results.

The Chairman, in moving the adoption of the report and accounts, said he must congratulate the shareholders upon another year of satisfactory trading. As the shareholders were aware, the profit balance from Randers which was included last year was not available in the present accounts; but, notwithstanding, there was a larger balance by £4000 than last year. In the year to June, 1909, an exceptional amount of money was spent upon repairs and special renewals; and the price of coal was also above the average. On this occasion, advantage was reaped from the lower price of coal, and from the renewals being less. The residuals had brought in less revenue by £9900; and the sale of gas, due to the loss of Randers, had been less by 27 million cubic feet than the year before—this representing an amount of £6000 in revenue. Still, on balance, they had £4000 to the good. Had the supply of Randers remained with the Company, instead of a deficiency in comparison with the preceding year, they would have had an increase of 2½ per cent. in the consumption of gas. The number of meters in use was now 77,067, or 2877 more than it was last year, although the Randers meters had all been wiped out. The loss in exchange had been £672 in excess of the previous year, owing to there having been more money transmitted to England. The amount transferred to reserve and redemption account was the same as in the preceding year—viz., £13,000. The balance available for dividend was £82,684. If the dividend and bonus which the Directors recommended be approved, they would, when added to the interim dividend already paid, absorb £43,500, and leave £39,184 to be carried forward. The corresponding figure at the end of the previous year was £36,758.

Capital Expenditure and Depreciation.

The capital expenditure during the year had been £51,993. This included further outlay upon the new works at Flensburg of £37,800; on gasholders at Assens and Elsinore, £7140; and upon mains, meters, lamps, and works of distribution generally, £8500. Against this addition to capital, the Directors had written off £40,000—the loss which they estimated as having been incurred by the shutting-down of the old gas-works at Flensburg, and also £5960 on account of depreciation in the value of meters. The latter had arisen in this way. The meters stood, as a matter of course, in the accounts at the price at which they were bought, less a certain amount of depreciation. But since they were purchased, the tendency of the price of meters had been downwards; and so the Board had dealt with them by bringing them down to a price at which they could now be bought, less 40 per cent. for depreciation. The net addition to capital on the year was thus reduced to £6032. The expended capital per million cubic feet of gas sold was now £696, as against £675 last year. The increase was due to the further amount spent at Flensburg, which was still unproductive, and to the falling off in the quantity of gas sold owing to the loss of Randers. There had been spent on the new works at Flensburg £88,594; and they were now so nearly complete that he (the Chairman) contemplated, in the course of a fortnight or three weeks, helping the Burgomaster of Flensburg to charge the first retorts. It would be seen from the balance-sheet that, while the fire insurance fund had been increased by £1307, the reserve and redemption account was less by £27,000. The latter sum was the balance between the amounts carried to the redemption fund and that written off, as he had explained, for the Flensburg old works and for meters.

A Prospective Transfer.

At the close of this year, the Company's contract with the town of Aalborg came to an end, and the supply of gas would be taken over by the Municipal Council. The works, mains, and other property belonging to the Company there had been valued by the Arbitrators; but the amount of their award had not as yet reached the Board. They had no reason to doubt that the sum accumulated to the credit of Aalborg in the redemption and reserve fund would cover such depreciation from the book value as the Arbitrators might think well to deduct. The Company would retain a valuable building estate in Aalborg for future disposal. Their position at the present time was more than usually interesting by reason of the maturing of contracts; but it contained no element to cause alarm. The Directors would, as they had done in the past, use every effort to secure the renewal of contracts; and they hoped to succeed. Meantime, it had been with much regret that they had lost such towns as Randers and Aalborg. The compensation paid to the Company on transfer was for works, including land, mains, and all other assets, but excluding goodwill. The property was valued not at cost, but subject to depreciation. The redemption account had been accumulated with the object of meeting this depreciation. In the case of Randers, they had a larger sum than was necessary for this purpose; and, as he had said, the Directors confidently expected this would be the case at Aalborg. He might explain that the scheme of redemption or amortization was calculated to return not only the nominal, but rather more than the market, value of the shareholders' stock. The value had been taken at £150 per cent. The Company incurred no risk therefore in purchasing ordinary shares at a price less than that rate.

New Contracts.

In addition to the contract for the supply of water to Tikjob, as already reported, the Directors had completed an agreement with another district, called Asminderod-Gronholt, on the Strandvei—both giving a monopoly for 35 years for gas and water. They were also considering the purchase of the works of the Horsholm Gas Company. If this were effected, they would have a continuous line of supply from Copenhagen to Elsinore.

Strong Reserve and Depreciation Fund.

The position of the reserve and depreciation fund to-day was, in his opinion, evidence that the principles on which it was founded were sound. In 1908, before the loss of Randers, the total accumulation was £224,514. In 1909, after making good the Randers loss, it was £228,884—an increase of more than £4000. That was to say, they carried into the redemption fund £4000 more than was necessary to make up the loss on the transfer of Randers. Now, after writing off £40,000 on account of the abandoned works at Flensburg, the fund stood at £201,868. So it had come down by only £27,000, against the £40,000, *plus* the £6000 for meters. In addition to the £13,000 taken from profit and loss to the credit of the redemption fund, it had, of course, benefited automatically by the interest received from the sum invested outside the Company, and by the dividend on £35,000 which they had invested in the Company's own shares. Without further preface, he moved the resolution for the adoption of the report and accounts.

Lieut.-Col. T. H. Lewin seconded the motion.

Mr. Alex. Baird said he rose to express the feelings of satisfaction, which, he was sure, all the shareholders must experience, in having such an excellent report and balance-sheet laid before them, and in listening, as they always did, with pleasure to the interesting and instructive remarks from the Chairman in explanation of the various items in the report, and in giving a general survey of the Company's position. It was always a pleasing feature of a balance-sheet to find that the net balance was larger than it ever was before; and it was all the more gratifying on this occasion when they had experienced the loss of such a profitable concession as Randers. He hoped that the consequent reduction in the consumption of gas was only temporary, and might speedily be compensated by an increased demand in other directions. He need scarcely say that, while year by year they saw considerable additions made to the capital account in extensions and other outlays (which were always features in successful gas undertakings), it was satisfactory to find that at the same time reductions were being made upon the capital account as concessions fell in. This happened last year on account of Randers, and had again this year on account of Flensburg. There is one point that was not quite clear to him—that was, the distinction made in dealing with this transaction last year and this. The Randers amount was deducted from capital only; while the Flensburg item had been deducted from capital and from the redemption account—leaving the financial position of the Company practically the same. He had no doubt the Chairman would be able to give the shareholders a sufficient explanation of this. It was satisfactory to find that the transfer of £45,000 in reduction of the redemption account had in no way affected the sum standing to the credit of the investment account, which now amounted to £123,000, being an increase of £8000 over last year. He did not intend to repeat the arguments which he had used on previous occasions as to the desirability, on the grounds of safety and sound finance, of placing the whole of the amounts added to the reserve and redemption account in investments outside the business so as to be available to be called upon in case of emergency. The Chairman was good enough to inform him on the last occasion of their meeting that these views had received every consideration by the Board; and it was a great satisfaction to him (Mr. Baird) to find on this occasion that the amount which had been placed to the credit of the investment account was more than double what it was last year. He had great pleasure in congratulating the Chairman and the Directors on the results of their labours in the shareholders' interests; and he could assure them that these labours were thoroughly appreciated.

The Chairman, in reply, said with regard to the manner of treating the loss on transfer of the Randers works, he thought it was identical with what had been done in respect of Flensburg, only that the detail was not shown on the occasion of the Randers transfer. The shareholders would see in the present accounts that the £40,000 was shown as an express item; while, the Secretary informed him, in the case of Randers it was deducted from the amount at the credit of reserve and depreciation account before the balance of £228,884 was brought in.

Mr. Warren remarked that this was the first year the detail had been shown as to the way the account was made up.

The motion was unanimously carried.

Lieut.-Col. C. M. Davidson moved the declaration of a final dividend for the year ended June 30 last of 2½ per cent. on the preference shares, 5 per cent. on the ordinary shares, and a bonus of 1 per cent. on the ordinary shares.

Mr. R. S. Gardiner seconded the motion, which was unanimously passed.

Purchase and Cancellation of Shares.

The Chairman said that he had next to move a resolution whitewashing the Directors, because of their action in purchasing a certain number of the Company's shares as an investment on account of the payment to the Company of the Randers purchase-money. They had bought 235 shares; and he therefore moved—"(*a*) That the purchase by the Directors of 235 of the Company's shares be approved." Further, "(*b*) That the Directors be authorized to purchase from time to time ordinary and preference shares of the Company to an amount not exceeding £100,000." And as a corollary to that—"(*c*) That the Directors be authorized to reduce the capital of the Company by cancelling the shares purchased for the Company should they deem it desirable to do so." As the shareholders were aware, at the end of the present year the Company were entitled to a large sum of money from Aalborg; and they would want an investment for it. They had spent nearly the whole of the money requisite to finish the new works at Flensburg; and the other work they had in front of them was not more than the Company's ordinary resources would provide for. But the money from Aalborg would have to be dealt with; and rather than keep it at the bankers, or invest it outside, the Directors thought it better they should buy up a certain proportion of the Company's shares, which meant they would make an investment at 6 per cent., instead of an investment at a smaller rate. If it should happen that they lost Flensburg four years hence, it was possible they would then have a much larger sum to deal with; and they could not possibly have a better way of disposing of it than this.

Mr. J. H. Birchenough, C.M.G., seconded the resolution in its three parts.

Mr. Baird said that the only suggestion he ventured to make in

connection with this matter was as to whether it would not be also desirable to purchase and cancel some of the debentures.

The CHAIRMAN said the Board had in the past year purchased and cancelled £3030 of debentures; and they were within their right in doing that. But, in addition, they had bought ordinary shares to the extent of £2350.

The resolution was unanimously agreed to.

On the proposition of Mr. M. M. BIDDER, seconded by Mr. BERNARD F. HARRIS, Mr. Edwin Waterhouse, F.C.A., and Major E. A. Critchely were re-elected Auditors.

Mr. R. L. ANDREWS, in proposing a vote of thanks to the Chairman and Directors, said, as a very old shareholder, and one who had never attended a meeting of the Company before, but knowing Copenhagen and the gas-works their money was in, he fully appreciated how the Chairman and Directors had had to work in conducting affairs so far off. The dividend had increased from small to medium, and now it was 10 per cent. Not long since he came from Canada, where 10 per cent. was a big amount for gas companies, and where the gas companies were looked after rather severely by the authorities. It was very refreshing to find that all his investments in gas companies had never had their dividends reduced. He had pleasure in proposing a vote of thanks to the Directors, and especially to Mr. Woodall, whom he had known ever since he (Mr. Andrews) was a boy, or at any rate for thirty years. He was pleased to find him in the position of Chairman of this Company.

Mr. M. M. BIDDER seconded the motion, which was cordially passed.

The CHAIRMAN said, on behalf of the Board, he was greatly obliged for the vote of thanks. This was an interesting time in the history of the Company; and he thought they might look forward to a period of continued prosperity.

Gas-Workers' Wages at Bradford.—When the minutes of the Gas Committee were submitted for confirmation by the Bradford City Council, Alderman Trotter inquired if a member of the Committee had conducted meetings of men at the gas-works. In reply, Mr. H. Geldard, the Chairman, said: I believe it is a fact that one of the members of the Gas Committee has held meetings or spoken to the men at the Valley Road and Birkshall Lane gas-works some time during the last two months. The probable result of these meetings has been that we have been requested by the Gas-Workers' Union (Leeds) for an advance of wages to the men amounting to over £4000 a year.

A Gas-Worker's Death.—The Birmingham City Coroner last Wednesday held an inquest on the body of a labourer named Thomas Hutchinson, whose death occurred at the Saltley Gas-Works of the Corporation. It appeared from the evidence of the widow that deceased had complained of an injury said to have been received twelve months ago. Thomas Rogers, foreman, said that on the day of his death deceased was emptying a purifier. Before he had the seizure, he had wheeled away several barrow-loads of oxide of iron. He suddenly complained of tightness about the chest, and told a companion who was working with him that he had difficulty in getting his breath. Deceased did not give any indication of having been "gassed." Dr. Hamilton attributed the death to heart disease; and a verdict of "Death from natural causes" was returned.

CEARA GAS COMPANY, LIMITED.

A Higher Dividend—The Death of Mr. Herbert Gandon.

The Annual General Meeting of this Company was held last Friday, at the London Offices, No. 9, Queen Street Place, E.C.—Mr. F. A. WALLROTH in the chair.

The SECRETARY (Mr. George R. Guyatt) read the notice convening the meeting, and the report and accounts were taken as read.

The CHAIRMAN, before moving the adoption of the report and accounts, said that there was one paragraph in the report to which he would like to allude. He felt sure the shareholders would all partake in the sorrow with which the Board received the news of the death of Mr. Herbert Gandon, their late Engineer. He had been in a very bad state of health for some time; and the Directors had a telegram at the end of last July, saying that he had been peremptorily ordered home by the doctor. Unhappily, however, he was too ill to reach England. He knew the sympathy of the proprietors would go out to Mrs. Gandon in her sad bereavement. The satisfactory progress of the Company during the last few years testified to the ability with which Mr. Gandon managed their affairs. Coming to the report and accounts, there were just a few points to which he would call attention. It was a very great pleasure to the Board to meet the shareholders on this occasion, and present the report and accounts which he thought they would all deem satisfactory. The net profit was £1200 more than last year. As regarded the profit and loss account, taking it in some detail, there was an increase in the item of coals carbonized of £700, in manufacturing of £100, in maintenance of £600, in rents and taxes of £160, in bad debts and allowances of £200. General charges were £300 less, and exchange was £800 more. This last was a matter which was totally beyond the control of the Board, and the increase largely resulted this time through there having been more money remitted. Commission, also, was slightly more. On the other side, there was an increase in the receipts from gas supplied of £700, and in products and fittings of £2900. This increase in the returns from products was greatly due to the sale of their coke. The shareholders would remember that last year he had occasion to explain that they had a large stock of coke on hand for which they could not find a market; and as coke always deteriorated rapidly, they thought it advisable not to take any credit for the stock of coke in the accounts on that occasion. He pointed out, however, that if they did find a market, it would come in as profit for the following accounts. They had disposed of the whole of it; at the end of the year there was no stock. This fact accounted to a very great extent for the increase in the item of products. The result, practically, was an increase of 8 per cent. in the expenditure and of 9 per cent. in the receipts—leaving a profit of £8700, which, as he had said, was £1200 more than last year. The Board proposed to deal with this as set out in the report. The exact result of the year's working was a net profit of £8699, which, added to the balance brought forward, gave a total of £12,880. Deducting the interim dividend paid in April last (£1681), there remained £11,199 available for division. Out of this sum, the Directors had transferred £4000 to the reserve fund—making this account £20,000—and recommended the payment of a dividend for the

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 311.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord. .	87-89	+1	5 12 4
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95–98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.. . . .	6⅜–6⅝*	+¼	5 5 8
40,000	5	.	7	Do. New, £4 paid .	4⅞–5⅛*		5 9 3
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c. . .	28½–29½	..	5 1 8
311,810	10	,	7	Bournemouth Gas and Water B 7 p.c. .	16¼–16¾	..	4 3 7
75,000	10		6	Bournemouth Gas and Water Pref. 6 p.c.	14¾–15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246–249	..	5 0 5
330,000	,,	.	9½	Do. New . . .	184–186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref. .	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb. .	99–101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215–218	..	5 0 11
246,320	,,	.	8	Do. A Ord. Stk. .	157–160	..	5 0 0
460,000	20	Sept. 29	10⅝	British	44–45	..	4 12 4
109,000	Stk.	Aug 12	6	Bromley, A 5 p.c. . .	117–119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c. . .	88–90	..	5 0 0
82,278	,,	.	5½	Do. C 5 p.c. . .	107–109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb. .	85–87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97–99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	4¼–5½	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	50½–51½	..	5 16 6
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. . .	109½–111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk. .	105–108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do. .	101–103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79–81	..	3 14 1
800 000	Stk.	June 10	5	Continental Union, Ltd.	95–97	−1	5 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122–124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk. . . .	104–105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord. .	103–105	..	4 15 3
486,090	10	July 14	12	European, Ltd. . . .	24–24½	..	4 18 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾–18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4¾	Gas light and Coke 4 p.c. Ord. . .	104½–105½	−½	4 8 5
2,600,000	,,	,,	3½	Gas light and Coke 3½ p.c. max. . .	87–89	..	3 18 8
4,062,235	,,	,,	4	Gas light and Coke 4 p.c. Con. Pref.	103–105	−1	3 16 2
4,531,705	,,	June 29	3	Gas light and Coke 3 p.c. Con. Deb.	80–82	..	3 13 2
258,740	Stk.	Sept 15	5	Hastings & St. L. 3½ p.c.	92–94	..	5 6 5
82,500	,,	,	6½	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17–17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C . . .	145–148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112–114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb. . . .	98–100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental .	187–189	..	4 15 3
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	120–122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A. .	220–222	..	4 10 1
718,100	,,	,,	7	Do. B . .	162–164	..	4 5 4
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅝–4⅞	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99–101	..	4 19 0
250,000	100	,,	4½	Met. of Melbourne 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd. . .	12½–13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102–103	+½	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90–91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½–14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd. . . .	138–140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6–6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A. . .	131–133	..	5 3 0
60,000	50	,,	13	Do. B. . .	124–126	..	5 3 2
100,000	50	,,	12	Do. C. . .	117–119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102–104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord. . . .	7¼–7½*	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref. .	5 3/16–5 7/16	..	4 11 11
488,900	100	June 1	4	Do. 4 p.c. Deb. .	97–99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb. .	97–99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd. . . .	15¼–15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref. .	11¼–11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb. .	51–52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229–231	..	4 6 7
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾–11¼	..	5 6 5
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 1
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80–82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120–122	..	4 2 [illegible]
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121–123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord. . .	110–112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c. .	141–143	..	4 17 11
483,940	,,	,,	5½	Tottenham and Edmonton B 3½ p.c. .	112–114	..	4 16 0
149,470	,,	June 29	4	Tottenham and Edmonton 4 p.c. Deb.	97–99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9–9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98–100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112–114	..	4 7 9
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c. . .	139–141	..	4 15 9
85,766	,,	June 29	3	Wandsworth 3 p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

six months ended June 30 of 5 per cent. on the preference shares (less income-tax), and of 6 per cent. on the ordinary shares (tax free)—together £2581. These payments, with the interim dividend already paid, would make 10 per cent. on the preference shares and 9 per cent. on the ordinary shares for the year—that was, 1 per cent. more on the latter than was paid last year. The balance carried forward would be £4617. The Company's debentures (£10,300) would be redeemed at the end of this year. The money was in hand, as would be seen by the amount invested. A further sum had been invested this year, so that there were ample funds with which to pay off the debentures. This operation would, of course, greatly deplete the amount invested; but they would, he thought, still have some £3000 left. It would be the aim of the Directors in future years to increase the amount invested as much as they could, so as to be prepared against any eventuality such as they experienced some years ago, when there was a drought, and they were very hard up for money, owing to the Province being unable to collect the wherewithal to pay the Company. He concluded by moving the adoption of the report and accounts.

Mr. F. W. Brothers seconded the motion.

Mr. Charles Webb said he noticed an item in the accounts "Dividends unpaid, £370." He took it these were unclaimed dividends; and, if so, was it not possible to find claimants? He thought some steps ought to be taken to ascertain whether these persons had lost sight of their shares.

The Chairman, in reply, said they were mostly people on the other side; and the Company could not take steps to find them. The dividends were posted half yearly. As a rule they were not returned, but were outstanding, and were liable to be presented at any time.

The resolution was carried unanimously.

On the proposition of the Chairman, seconded by Mr. Thomas M'Making, a dividend was declared for the six months of 5 per cent. on the preference shares (less income-tax) and of 6 per cent. on the ordinary shares (tax free), making with the interim dividend already paid 10 per cent. on the preference shares and 9 per cent. on the ordinary shares for the year.

The retiring Directors (Mr. Brothers and Mr. M'Making) were then re-elected, on the motion of the Chairman, seconded by Mr. F. E. Linging, as was also the Auditor (Mr. A. W. Cooper), on the proposition of Mr. T. A. Guyatt, seconded by Mr. Webb.

Mr. Webb, in proposing a hearty vote of thanks to the Chairman and Directors, remarked that the Company was a progressive one.

Mr. Long seconded the resolution, which was cordially agreed to.

The Chairman, after acknowledging the compliment, proposed a similar vote to the Engineer and staff in Ceara and the Secretary in London. He remarked that they had filled Mr. Gandon's place by appointing Mr. John Reid, who was an old servant with the Company. The Directors had every confidence in Mr. Reid's integrity, and in his ability to carry on the Company's work in a satisfactory manner.

Mr. M'Making seconded the proposal, which was heartily carried.

The Secretary's acknowledgment brought the meeting to a close.

HOLBORN PUBLIC LIGHTING.

Proposed Competitive Trial of Gas and Electricity.

At the Meeting of the Holborn Borough Council last Wednesday, the Works and General Purposes Committee further reported on the public lighting of the borough, having special reference to the petition of a number of the inhabitants in favour of improved lighting in the thoroughfares of Holborn, High Holborn, and New Oxford Street, to which reference was made in the "Journal" for the 18th ult. (p. 208).

The Committee stated that in the course of the debate which took place on the report they presented to the Council on the 27th of July with reference to their proposals for the improvement of the lighting of the borough, which were not adopted, a letter was read from the Secretary of the Metropolitan Electric Supply Company, asking for an opportunity of submitting a scheme of lighting by electricity; and the Committee had had the subject before them. In order that the Council might have an opportunity of deciding as to the most suitable system of improved lighting to be adopted, the Committee were of opinion that the Electric Lighting Companies and the Gaslight and Coke Company should be invited to give a public demonstration, extending over a considerable period, in one of the streets of the borough. They had accordingly given directions that the Gas Company, the Metropolitan Electric Supply Company, and the County of London Electric Supply Company should be invited to undertake such a trial at their own expense, subject to the terms of a specification to be prepared by the Borough Surveyor and approved by the Committee—the specification to provide for equal illuminating power by either system, so that a correct estimate might be formed of the respective merits of each kind of lighting. To make the test thoroughly satisfactory, it was necessary to conduct the experiments in some thoroughfare where the lighting was entirely dependent upon the public lamps; and the Committee thought that for this purpose Gower Street was most suitable. They proposed that an equal section of the street should be given over for lighting by each Company. During the trial, frequent tests would be made of the illuminating power of each light; and at the conclusion of the trial period the Committee would submit a report of the results, both from the point of view of efficiency of the light and its cost. The Committee reported that they had also considered the memorial presented to the Council by inhabitants of the borough at the last meeting, with reference to this subject. They said the memorialists appeared to be unaware that the proposal to give the Gaslight and Coke Company a ten-years contract had already been rejected by the Council, and that the question of improving the street lighting was still under consideration. They recommended that the action of the Committee in inviting the Electric Lighting Companies and the Gaslight and Coke Company to carry out a series of experiments in street lighting in Gower Street be approved; and that a reply be sent to the memorial of inhabitants on the

subject of the lighting of the borough, informing them that the proposals of the Gaslight and Coke Company for lighting the borough for a period of ten years were declined in July last, and that the question of the best method of improving the lighting of the borough is still under consideration.

Mr. Nolan Glave, the Chairman of the Committee, stated that they had chosen Gower Street for the purposes of the experiment because there was no shop lighting or other extraneous lighting in it. He should like those who formed the deputation to the Council to understand that there was no question of a ten-years agreement between them and the Gas Company, as provision was made for the Council to terminate the contract at the end of five years by the payment of a sum of £2500 to the Company—proving that the Council had not overstepped the limits of public business. At the end of the contract term, whether long or short, the Council would be in possession of the lanterns and burners supplied by the Gas Company; while if the Electric Light Company lighted the streets, the Company would have to provide new standards throughout the district, which would be a capital charge upon the new lighting to be paid by the Council. In answer to a question, Mr. Glave explained that it was proposed to divide the street selected into three sections, and give one to each of the three Companies, and the lamps would be alight simultaneously.

FINANCES OF BRADFORD.

The Trading Departments.

The Bradford City Treasurer (Mr. G. A. Thorpe), in his abstract of the accounts of the Corporation for the year to March 31 last, shows that the total receipts for the twelve months amounted to £2,410,396, and the payments to £2,658,137; and there was at the end of the year a balance in the hands of the bankers of £131,965. On works there had been expended up to the end of the year £12,417,927, of which £11,931,903 had been spent on capital account. Deducting the amount paid off by means of sinking funds, the net debt of the city at that date was £8,068,023. On March 31, there was an aggregate amount of £111,616 standing to the credit of depreciation and reserve accounts, of which £44,006 was in respect of the tramways, £7952 in respect of the electricity department, and £26,702 in respect of the gas undertaking. The sum raised by rates during the year was £516,584; and £29,000 was transferred from the trading departments to the rate-aided funds, of which sum the tramways contributed £20,000, the gas department £6000, and the conditioning-house £3000.

The capital expenditure on the gas-works amounts to £1,265,632, of which £406,300 has been provided for by sinking fund; and the amount outstanding is £759,332. The revenue for the year was £286,954; and the gross profit, £58,406. After deducting interest and sinking fund, there remained a deficit of £737. At the beginning of the year, the department had a surplus of £6485; but £6000 was appropriated to the relief of rates, and there is consequently a deficit of £253 to be carried forward. The total standing to the credit of the department's reserve accounts is £26,702.

On a capital expenditure of £775,667, the electricity department owed at the end of the year £516,703. The income for the year was £113,983, and the gross profit £63,135, which is reduced after payment of interest and sinking fund to £7399. Of this amount, £5000 was transferred to renewals account, which on March 31 stood at £7952. There was then an unappropriated revenue balance of £5364.

The capital expenditure on the water-works up to the end of the year is shown to be £3,734,907, towards which there has been provided by means of sinking fund £744,634; leaving an indebtedness of £2,990,273. The income for the year was £186,597, and the working expenses £42,213, which gives a gross profit of £144,384. From this, £128,762 has to be deducted for interest and sinking fund charges, leaving a net profit of £15,622. Of the latter sum, £2177 was utilized to wipe out a deficit balance, and the remainder was carried forward. The income of the Nidd Valley Light Railway was £4331, and the deficit £334, as compared with £2233 for the previous year.

GAS-METER RENT CHARGES AT SALFORD.

Town Council Decide on Abolition.

There was a good deal of discussion at the meeting of the Salford Town Council last Wednesday on the recommendation of the Gas Committee, already noticed in the "Journal," that, in view of the strong feeling prevalent in the borough, the charges for gas-meter rents should be abolished. The only point of difference really was as to when the resolution should become operative. The original intention of the Committee was to withdraw the charges from Dec. 25 next; but several members were in favour of the resolution being made retrospective. It was pointed out by the Town Clerk, however, that since the rents which had been paid in the past quarter's accounts had been legally collected, none of the money could be returned. In the end, it was agreed for the abolition of the charges to date from Sept. 29, which means that they will not be included in the current quarter's accounts.

The position of the Gas Committee in the matter was explained by the Chairman (Alderman Phillips), who moved the adoption of the resolution for the abolition of the rents. He explained that when the estimates of the different Committees were before the Council, the Gas Committee had pressure brought to bear upon them to increase their contribution in relief of rates; and in order that this could be done, the Council on the 22nd of June last adopted a resolution authorizing the Committee to re-impose the meter-rents, lower the quantity of gas supplied to users of penny-in-the-slot meters from 30 to 27 cubic feet for 1d., and reduce the price to consumers of very large quantities of gas.

Alderman Phillips added that if it were the will of the Council to take from the Gas Committee the responsibility of handing over anything in relief of the rates, nobody would be more pleased than the Committee, who would then be in a position to supply gas at a low figure to ordinary consumers, and allow a much greater quantity for 1d. to those using prepayment meters. It was for the Council to decide whether, the present way of raising money being objectionable, the Gas Committee should be authorized to adopt some other method, probably that of increasing the price of gas. He pointed out that 88 per cent. of the gas undertakings in the country were charging meter-rents.

After the Gas Committee's resolution had been carried, with but a few dissentients, Alderman Desquesnes moved that the Committee be instructed to raise any further revenue required by "a readjustment of the charges for gas in the usual way." Alderman Huddart, who seconded the motion, expressed the hope that the position of the users of slot-meters would not escape the attention of the Committee when action was taken to give effect to the resolution.

There was no opposition, and the motion was agreed to unanimously.

ST. DAVIDS WATER AND GAS COMPANY'S POSITION.

Appointment of New Directors.

In response to an invitation by Mr. Matthew J. Jarvis, a Solicitor, acting for nearly all the debenture-holders and several of the shareholders in the St. Davids Water and Gas Company, a meeting was held at Salisbury House, E.C., last Tuesday—the Rev. E. Rivers presiding—for the purpose of calling upon the present Directors to resign and to appoint others in their places.

We learn from a long report in the "Financial News" that after Mr. Jarvis had explained the circumstances under which he was acting, he stated that the Directors of the Company were Mr. W. B. Martin, who had been a Director of most of Mr. Preston's companies, Mr. Miller, and Mr. Brown, a clerk employed by Mr. Preston. In almost every instance, the Engineer appointed was Mr. Alex. Painter. He had written to both Mr. Miller and Mr. Martin, inviting them to meet shareholders; but both had replied saying they had other engagements. He was pleased to say, however, that Mr. Saphin, who was Secretary to the Company, was present, and would be able to explain why dividends had not been paid. He had learnt that Mr. Martin intended to hand in his resignation; and he understood that Mr. Miller would do likewise.

Mr. Saphin said that balance-sheets and reports had been sent out regularly to shareholders, and, with the exception of one year, meetings had been held annually. The whole scheme had from the beginning been a great disappointment to the Directors as well as to the shareholders. It was originally thought that St. Davids would be made the port for the Great Western Railway traffic; but the Great Western Bill was eventually altered so as to include Fishguard. The promoters had secured their Act in the belief that the Great Western Railway Company would spend £2,000,000 on St. Davids; but this hope had been shattered. The district, moreover, had not developed to the extent anticipated; hence the Directors could not be held to blame. They had put their money into the concern, and it was lost. They were most anxious to do their best for the Company.

After some conversation, Mr. Miller said that when the Company's Act was secured, it was regarded as quite a foregone conclusion that a light railway would be constructed between Fishguard and St. Davids. The Great Western Company, however, backed out of the project at the last moment. So far as he himself was concerned, he paid for his own qualification as a Director, and he would not back out at the last moment. He did not propose to tender his resignation. He was confident that the Company would prove valuable; and he was prepared to remain on the Board with others. The revenue was only about £200.

Mr. Jarvis: And that is what we paid £21,000 for.

After further discussion, it was resolved that Messrs. Evans, Bone, Fitchett, and Cadman be appointed Directors of the Company. It was also decided to hold a special meeting the following Monday (yesterday).

EXTENSIONS AT THE CLEATOR MOOR GAS-WORKS.

During the past eighteen months, extensions and additions have been in progress at the gas-works of the Cleator Moor Urban District Council; and they were lately inspected by members and officials, who were accompanied by members of the Egremont and Frizington Councils. Mr. J. A. Gray, the Gas Engineer of the Teignmouth Urban District Council, who has been the Consulting Engineer in connection with the extensions, explained the various features of the works.

The scheme of alterations and extensions, which has cost approximately £5000, includes the erection of a two-lift gasholder, having a capacity of about 118,000 cubic feet, which is more than equal to a maximum day's supply of gas. It is of the Gadd and Mason spiral-guided type, and was erected by Messrs. Robert Dempster and Sons, Limited, of Elland. A complete set of four luteless and connectionless purifiers, 12 feet square, has been installed by Messrs. Dempster in a new purifying-house; the purifiers being operated by a centre-valve of the firm's patent Weck type—the purifying material being oxide of iron. The exhausting plant has been duplicated by the provision and erection in the old purifying-house of a 7500 cubic feet per hour exhauster by the Bryan Donkin Company, Limited, Chesterfield. It is driven by a gas-engine; and the whole of the plant is so arranged in connection with the existing steam-driven exhauster plant as to enable either exhauster or both to be driven by the gas or the steam engine

at will. The old station meter has been replaced by a 6000 cubic feet per hour meter by Messrs. R. Laidlaw and Son, of Glasgow, and a new circulating main, nearly 3000 yards in length, has been laid by Messrs. Dempster; the pressure being controlled by a new 8-inch governor by Messrs. Parkinson and W. & B. Cowan. The whole of the work was satisfactorily carried out by the various firms engaged, under the superintendence of Mr. Gray.

CLAIM AGAINST THE DERWENT VALLEY WATER BOARD.

Arbitration Proceedings.

Readers of the "JOURNAL" are aware that the Derwent Valley Water Board are carrying out a scheme for the supply of Derby, Sheffield, and other places from a source in the Peak district. The aqueduct runs through Darley Dale; and in connection with this portion of the work, the Stancliffe Estate Company made a claim of £8216 upon the Board in respect of land taken and injurious affectation of their Hall Dale quarry. As the Board disputed the claim, the matter was referred to arbitration under the Land Clauses Act; and it recently occupied the attention of Messrs. JOHN COLEMAN and EDWARD HOLMES as Arbitrators and Mr. W. H. ELWELL as Umpire, sitting at the Surveyors' Institution, Westminster, for three days, with the result that a settlement was somewhat abruptly arrived at.

Mr. BALFOUR BROWNE, K.C., and Mr. LOWENTHAL appeared for the claimants; Mr. HONORATUS LLOYD, K.C., and Mr. GIBBONS represented the Water Board.

Mr. BALFOUR BROWNE, in opening the case, said the Stancliffe Estate Company was formed in 1897 for the purpose of purchasing and developing the Stancliffe Hall Estate of the late Sir Joseph Whitworth, which was rather more than 915 acres in extent, situated in Darley Dale. The object of the Company was also to work the Stancliffe and Hall Dale quarries on the estate. When the Company took over the property, they proceeded to work both quarries, and spent £10,258 in connecting them with the Midland Railway. The stone from them was known all over the world. Unfortunately, the Water Board had given the Company notice to acquire by compulsion an "island" of land in the centre of the Hall Dale quarry, which, though infinitesimal in itself, would cause the greatest inconvenience and loss by preventing the Company working a large quantity of stone; while the easement they would require for their aqueduct also had an injurious effect upon the building site adjoining it. For this, the Company now made a claim amounting altogether to £8216. [Counsel gave the several items constituting the total.]

Mr. *J. H. Dawson*, the Managing-Director of the Company, bore out the learned Counsel's opening statement. He said the Company were asking £8216 from the Board; but seeing that they purchased the estate and quarries for development and purely commercial purposes, and that they could not tell what would be the ultimate result of the Board's action, had the sum claimed been offered to them, they would have refused it if they had had the power. In dealing with the quarry, witness said the claimants were entitled to 1d. per foot as royalty as owners of the estate, and as owners of the quarry to a reasonable profit for working it, which he put at 3d. per foot. In excavating for the aqueduct, the Board had used a great deal of stone that would otherwise have been worked; and for this they claimed 4d. per foot, or a total of £1087.

In cross-examination by Mr. HONORATUS LLOYD, witness said the price the Company paid for the estate worked out at £80 per acre, which included the quarries and also the mansion of Sir Joseph Whitworth. He admitted that one-eighth of the stone quarried was good building stone and seven-eighths waste; but he said this did not prevent the quarry being worked at a profit. The tunnel for the aqueduct was, at its deepest point, 154 feet below the surface. He acknowledged that a tunnel at this depth would not have any injurious effect on the land itself; but he said its presence causing persons to refuse to become purchasers would injuriously affect him as a seller. Witness was cross-examined at great length with a view to showing that the Hall Dale quarry was an unprofitable undertaking; but he denied this.

Other witnesses gave evidence to the effect that the working of the quarry would be injuriously affected by the owners being compelled to leave the "island" in the centre of their works; and they agreed that the working cost would be increased by 4d. per cubic yard. The loss of tipping space would, they said, similarly affect the workings.

Evidence having been given as to the nature and use of the stone quarried,

Mr. *T. T. Wainwright*, a Past-President of the Surveyors' Institution, stated that the easements would injuriously affect the land in question for building purposes, apart from the effect they would have on the quarry. Cross-examined at some length as to the possibilities of the tunnel having any effect on the surface of the land, he maintained that persons might in consequence refuse to purchase.

The case for the Water Board was opened by calling evidence to show that the Hall Dale quarry was not a good one, and that the action of the Board would not increase the cost of working it. One witness stated that, in his opinion, from an examination of the Company's books, the quarry was not worked at a profit.

At this stage, a consultation took place between the leading Counsel on either side. As a result,

Mr. BALFOUR BROWNE stated that the parties had agreed to terms. He asked the Umpire to make an award for £3750; remarking that, under section 32 of the Lands Clauses Act, this would carry costs.

A great deal of interest was manifested in the case, as it is understood that there are other large claims against the Water Board, including one of considerable amount in connection with the estates of the Duke of Devonshire.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Aberdeen Town Council yesterday, the Gas Committee reported that they had had under consideration section 53 of the Aberdeen Extension and Improvement Act, 1883, which provides for the regulation of the traffic on the railway from Waterloo Quay to the gas-works. It appeared to the Committee to be desirable that the regulations should be amended so as to afford further facilities for the increasing traffic in connection with the gas-works. The Committee accordingly recommended that amendments for this purpose be inserted in a proposed Provisional Order. The Council agreed to the recommendation, and appointed a Sub-Committee to confer with the Harbour Commissioners on the subject.

Mr. Adam Macpherson, who was Manager and is now Chairman of the Kirkcaldy Gas Company, Limited, in addition to having a gas transfer on hand at home, has been called in to a forthcoming transfer at Fraserburgh, having been appointed Arbiter on behalf of the Fraserburgh Gas Company, Limited.

During the past week or two, negotiations have been in progress between the Corporation of Glasgow and adjacent burgh and county authorities with regard to a contemplated extension of the boundaries of the city of Glasgow, and the consequent amalgamation of suburban burghs with the city. Speaking the other evening at a meeting of electors, Treasurer Graham said there would have been no question of amalgamation had it not been for outside people threatening that they desired to go in for a Gas Board and a Water Board. These people did not want to take any of the responsibilities of these undertakings, but to take them as they stood at present, with the capital very largely paid off—by one-half at least—and simply assist Glasgow in their management. Glasgow would not agree to such a policy. The only way to meet the matter was by going forward for a large extension of the city area to those districts which Glasgow supplied with gas and water, and to be able to say that they formed one community. Certain representatives of Govan had spoken very strongly about the Gas Consolidation Bill, as if Glasgow had endeavoured to obtain something that was not in the Bill. As a matter of fact, the question of consolidating various Acts had been before the Corporation for a long series of years. Two years ago it was the Tramways Acts, and in the last session of Parliament it was the Gas Acts which were consolidated. The Glasgow Corporation were very desirous of having differential rates for large consumers of gas, because it was thought that the Corporation would thus be able to supply some of the large consumers who at present could make their own gas cheaper. Such an arrangement would permit the Corporation to use their plant in the summer time, when it was practically idle, and enable them to reduce the price of gas to all consumers. To say that the Glasgow Corporation endeavoured to take advantage of Govan was entirely wrong. One of the Govan critics referred to the indebtedness of Glasgow—saying it was £17 per head of the population; whereas in Govan it was only £4 per head. The fact was that from £12,500,000 to £13,000,000 of the city's indebtedness was incurred by the great commercial undertakings—gas, water, tramways, and electricity departments—which were earning good revenues, and which were well managed. Apart from the sum mentioned above, the indebtedness of Glasgow was £4 10s. or £4 15s. per head of the population. At a meeting of the Corporation on Thursday, a Special Sub-Committee on Amalgamation recommended suspension of the Standing Orders so that a resolution to proceed with a Provisional Order for the extension of the city boundaries might be moved. The areas proposed to be taken in extend to 22,000 acres, contain a population of 275,000, and have a valuation of £1,684,000. There was a discussion upon the subject, held in private, for two hours; and then a division was taken which brought out 43 in favour and 29 against. As there was not a two-thirds majority, the proceedings were brought to a stop meantime. It is understood that there was unanimity as to the necessity for amalgamation, but that it was considered desirable that there should be more friendly negotiations with the other bodies before the question is moved further in. These negotiations it is proposed to resume after a few months have passed.

Bailie Anderson, the Convener of the Gas Committee of the Hamilton Town Council, addressing the electors the other evening, said they had one of the finest-equipped works in Scotland, and, with two exceptions in England, the cheapest gas in Britain. They were specially fortunate in their officials at the gas-works.

On Monday, in the Dean of Guild Court in Dumbarton, authority was granted to proceed with the erection of a coal-store and retort-bench at the Corporation gas-works, the Contractors for which are West's Gas Improvement Company, Limited, of Manchester.

In the course of the present municipal election, Provost Skinner, of Inverurie, stated at a public meeting that a motion would be considered at the next meeting of the Town Council as to the acquisition of the gas-works. He was in sympathy with the movement; but the matter would have to be very carefully considered. If he found that it was to be for the benefit of the ratepayers, he would support the proposal. Mr. A. F. Young, one of the municipal candidates, strongly supported the proposal, thinking that it would mean a supply of cheaper gas for the ratepayers.

The Hospital Sub-Committee of the Aberdeen District Committee of the Aberdeen County Council reported on Monday that they had again had under consideration the question of whether Summerfield Hospital should be lighted by electricity or gas; and they recommended that the lighting be by gas. The estimated cost of introducing the light was £127, and the annual charge from £12 to £15. Gas is to be supplied by the Corporation of Aberdeen at the same price as in the city—2s. 6d. per 1000 cubic feet. The recommendation was adopted.

The Directors of Meters Limited have declared interim dividends to the 30th of September last at the rates of $5\frac{1}{2}$ and 4 per cent. per annum on the preference and ordinary shares respectively.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 29.

Sulphate of Ammonia.

The market opened with a strong tone, and full prices continued to be paid in the early part of the week; but the month's requirements having been filled, the position has become somewhat easier, and the closing values are barely steady at £13 per ton f.o.b. Hull, £13 1s. 3d. per ton f.o.b. Liverpool, and £13 3s. 9d. per ton f.o.b. Leith, for early shipment. In the forward position, no new first-hand business has transpired; but it is reported that sales have been made by dealers for delivery over the first half of next year at a discount on current values, though for this period makers are still quoting the prices now ruling.

Nitrate of Soda.

There is a better feeling in this article, but so far quotations remain without alteration at 9s. 4½d. per cwt. for 95 per cent. quality, and 9s. 7½d. for refined, on spot.

LONDON, *Oct.* 31.

Tar Products.

The markets for tar products have been fairly steady throughout the past week. Creosote has not improved, and new orders are scarce. Benzols are steady for prompt; but improved prices cannot be obtained for forward. Crude carbolic still remains in a somewhat unsatisfactory state. Solvent naphtha is in fairly good position, and a little business has transpired at present market prices. Heavy naphthas are steady, and a fair amount of business has been transacted of late. In pitch, the market has been quiet, and new orders are scarce.

The average values during the week were: Tar, 17s. 3d. to 20s. 9d. *ex* works. Pitch, London, 34s. to 34s. 6d.; east coast, 33s. 6d. to 34s.; west coast, 37s. to 38s. 6d. Clyde ports, 32s. 6d. to 33s. Manchester, 33s. 6d. to 34s. Liverpool. Benzol, 90 per cent., casks included, London, 7¾d. to 8d.; North, 7½d. to 7¾d.; 50-90 per cent., casks included, London, 7¾d. to 8d.; North, 7½d. to 7¾d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4d.; North, 3⅛d. to 3¼d.; solvent naphtha, casks included, London, 11½d. to 1s. 0½d.; North, 11d. to 1s.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 10½d. to 11d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2⅛d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article has remained very firm, and prices continue to improve. Actual Beckton is quoted £12 2s. 6d.; outside London makes, £12 10s.; Hull, £13 1s. 3d. to £13 2s. 6d.; Leith, £13 5s.; Liverpool, £13 2s. 6d.; and Middlesbrough, £13 2s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is still irregular; and the lack of steamers at some of the ports causes the shipments to be restricted in some instances. In steam coals, there is variation in the quotations; best Northumbrians being from 9s. 3d. to 10s. per ton f.o.b., according to the position of the colliery. Second-class steams are from 8s. 6d. to 8s. 9d.; and steam smalls are from 5s. 3d. to 6s. 6d. Work is fair at the collieries, and seems likely to continue so, if shipments are normal. In the gas coal trade, the demand now shows a steady increase; but steamers have been scarce, and higher freights have been needed to ensure tonnage to take the enlarged quantities required on the long contracts. Durham gas coals vary in price. The usual classes are from 8s. 6d. to 9s. 9d. per ton f.o.b., according to quality; and for "Wear" specials, about 10s. 3d. per ton is the f.o.b. price. There are few contracts in the market at present. Some sales, however, are being negotiated for Italian ports at 16s. per ton delivered at Genoa. Coke is firmer; and for good gas coke 13s. 6d. to 14s. per ton f.o.b. is now quoted.

Scotch Coal Trade.

The market has been fairly active; the home demand continuing the least satisfactory. It may be said that the coal trade is waiting for the settlement of the trouble in the shipbuilding industry. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 335,424 tons—an increase of 6087 tons upon the preceding week, but a decrease of 11,322 tons upon the corresponding week last year. For the year to date, the total shipments have been 13,123,095 tons—an increase upon the corresponding period of 698,073 tons.

An Elective Auditor on the St. Helens Gas Undertaking.—The following is an extract from the account in the "St. Helens Reporter" of the Elective Auditor's report on the working of the gas undertaking in the last financial year: "I have again to point out that the gas account shows a substantial balance on the year's working, and is again able to help the borough fund by a solid amount to relieve the rates, and thus relieve the general burden of rates to the ratepayers year by year. We now look forward to this department to furnish the means whereby the rates are kept down. The balance profit on the year's working from April 1, 1909, to March 31, 1910, is £9298 19s. 11d., which it has been decided to apportion as follows: To capital account, extension of mains and services, £1896 19s. 1d.; to works improvement account, £2402 0s. 10d.; to borough fund account (to relieve the rates), £5000—total, £9298 19s. 11d. The ratepayers of St. Helens have every occasion to be proud of their gas undertaking; and the credit for the success of this undertaking is largely due to the efficiency of the Gas Engineer, Mr. S. Glover, whose genius and inventive ability have made St. Helens famous for its up-to-date means of producing gas all over the world."

Aldridge Gas Company to be Wound-Up.—At an extraordinary general meeting of the shareholders of the Aldridge Gas Company, Limited, held recently at Walsall, a resolution was passed to the effect that the Company should be wound-up voluntarily. Mr. W. J. Cooke, of 145, Lichfield Street, Walsall, the Secretary of the Company, was appointed Liquidator.

New Joint-Stock Companies.—Hotton Malleable Fittings Company, Limited, has been registered with a capital of £300, in £1 shares, to carry on the business of dealers in malleable and other gas-fittings, meters, pipes, and apparatus, &c. Under the title of Ernst Hildebrandt, Limited, a Company has been registered with a capital of £5000, in £1 shares, to carry on the business of manufacturers of ceramic articles and accessories used in the incandescent gas light industries; also to acquire the undertaking in England of the Vereinigts Magnesia Company and Ernst Hildebrandt Aktiengesellschaft of Pankow-Berlin.

Unprofitable Electricity Supply by the Stalybridge Joint Board.—In the course of the proceedings at a recent meeting of the Ashton Town Council, reference was made to a reported offer from the Stalybridge, Hyde, Mossley, and Dukinfield Joint Electricity Board to supply the Ashton Corporation with current at a lower price than that at which it could be produced at Ashton. Alderman M. L. Hall said that no such offer had been received; but he did not agree that the Joint Board could produce current at a cheaper rate than Ashton. During the last five years, the Ashton undertaking had made a considerable profit; whereas the Board for the same period showed a loss of £13,019. These figures spoke for themselves; and no further comment was required.

Sale of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards sold three new issues of capital by order of Directors. The first lots consisted of £4000 of additional ordinary consolidated "A" stock of the Bognor Gas Company, ranking for a standard dividend of 5 per cent. per annum, but carrying 5¾ per cent. from the 7th inst.; and it was all sold at from £110 to £112 per £100. Next came an issue of £2000 of 4½ per cent. perpetual debenture stock of the Company, which fetched from £100 to £101 per £100. A new issue of £10 "B" 7 per cent. shares in the Grays and Tilbury Gas Company, carrying £5 12s. per cent. per annum as from the 11th inst., was placed at £10 10s. to £10 12s. 6d. per share. The last lots offered were some £10 "B" 8 per cent. shares in the Tendring Hundred Water Company, carrying dividends at the rate of 4½ per cent. per annum; and they realized from £10 12s. 6d. to £11 each.

We understand that the makers of one of the exhausters erected at the new Padiham Gas-Works recently opened—as reported in the last two issues of the "JOURNAL"—were Messrs. George Waller and Son, of the Phœnix Iron-Works, Stroud, Glos.

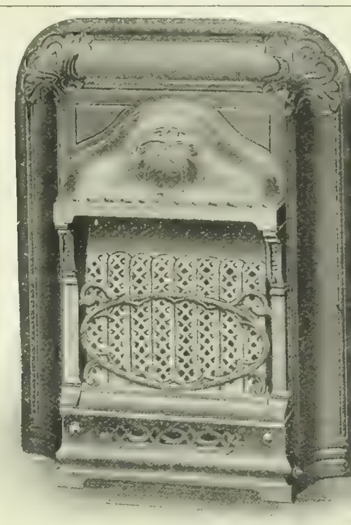
Last Tuesday, a disastrous fire occurred at the premises of the Bland Light Syndicate, Limited, in Fennel Street, Manchester. Such was the extent of the conflagration, that the place was completely gutted. Notwithstanding this, however, owing to the large stock the Syndicate have in hand for the season's requirements, all orders are being executed expeditiously direct from the works.

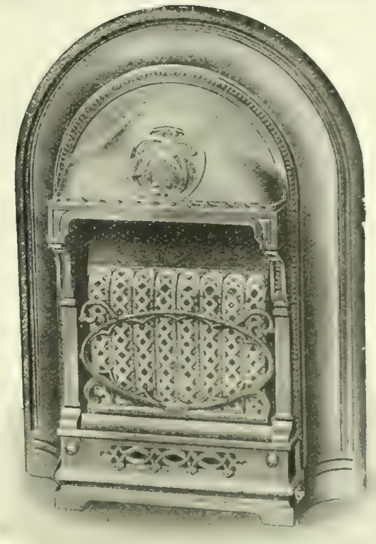
A report has been presented to the Eccles Town Council as to the experimental supply of electricity for lighting a block of houses belonging to the Corporation. It was stated that the supply was unlimited; there was one meter for the whole block; and the charge was 6d. per week per house added to the rent. Alderman Pearson said the cost had worked out at about 4d. per week per house; and the Committee were prepared to treat with any owner of property who would light a block of about twelve houses and pay on the basis of the rent.

An agreement has been arrived at in the dispute between the Paignton District Council and their former Water Engineer, Mr. Vanstone. The point at issue was as to the remuneration to be allowed for Mr. Vanstone's services in connection with the arbitration proceedings under the contract for the water-works. It has now been arranged that he shall be paid £225 in full and final settlement, and that he shall receive such documents in the Council's possession as are his private property, and hand over any plans and papers belonging to the Council which he may have.

According to a paragraph in the "Daily Mail" last Friday, Mr. Henry Claridge, an engineer, was attacked by a number of young men, and received a severe scalp wound, as he was leaving the premises of the Gaslight and Coke Company at Bow Common last Wednesday night. It is reported that the members of this gang have lately terrorized the neighbourhood. They were pursued by the police and a crowd of people; but the men kept their passage clear by firing their revolvers at random. A young man was shot in the shoulder, and had to be taken to the Poplar Hospital. No arrests were effected.

We have received from Messrs. J. & W. B. Smith, of Farringdon Road, E.C., the new shop lighting list they have just issued, accompanied by a sheet of artistic and up-to-date fittings for domestic lighting. The list shows the firm's "Silva," "Graetzin," and "Imperial" lamps. The first-named lamp, which they put forward as an ideal one for both inside and outside shop lighting, is shown dissected, so that the simplicity of its construction, and the ease with which any part can be replaced, are apparent. The lamp is also made with a parabolic reflector of new shape. The "Graetzin" high-power outdoor lamps working at low pressure are suitable for lighting all large areas; and the "Imperial" is a regenerative indoor lamp. For all these lamps a lighting efficiency of about 31 candles per cubic foot is claimed. The rest of the list is occupied with illustrations of suitable fittings for inside shop lighting, "Glasmi" mantles, and patterns of inverted gas-burners, all British made. On the last page are shown samples of advertising screens for gas-lamps. We learn that this neat and concise list is being sent to all the gas companies in the United Kingdom, accompanied by an offer by the firm to send a supply, free of charge, with the Company's name and address printed thereon, and the amount of discount they are prepared to allow on the prices stated. They consider the distribution of these booklets among a gas company's customers should lead to increased business.





Messrs. Fletcher, Russell, & Co., Limited, ask us to state that the competition advertised on p. II. of our issue of Oct. 18, under the title of "The Luxury of the Geyser," will close on Nov. 30—that is to say, all designs must reach the Palatine Works, Warrington, not later than the evening of that day.

The Manchester Smoke Abatement Society have decided to promote an exhibition of ways and means of preventing or reducing smoke. The date of the exhibition has been fixed as from Oct. 16 to Nov. 4 next year. A deputation from the Bradford Electricity Committee, who recently paid a visit to the Glasgow Smoke Abatement Exhibition, have come back impressed with the importance of holding such an exhibition in Bradford; and this forms one of their recommendations to the Council. In one detail the exhibition was considered incomplete—no special grates or other inventions for the prevention of smoke in steam-boilers being shown. The chief object aimed at, they say, appears to have been to encourage the extensive use of gas and electricity for domestic purposes (as well as power), and so greatly to reduce the number of house-fires. The deputation formed the opinion that the Glasgow exhibition was a complete success from this point of view, and that a similar exhibition in Bradford would not only be of advantage to the electricity and gas departments, but would tend to the promotion of good health and sanitation in the city.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEER AND MANAGER. Pontypridd and Rhondda Joint Water Board. Applications by Nov. 14.
CHEMIST AND WORKS MANAGER (FACTORY). Applications to E. White, c/o Hopkins and Williams, Hatton Garden, E.C.
DRAUGHTSMAN. No. 5307.
ANALYST (JUNIOR). No. 5308.

Situation Wanted.

GENERAL MANAGER (GAS FITTING, &c., TRADE). T. L. Cuttell, Stockton-on-Tees.

Plant, &c. (Second-Hand), Wanted.

JET PHOTOMETER. No. 5309.

Patent Licence, &c.

ACETYLENE GAS GENERATORS. Haseltine, Lake, and Co., Southampton Buildings, Chancery Lane, W.C.

Stocks and Shares.

CITY OF ELY GAS COMPANY (BY AUCTION). Nov. 8.
GAS METER COMPANY (BY AUCTION). Nov. 8.
LOWESTOFT WATER AND GAS COMPANY (BY AUCTION). Nov. 8.
PINNER GAS COMPANY (BY AUCTION). Nov. 22.
TAUNTON GASLIGHT COMPANY (BY AUCTION). Nov. 7.

Meeting.

ORIENTAL GAS COMPANY. London Office. Nov. 16 Twelve o'clock.

TENDERS FOR

Fire-Clay Goods.

BRADFORD CORPORATION. Tenders by Dec. 1.
SHEFFIELD GAS COMPANY. Tenders by Nov. 8.

Pipes, &c.

DEVONPORT GAS DEPARTMENT. Tenders by Nov. 12.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

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See Illustrated Advertisement, Oct. 25, p. 238.

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PONTYPRIDD AND RHONDDA JOINT WATER BOARD.

THE above-named Board invite Applications for the Appointment of ENGINEER and MANAGER to the Board, which has been formed for the purpose of acquiring the undertaking of the Pontypridd Water-Works Company.
Candidates must have a thorough practical knowledge of Water Engineering in relation both to the Storage and Distribution of Water, as well as the Detection and Prevention of Waste, and must also have had previous Experience in the Management of large Water Undertakings.
Salary, £350 per Annum.
The person appointed will be required to devote the whole of his time to the duties of the Office.
Applications, stating Age, Qualifications, and Experience, accompanied by Three recent Testimonials, should be sent to the undersigned addressed to him at his Offices in Mill Street, Pontypridd, marked "Engineer and Manager," not later than Monday, the 14th day of November, 1910.
Dated this 21st day of October, 1910.

W. P. Nicholas,
Clerk to the Board.

JET Photometer Wanted, with all Accessories, Second-Hand.
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COUNTY BOROUGH OF DEVONPORT.
(Gas Department.)

TENDERS are invited for the Supply of CAST-IRON MAINS and SPECIALS required by the above Department.
Specification and Form of Tender, together with other Particulars, may be obtained from the undersigned.
Tenders, endorsed "No. 3," addressed to the Town Clerk, Devonport, to be delivered on or before Nov. 12, 1910.

W. P. Tervet,
Engineer and Manager.

Gas-Works, Devonport,
Oct. 26, 1910.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the Supply of SILICA and FIRE-CLAY GOODS required at their Works during the next Twelve Months.
Specifications and Forms of Tender may be obtained upon Application to the Company's Engineer, Mr. J. W. Morrison, Commercial Street, Sheffield.
The Directors do not bind themselves to accept the lowest or any Tender.
Scaled Tenders, marked "Tender for Fire-Clay Goods," must be delivered by post to Mr. Hanbury Thomas, Managing Director, not later than the first post on Tuesday, Nov. 8.

Wm. Hamby,
Secretary.

Commercial Street,
Sheffield, Oct. 18, 1910.

TO RETORT MANUFACTURERS.

THE Bradford Corporation are prepared to receive TENDERS for the Supply of GAS RETORTS, and of FIRE-BRICKS and FIRE-CLAY required in the fixing of such Retorts, during the Year 1911.
Form of Tender may be obtained on Application to Mr. Chas. Wood, Gas Engineer, Town Hall, Bradford.
Tenders, endorsed "Tender for Retorts," to be sent to me so as to arrive on or before Thursday, the 1st of December.
The Contract will be let subject to the Fair-Contracts Clauses of the Corporation, which may be seen at the Town Clerk's Office, and which the accepted Contractor will be required to sign.
The lowest or any Tender will not necessarily be accepted.

Frederick Stevens,
Town Clerk.

Town Hall, Bradford,
Nov. 2, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES.
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£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 8, at Two o'clock, in Lots.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of Executors and Other Owners.
THE GAS-METER COMPANY,
73 £10 FULLY-PAID ORDINARY SHARES.

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£300 ORIGINAL CAPITAL STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 8, at Two o'clock, in Lots.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
PINNER GAS COMPANY, LIMITED.

NEW ISSUE OF 800 £5 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 22, at Two o'clock, in Lots.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
TAUNTON GASLIGHT AND COKE COMPANY.

ISSUE OF £3000 NEW STOCK (PAYING £7 17s. 6d. PER CENT.).

WILLIAM J. VILLAR and Co. will SELL THE ABOVE BY AUCTION, at the Castle Hotel, Taunton, on Monday, Nov. 7, at 3.30, in Lots.
Particulars of the Auctioneers, 10, Hammet Street, Taunton.

THE Proprietor of the Patent No. 24,463, of 1907, for "IMPROVEMENTS IN ACETYLENE GAS GENERATORS," is desirous of entering into Arrangements, by way of LICENSE and otherwise, on Reasonable Terms, for the purpose of EXPLOITING the same and ensuring its Full Development and Practical Working in this Country.
All Communications should be addressed in the first instance to Haseltine, Lake, and Co., Chartered Patent Agents and Consulting Engineers, 7 & 8, Southampton Buildings, Chancery Lane, London, W.C.

ORIENTAL GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that an ORDINARY GENERAL MEETING of this Company will be held at the Company's Office, Finsbury House, Blomfield Street, London, E.C., on Wednesday, the 16th day of November, 1910, at Twelve o'clock noon precisely, for the following purposes: To receive the Directors' Report and the Accounts of the Company for the Year ended the 30th of June, 1910; to declare a Dividend; and to elect Directors and Auditors in the place of those retiring.

The TRANSFER BOOKS WILL BE CLOSED from the 2nd to the 24th of November, both days inclusive.

By order of the Board,
H. J. Luff,
Secretary.

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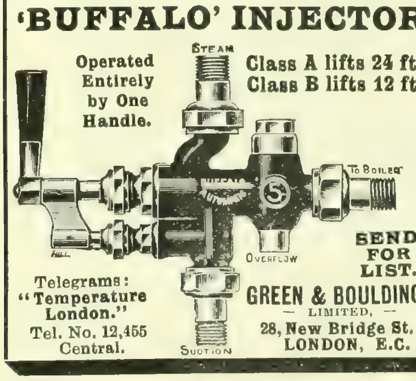

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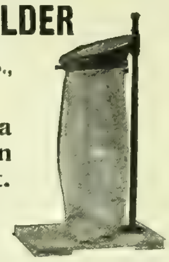

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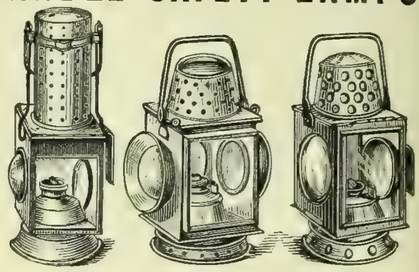

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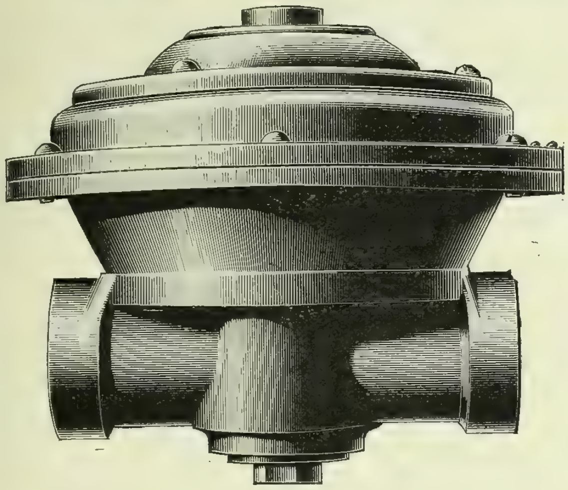

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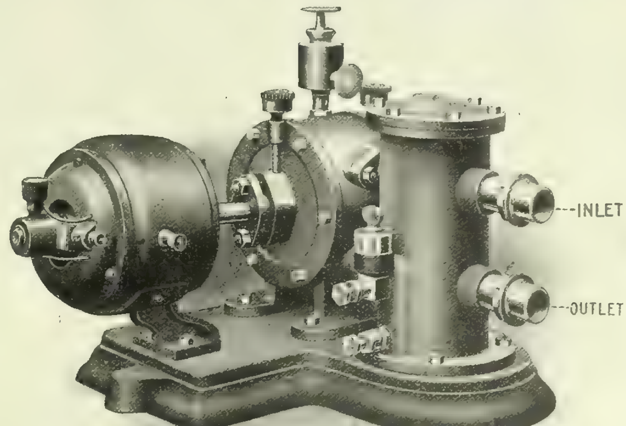

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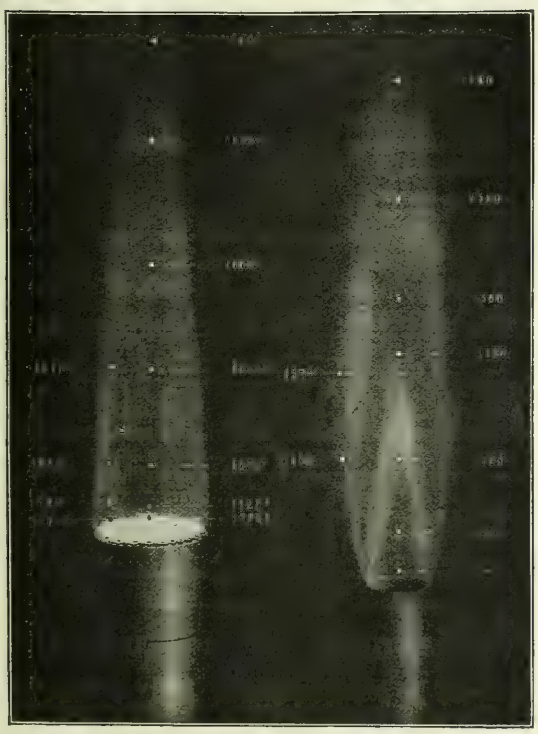

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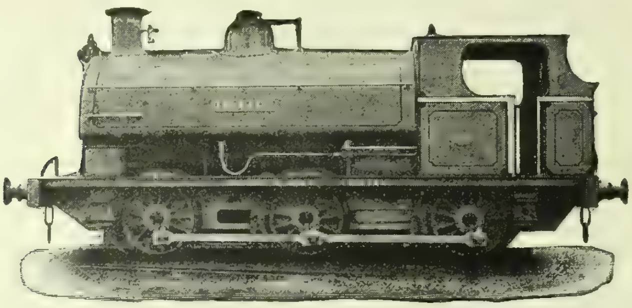

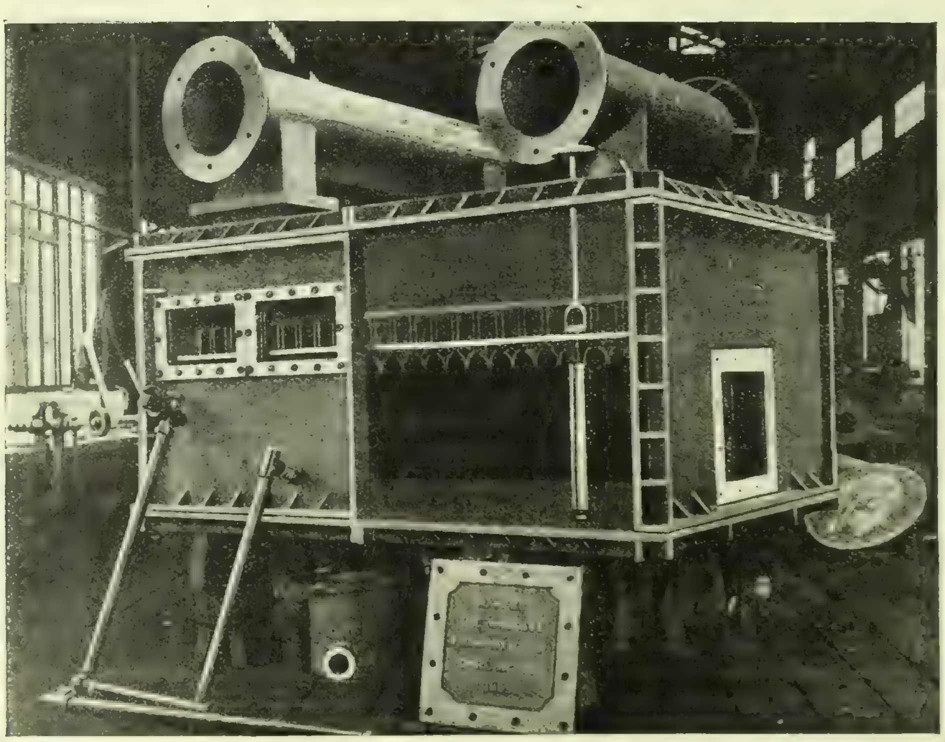

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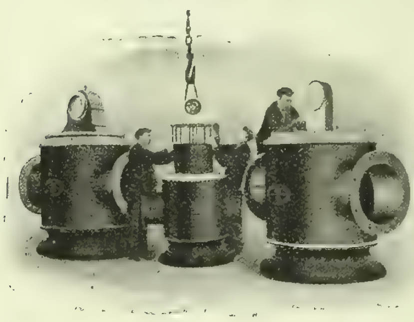

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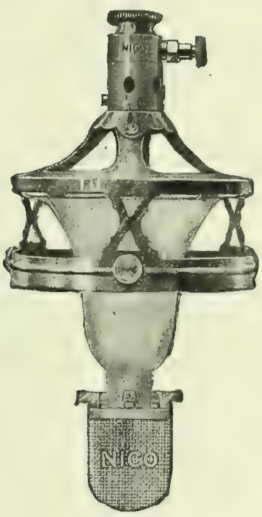

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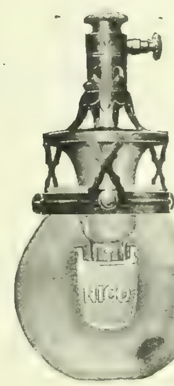

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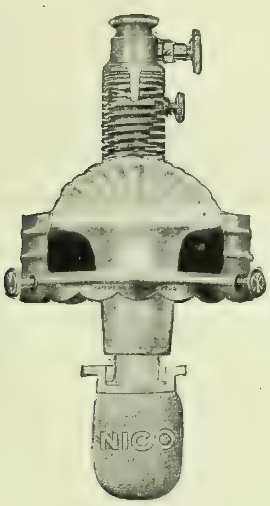

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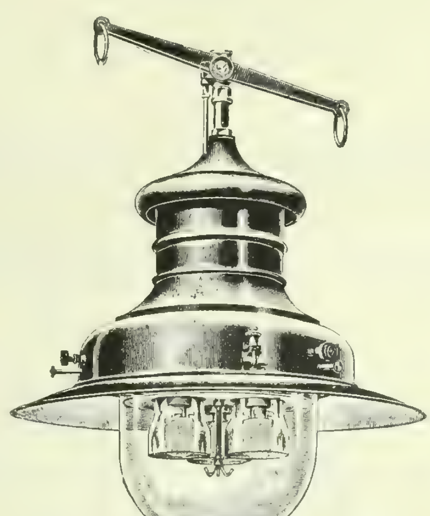

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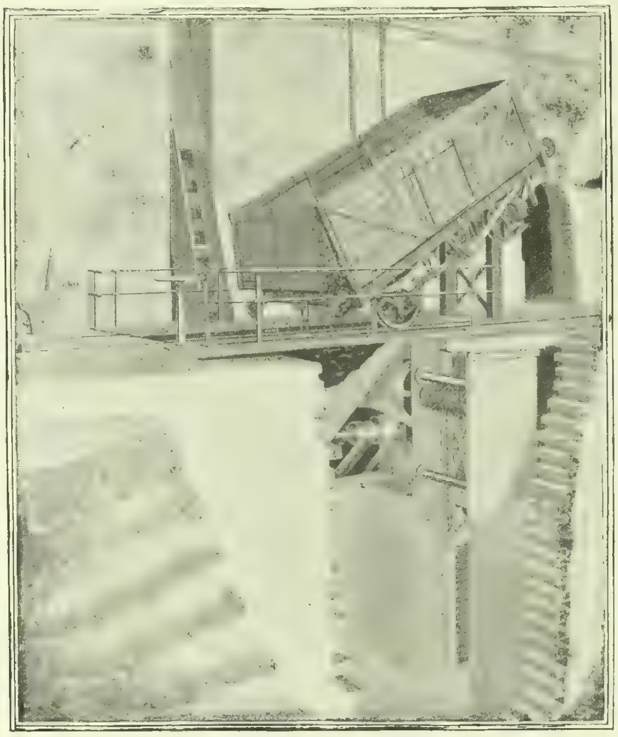

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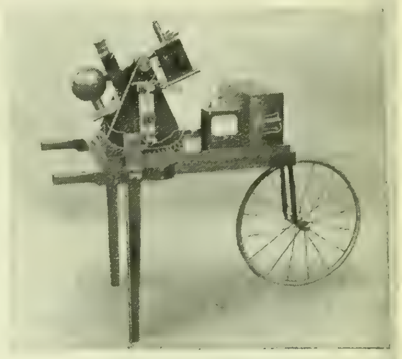

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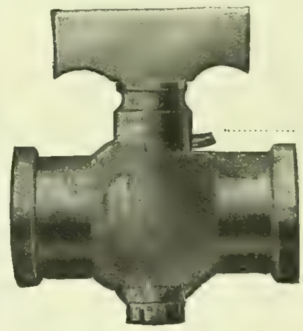

A

Fig. 1. The Old Style with the Old Trouble. Note the Pin **A.**

Buyers of Gas Fittings are familiar with the trouble constantly arising through the Stop Pin of the Tap or Cock getting bent or broken, or falling out, thus leaving the Tap without a Stop, and leading to great danger of an escape of Gas.

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renders the old Stop Pin unnecessary and is an absolutely **Safe and Permanent Stop.**

The projection shown in Fig. 3, marked **B,** working in the recess shown in Block, allows the Tap to be turned only so far as the recess extends. There is no possibility of the Tap turning further round as there is no Pin to become displaced or broken.

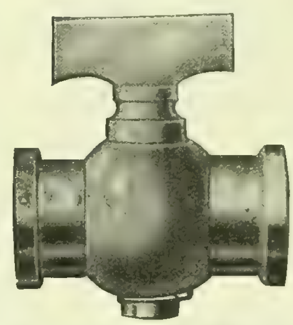
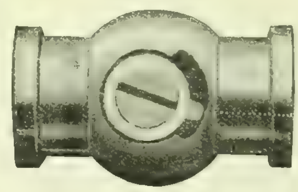


Fig. 2. **Evered's Patent "Safety Stop."** No Pin. No trouble.

Any fitting specifically so ordered will be made with the "Safety Stop."



B

Fig. 3. Underside showing "Safety Stop" in lieu of Pin.

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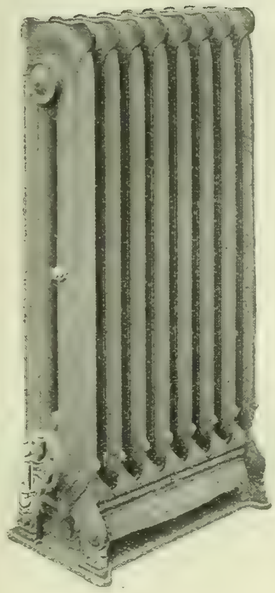

There are good reasons, and here is one—

These Radiators are so constructed that the gas flame cannot impinge on the underside of the loops, and so perfect combustion is ensured.

The "MARS" is, therefore, absolutely odourless!

Other reasons will follow.

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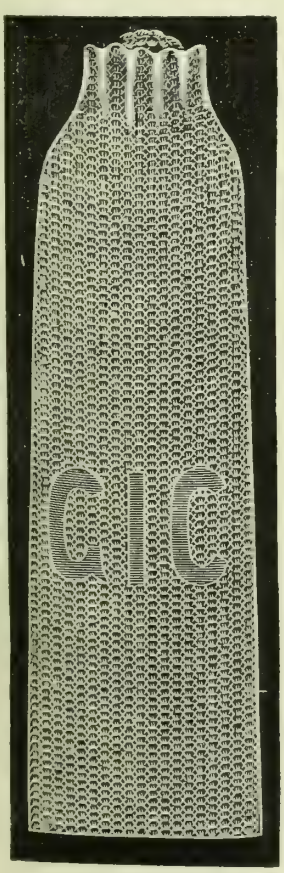

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

Editor & Publisher: WALTER KING. Office: 11, Bolt Court, Fleet St., London.

VOL. CXII., No. 2478.——TUESDAY, NOVEMBER 8, 1910.

EDITORIAL NOTES—GAS, &c.

The Standard Burner Bills.

Active Assistance Imperative.

Duty calls! It is impossible to too strongly urge upon the administrators and officials of gas undertakings throughout the country the importance of taking steps, in the defence of the interests of the whole gas industry, to defeat the opponents of the Standard Burner Bills in their last and strenuous endeavour to overthrow these measures, which have withstood the fiercest possible attack through their parliamentary career to the present and final stage, which, in other circumstances, would be a simple formality. Opposition now, as we have said before, savours of pure vindictiveness; and the opponents are unfortunately not at all particular as to the methods they employ in gaining their end. Their present action is unjustifiable and is entirely antagonistic to fair play and justice. They are attempting to go behind the verdicts of the Committees of the House of Lords and the House of Commons, and are trying to enlist the votes of a tribunal the majority of the members constituting which do not understand the question, through not having heard the evidence for and against the Bills such as was submitted to the Committees.

Influence, and not argument or evidence, is the weapon that is now being employed in the effort to cancel the success of the Bills, which, it is of the utmost importance to the gas industry as a whole, should be entered upon the Statute Book this session. Perforce, though much against the grain in such a matter as this, the only method open to the promoters is to meet the present action of the opponents by asking that all possible influence shall be brought to bear upon Members of Parliament to vote in favour of the Bills, and so support the verdict of one of their own Committees, uphold the custom of the House in dealing with Bills ratified as these have been, and protect Committee procedure from the designed violation. We have to recognize that Local Authorities and their chief officials—the Town Clerks—are in an exceptionally strong position in getting the ear of local Members of Parliament. From several quarters it is heard that the Liverpool Corporation are communicating with local authorities throughout the country—whether or not interested in the matter of the standard gas-burner—with the view of getting them to stir up their Members of Parliament to oppose the consideration. We can quite imagine—and this is a bad feature of the fresh tactics—that many Town Clerks will take upon themselves the responsibility of writing to Members of Parliament asking for support to the opposition merely because they are desired to do so by the Town Clerk of Liverpool. Already, we believe, in several cases—we know that it was so on second reading—Members of Parliament have pledged themselves to oppose the consideration without making any inquiries whatever into the matter. And this is what passes for statesmanship among some—we hope very few—Members of Parliament.

In the interests of the gas industry, the Gas Committees of local authorities throughout the country should object to the Clerk or Town Clerk making any communication whatsoever to Members of Parliament on the subject; and where Town Clerks have without formal instruction sent appeals to Members of Parliament, and the information of this having been done is obtained, the question of authority should be raised in the Council Chambers. All gas companies throughout the country should also use their influence—at once—with their local Members of Parliament and with their gas shareholders who are also members of the House to obtain their support to the Bills. It is important. It is a case in which—unfortunately, but imperatively—like must be met with like. There is no alternative.

We make this appeal to supplement one that is now being issued by the Parliamentary Agents of the Bills (Messrs. R. W. Cooper and Sons) to all gas undertakings with an output of over 10 million cubic feet. The consideration of the Bills stands adjourned to the 15th inst.; but the date for the discussion has not yet been fixed. It will, however, be recognized that no time must be lost. The opponents are hard and actively at work. Their action, after the fair trial of the question in both Houses, is nothing short of an iniquitous attempt to degrade parliamentary procedure in respect of Private Bill Legislation. On all grounds, everything that can be done must be done to frustrate them; and we hope Members of Parliament will rise superior to the singularly false position in which the vindictiveness of the opponents of the Bills seeks to place them. Once more we urge all gas companies to immediately take the action that they are fortunately in the position to take.

Reflections.

It is a poor gas-works, and poor administrative and engineering policies, that do not reflect something from which every technical and commercial man connected with the industry can learn something. We hazard the opinion, with a considerable amount of assurance, that there were few, if any, of the members of the Manchester District Institution of Gas Engineers who visited the Stretford Gas Company's works last Saturday week (as already fully reported in the "Journal"), and who were subsequently present at the luncheon to which they were invited by the Board of the Company, and heard the breezy, broad-minded speeches of the Chairman (Mr. Lewis Galloway) and of the Deputy-Chairman (Mr. W. A. Nicholls), who did not add something to the knowledge that they before possessed. We are not holding up the Stretford works, nor the engineering and commercial policies, as paragons of their kind. They are but an example of many others, in which there are individual characteristics that produce certain effects. By their fruits we know them; and the fruits of the Stretford Gas Company are something of which the Board and their Engineer (Mr. H. Kendrick), the President of the Manchester Gas Institution, may well be proud. They reflect worthily upon the Engineer, and upon a Board having true co-operative relationships with their chief technical and commercial adviser. The policy of the Board, and the broad view they take of the affairs of the industry, were reflected in the speech made at the luncheon by the Deputy-Chairman. Would that all Boards of Directors and Committees were animated by the same spirit. If it were so, the gas industry would have fewer of those obstructive boulders in the path of progress that short-sightedness and reticence to afford help for the general good place there.

Mr. Galloway, Mr. Nicholls, and their colleagues can see no finality in the gas industry; and they recognize that "a "rest and be thankful policy" is the best possible for bringing about a premature check to advance. The inherent vitality of the gas industry has been markedly disclosed during the last few years; and the position it has attained in the general economy of things is the most amazing part of the history of gas manufacture and supply during those years in which it has had to meet a competition from electricity conducted on lines and principles that are unusual in the ordinary competitive strife of the business world. In the case of Stretford, the economy reached is seen in the production now of above 12,000 cubic feet of gas, per ton of coal carbonized, of good illuminating and calorific qualities, and selling for power and lighting at prices between 1s. 11d. and 2s. 3d. In the liberal commercial methods, in the plans adopted for ensuring the satisfactory use of the appliances sent out to the consumers, we trace some of the causes contributing to the approximately 50 per cent. daylight load in the summer, and a load working gradually up to the same ratio in the winter. Results such as these speak loudly. They are of the hard facts that refuse to be ignominiously dismissed and belittled. Boards of directors and committeemen must be sympathized with for a deficiency of mental capacity if they cannot recognize the causes and the forces, together with the sources, contributing to these things. The

individual is the main source, and upon him rests the responsibility. But the initiative of the individual and the capacity for good must have, in varied degree truly, their limits. But beyond there is technical organization and cooperative effort. There is the reflection in the speeches of the Stretford Chairman and Deputy-Chairman that, giving encouragement in these directions, is, apart from the immediate concerns of their own undertaking, one of the best ways of contributing to the individual and collective good of the numerous units that go to make up that which we combine under the single title of the gas industry.

We look to other parts of the proceedings on the occasion of this particular meeting. There is one direction in which they reflect work that calls for pursuit. An important work in the interests of the gas industry is the provision of facilities for the broadening of knowledge among the technical and commercial juniors. The report that was presented regarding the Manchester University lectures only reiterated intelligence already published. But, nevertheless, congratution falls due to the Senior Institution for the part taken in assisting the movement to this end on behalf of the Manchester and District Junior Gas Association. But there is another stratum of workers attached to the industry that need, perhaps in some districts more than in others—sadly need we were almost saying—educating in all up-to-date methods of gas utilization; and those are the fitters employed by firms engaged in gas fitting and plumbing business outside the gas undertaking. Lamentable (more lamentable than ever in view of the expansion of fitting work in gas lighting, heating, and hot water supply) is the amount of ignorance that is found among them. Not long since an instance came under notice where a man was sent to fit up, in a private house, a pendant for a cluster of small inverted burners; and he left the whole of the latter without adjustment, simply through a want of knowledge as to the purpose of the gas-regulators. The Manchester Gas Institution have been taking steps in an effort to remedy this state of things in their area; and when they have got well on the way in the making of provision for this, they find failure in their precise purpose coming through the very men whose attendance is required at the classes being altogether indifferent. With men of this kind, there is a certain amount of pride that has to be tenderly handled. They want to know what the technical schools can do in teaching them the business in which they have been engaged both man and boy. They have to be shown that what is desired is to simply supplement the knowledge already possessed by information regarding modern developments. With the apprentice or the improver in gas-fitting work, the difficulty of getting hold of them for technical instruction is not so very great; but the immediate purpose is to attract the men who are doing the practical work of the day in this line. And the only way to get to them will be through their employers. Surely the masters must see that the greater the knowledge of their men, the better for the work that is undertaken; and it should be to their interest to give their men all the encouragement possible. Would not a conference with the master fitters enlist their aid in this matter? At any rate, if not already tried, it might be found to be productive of some good effect.

Then the Presidential Address with which Mr. Kendrick inaugurated his year of office in February is found to reflect many things that he has found useful in the conduct of the works under his charge, and the business confided to his care. They are the "wrinkles" drawn from personal and successful experience; and they are worth reading by those who missed them at the time of their publication. The discussion of the address at this meeting was somewhat disappointing. The speakers—and there were few of them—touched upon but one or two of the many matters that constitute the address. The most pertinent remarks were made on the subject of vertical retorts. There was the old complaint that there is as yet little published information that is definite regarding their capital, wear and tear, and renewal charges; and it seemed to one speaker that these costs would be greater than with horizontal and inclined retorts. It is extremely difficult for capital costs to be yet published in this country; and capital costs applying to one place and to one period are the most elusory things when places of other geographical position and when other periods are factors that come into play. As to wear and tear, the available information in this country, it must be confessed, is sparse; but from Germany we have had assurances of long life, and a condition in respect of wear and tear that compares favourably with horizontal and inclined retorts. In this matter, observation alone must disclose a condition that appears to be more favourable to vertical than to horizontal retorts. It is that the horizontal retort has to bear more strain than the vertical one, through having to carry the weight of the charges along the bottom; whereas the weight of the vertical charges do not come upon the retort itself, but is really borne by the lower part of the structure of the setting. After all, important as capital and wear and tear costs are, they cannot be the final consideration as to the financial advantage of one system over another. The final consideration must be looked for at the foot of a specially prepared balance-sheet. Coal and coke handling machinery costs more than barrows, shovels, and forks; but they are bought and installed. What for? Many initially expensive things are introduced into manufacture to produce economy or improved result which pays; and the information British engineers want is as to whether the ultimate result of adopting verticals will be in their favour as compared with horizontal retorts working in compliance with the most approved practices. In these and in many other ways, reflections of value are obtained from the meeting on Saturday week; and upon the meeting the President is to be congratulated.

The Relation of Percentage to Volume.

We have of late years been looking a little dubiously on the expression by chairmen at meetings of shareholders of the rate of increase of gas sales in terms of percentages rather than in volumes. Percentages are oftentimes misleading to the layman. To take a hypothetical illustration: Suppose a concern that twenty years ago had a consumption of 100 millions, and the rate of increase was then 5 per cent.; the business has grown meantime to 200 million cubic feet, and the increase is now at the rate of 2½ per cent. The old shareholder who does not look below the face representation of the figures jumps to the conclusion that the rate of increase in the business is on the decline, when his mind reverts from the 2½ per cent. increase of to-day to the 5 per cent. advances of twenty years and less ago; whereas the 5 per cent. of those times and the 2½ per cent. of the present day, under the circumstances named, have precisely the same value in volume.

To this matter we called attention in commenting on the affairs of the Imperial Continental Gas Association in May last. There had been a fractional reduction in the percentage rate of increase of consumption; and the Chairman (Mr. J. Horsley Palmer) had remarked upon it. It was then observed in the article in our columns: "We should like "Mr. Palmer to look at this matter of percentage increases "another way; and tell us what 5 per cent. increase in the "gas business represented in volume on the consumption of "ten and twenty years ago, as compared with that of to-day, "making allowance, of course, for the stations that have "been severed from the main body. The proprietors, we "rather think, would be very gratified with the result of "the exercise." And they were when the Chairman gave, at their meeting last Tuesday, the result of the investigation that had been made in compliance with the foregoing suggestion. His figures showed that twenty years ago a 5 per cent. increase (making the allowances suggested) meant in volume in a half year 198 million cubic feet; ten years ago, 244 millions; and in the second half of 1909, 279 millions. Now on these figures we contend that the statement as to the percentage increase does not, in view of the great divergence in the volume that a given percentage figure represents as compared with the past, do complete justice in interpreting business progress. As the progressive volume figures were read out by the Chairman representing the 5 per cent. increase at different periods, the proprietors at the meeting grasped their import and applauded. Nevertheless, Mr. Palmer is rather inclined to think that the volume figures have no interest, and that the tonnage of coal carbonized would appeal with greater effect to others than experts. We are not of that opinion. There are certain large companies with which one member of the Board of the Imperial Continental Association has acquaintance that have had considerable increases in gas made in recent times, with recession in the tonnage of coal carbonized. If the progress of these concerns was expressed in tons of coal carbonized, the proprietors might be pardoned for feeling a bit troubled. With all deference to Mr. Palmer, we still hold that to have increases of gas sales expressed in volume conveys more to the lay mind than either percentages of gas increase or tons of coal carbonized.

Radiators and Atmospheric Effects.

Some of the old forms of flueless gas radiators had, there is no question, a deservedly bad character; and this bad character seems to have left a sort of indelible impression upon the minds of the officials of the Home Office which they, with a consistency that acknowledges no possibility of progress and improvement, allow to still direct their judgment in regard to the effect of gas-radiators upon the atmosphere of workrooms and other places. To remove the false impression which tends to stifle progress in a useful application, under suitable conditions, of this form of gas heating, is work that lies immediately to hand; and undoubtedly the best procedure is to show that the new types of flueless gas radiator—gas-steam radiators confessedly stand far ahead of all forerunners—have not that noxious effect upon the atmosphere which official contumacy in refusing to recognize changed conditions and facts still ascribe to them. In view of this, what are the best steps to be taken? The answer is supplied in an article contributed to our pages this week by Mr. H. James Yates, of Birmingham, who has, in defence of this mode of gas heating and in the protection of his Company, been forced to take a prominent part in the endeavour to convince of error (it is only human under the circumstances, though perhaps not honest, to set one's back against any such convincing) the authorities concerned in the use of such heating arrangements in factories. In this work there has had to be a heavy amount of exploitation to produce evidence of an order satisfactory and of a weight sufficient to serve to rebut allegation; and it is from all this experience that Mr. Yates reduces, in the narrow compass of an article, the arguments and the advice as to what is necessary to prove to the authorities that the modern gas-steam radiator is more sinned against than sinning. The form that has been prepared, and which accompanies the article, showing all the particulars requisite in taking samples of air for analysis, has been gradually constructed from a considerable experience as to the points essential to the end in view. A contribution such as this one of Mr. Yates, dealing with a practical necessity in the cause of establishing public confidence and removing from the official mind the prejudices born in other days through the then existing inefficiency, is exceedingly serviceable and opportune in the interests of the whole gas industry.

Daylight Consumption.

Since Mr. W. J. Carpenter, of Great Yarmouth, called attention in the spring of last year, at the meeting of the Eastern Counties Association, to the fact that the growth of the daylight consumption in his supply area was, in certain months of the year, oscillating but little in the neighbourhood of 50 per cent. of the total output, many engineers have been interested to ascertain how they stand in the same respect; and not a few have found that their experience has quite a respectable resemblance with that of Great Yarmouth. Mr. Thomas Glover, of Norwich, in his Presidential Address to the Institution of Gas Engineers in 1909, attested to a movement in his own case towards an approximation with his not distant colleague's figures; and later in the year, in the discussion on Mr. Carpenter's paper, Mr. Paternoster showed that in certain months at Felixstowe he was, in the day percentage of output, running a neck-and-neck race with his Yarmouth friend. In the description of the Stretford Gas-Works published last week, it was seen that in that industrial area in the summer months the consumption, during the daylight hours, is all but balancing the consumption of the twelve hours from 6 p.m. to 6 a.m.; and in the winter the day figures are working up somewhat vigorously towards producing a balance. We think that, if Stretford would credit the summer with daylight beyond 6 p.m., the balance would be completely established. But there we have two eastern counties seaside resorts, a cathedral city, and an industrial area near Manchester all showing the same ascent of the output in the light hours of the day.

But the First Garden City—the product of seven years—issues a challenge on the figures for its last financial year to a pre-eminence in the matter of the day percentage of the total consumption. An article published elsewhere shows that about 60 per cent. of the consumption last year was accounted for during the hours of daylight. But the First Garden City is a residential place where the numerous workers in the factories that have settled there can go home to their midday meals; and of the consumers no less than 97 per cent. are furnished with cooking-stoves. Compare elsewhere this condition of things, as was done in the case of Stretford last week, with the consumption conditions that obtained in the daytime (say) twenty years ago. The change has been remarkable; but the alteration in the output of the daylight hours has worked its way into the gas business so gradually and easily that its full significance has not been appreciated in all quarters. It has an economic bearing of considerable importance; and one direction was pointed out by Mr. Stanley H. Jones in the address that he recently delivered to the Southern Junior Association (*ante*, p. 334), in mentioning that, through the change, the old accepted basis of the relationship (in the matter of provision) of gas storage to output is no longer necessary. In this and in several other directions—right along, for instance, to the consumers' meters—there is a marked capital economy in the tendency to equalization of the day and night output. Opposed to this economy is the increased capital expenditure demanded beyond the domestic meter by the daylight consumption. But it pays.

Further Gas-Power Economy only in Cheaper Gas.

If anyone seriously asked for justification for the series of lectures that are being delivered at the Manchester University, specially for juniors and learners of the gas industry, it would only be necessary to point to the character of the lectures and to the lecturers themselves for what was required. The lectures are of such a high order that they claim, and will obtain, a much larger audience than that immediately present before the lecturer. Mr. Dugald Clerk's deliverance last Saturday is an example; and we have no hesitation in saying that there are many gas engineers who will rise from the perusal of this plain digest of "The "Phenomena of Explosions in Gas and other Internal "Combustion Engines" much wiser than they were before. Only a physicist and chemist with a capacity for condensed statement could portray so concisely and so distinctly as Mr. Clerk has here done the many troublesome phenomena surrounding this subject, so as to be intelligible to the ordinary practical mind.

The phenomena of explosions in internal combustion engines are not of comparatively recent disclosure; but the fact remains that all the expenditure of time and talent with the view to their better understanding has left the scientific world in a state of inconclusiveness in regard to them. The gas-engine, like many other notable inventions, has moved along from stage to stage in success, with marked credit to the manufacturers, but without on their part any particularly great knowledge as to the governing science. But there, it has to be recognized, we have come to a pause, and further advances need the aid of science. This is why all (excepting probably a few who think they can get along very well without scientific help) interested in internal combustion engines welcome heartily the informative work of the British Association Committee on Gaseous Explosions. There is plenty of work for this Committee to prosecute in trying to replace the indefinite by the definite; and the extent of that work can be gathered by Mr. Clerk's statement of the practical points on which more accurate scientific knowledge is required. There is nothing really controversial about Saturday's lecture. The occasion was not one when controversial matters could be raised, in the absence of competent scientific critics.

But there will be one disappointment as the result of the lecture. Mr. Clerk still holds to the view that, in respect of the smaller types of gas-engine, in which town gas is used, there is little prospect of increasing the thermal efficiency. Indicated thermal efficiencies running up to, and in the neighbourhood of, 37 per cent. for 40-horse power engines, or thereabouts, are high; but the balance of the thermal value of the gas is also great. The longer the consideration Mr. Dugald Clerk gives to this balance, which must be largely, if not entirely, regarded as waste, the more confirmed he becomes in his opinion that further saving or economy would bear no equivalent to the heavy cost involved in realizing it. Therefore, if we accept Mr. Clerk's judgment as final, it amounts to this: That the means the town-gas industry can offer of producing power have attained the highest possible economical efficiency; and that this leaves but one open door to the reduction of the cost of gas power to the manufacturer, and that is the lowering of the price of gas. This view is expressed in Mr. Clerk's own words: "It would appear that the efforts of gas engineers

" to reduce the selling price of coal gas are more important " than those of the engine designer. There seems to be " more likelihood of reducing the cost of coal gas to the " power consumer by (say) 20 per cent. than there is of " increasing the brake efficiency of a coal-gas engine by this " amount."

Looking Forward at the Leeds University.

Special attention is asked to a letter in our "Correspondence" columns from Dr. William A. Bone, Livesey Professor and Head of the Department of Fuel and Gas Engineering at the Leeds University. It will be seen therefrom that to the juniors of the gas industry in the North, and to those elsewhere who can avail themselves of the privileges, is offered a most attractive programme in a series of 22 lectures, the delivery of which will commence on Jan. 11 next year. There is a current appropriateness about the subjects chosen for the lectures. In these days all technical juniors, and particularly those qualifying for, or holding, official position in the distribution department, should extend their knowledge to the utmost possible limits into the general subject of the distribution of gas, be in a position to bring knowledge as to gaseous combustion and the structure of flames to bear on their work, be thoroughly equipped with information as to the uses of coal gas for heating purposes, and be up-to-date in the science and art of both gas lighting and photometry. The men with knowledge on these subjects are the men who are best able to produce advances, and they too are the best qualified to carry the use of gas into places where gas has not been used before. When it is mentioned that the lecturers on the subjects named are Professor Arthur Smithells, Dr. W. A. Bone, Mr. Walter Hole, Mr. John Bond, and Mr. Jacques Abady, there is no need to allocate subject to lecturer. Every name stands high as that of a specialist in one or other of the subjects mentioned. Mr. Ernest Bury is also delivering a course of eight lectures on Bye-Product Coking Processes; and the plans are already being formulated for more distant dates, in which plans Dr. Colman is included. It will be seen that the Leeds University is bringing around its new department some of the most accomplished men in the laws and principles governing certain branches of the industry's work. We hope that what is being done will be rewarded in a manner that will give the fullest encouragement for the future; and that manner is the one set forth in the last half-a-dozen lines of Dr. Bone's letter.

High-Pressure Mantle Renewals.

There is a very useful letter in our "Correspondence" columns this week, for which we are indebted to Mr. E. R. H. Wingfield, the Chief Inspector of the Brentford Gas Company. The Electrical Press has a bad habit of dealing largely in assumption; and among their assumptions is one that high-pressure inverted gas-lamps are costly in the matter of mantle maintenance. Their hypotheses in this respect are as remarkable as they are varied; and use is made of them by electrical engineers when pressed into a tight corner by high-pressure gas-lamps. The experience Mr. Wingfield relates refers to the 309 lamps in the grounds of the Japan-British Exhibition, where they were exposed to the extremes of weather of the past six months. The details he gives show that these 309 lamps only demanded an average of 1·87 mantles per lamp over the six months' run of the exhibition; and this though no mantle was allowed to remain in position after it indicated the least sign of deterioration. We remember that Mr. Alex. A. Johnston, the Chief Engineer of the Brentford Gas Company, told us, that when the lamps were being overhauled in preparation for the exhibition of 1909, the mantles that had been left in the lamps during the whole of the winter succeeding the Franco-British Exhibition were found to be intact. Compare Mr. Wingfield's experience with the erratic life of metallic filament lamps as given, on electrical authority, in the "Electricity Supply Memoranda" for Oct. 11.

Centrally Suspended Gas-Lamps.

Quoth the electrical press (thereby confessing to their belief in very narrow limits being applied to the art of engineering) "it cannot be done," when the simple, though not universally approved, proposition was made that there should be a trial of central suspended high-pressure gas-lamps in the City of London, after the fashion of the centrally suspended electric flame arcs. It has now been done, and the electrical prophets have retired without a word of admiration for those who have shown that what was electrically believed to be impossible has been quite possible through gas ability. The suspended trial lamps at the London Bridge end of Cannon Street are of Keith's standard pattern high-pressure inverted type. There are two lamps on columns similar to those that are being fixed in the West-end. The centrally-suspended ones are each fitted with two 1000-candle power burners. They are supported on strong steel wire ropes (on which a small carriage runs) attached to the buildings on each side of the street. The gas supply is taken to the lamp by means of flexible tubing, in turn supported by a second wire. Normally, of course, the lamps are suspended centrally over the street; but by a special arrangement of wires, pulleys, and winch, they can be drawn to the side, and there lowered to the pavement level for easy maintenance. The gas supply is always connected; this being very desirable with gas-lamps in order that they may be adjusted, and everything seen in proper working order before being again raised and transferred to their aërial position centrally over the roadway. When in proper position over the street, the weight of the lamp is taken off the wires attached to the winch, and supported by a special safety-catch arranged in the carriage running on the main wire.

Retribution at Hastings.

We have often had a tilt at the Hastings Town Council over their extraordinary conduct of the electric supply undertaking, over their aggressive attitude towards the Hastings Gas Company, and lastly and more recently over their hostility to the Standard Burner Bills. For this occasion, we must suspend stricture and adverse comment, and adopt an attitude of the profoundest sympathy, with perhaps just a little contempt underlying it for the narrow-minded and revengeful spirit in which the Council entered into the opposition of the Standard Burner Bills on the Gas Company uniting in the promotion. The Council set their own ignorance in regard to this matter above all the investigation—scientific and parliamentary—there had already been into it, and seemed glad to have any opportunity of making an attempt to score against the Gas Company. The attempt has been an ignominious failure; and the Council feel they have been sold. The bill of expenses has been sent in; and it is sufficient to say that the Town Clerk when he saw the amount at the foot was staggered. As a rule, it requires something of a very potent nature to stagger a Town Clerk; but the Hastings Town Clerk (unaccountably there is some pleasure in dwelling upon the fact) was staggered by this particular bill. Complaint was made at the Council meeting last week as to the amount of the account; but it was felt that the only course was to pay it, and let the affair be buried among the things that are best forgotten. But some of the ratepayers appear to be taking a very live interest in questions that at one time they allowed to slide along without much heed. The ward elections have been proceeding; and in one ward the opposition to the Standard Burner Bill was one of the strong points. In that ward the Chairman of the Public Lighting Committee was rejected! In another ward, the electric light business was made a test point The Electricity Committee have lost their Chairman! If this is the gentleman who at one time thought electricity could be generated almost for nothing for public lighting, but could not be for the private consumers—well, perhaps rejection may be taken as a providential intervention in the interests of the borough!

Ventilation and Lighting.

The Reading Electric Supply Company is one of those concerns that has to meet the competition of a progressive Gas Company very much alive in its commercial methods; and good fortune does not in consequence seem to run very much in the way of the electrical undertaking. In an advertisement, the Electricity Company recently tried to score off one of the Directors of the Gas Company—Dr. Jamieson B. Hurry, who some time ago, in a contribution to the "British Medical Journal," stated that: "An ill-ventilated gas-lit office may so depress the heart even when organically sound, that the pulse becomes feeble and intermittent and life miserable and useless; the heart and general health depressing each other. Removal of the exciting cause may in itself ensure recovery." The Electricity Company

happened across this statement, and made use of it in one of its advertisements in a local paper. Whereupon Dr. Hurry wrote a letter to the local paper, in the course of which he remarks: "To anyone familiar with the overwhelming influence of adequate ventilation on health, it will be obvious that want of ventilation in any office is highly prejudicial, and that what was said would apply, *cæteris paribus*, to an ill-ventilated office even if lit by the electric light. Indeed, much evidence has lately been adduced to show that gas is more useful than the electric light in promoting efficient circulation of air. It is for this among other reasons that gas is being frequently substituted for the electric light. The latest example is perhaps the Society of Medical Officers of Health, which has recently installed gas on its premises, after previous experience with the electric light." A reference to what has been done at the headquarters of the Society mentioned appears in our "Electricity Supply Memoranda" to-day; and a full description of the gas lighting and heating installation there will be found in the "Journal" for Oct. 18, pp. 179, 186.

The Cement Market.

The welcome news of an improved outlook in the cement market is chronicled by the "Financial Times" in an article contributed by an expert correspondent, who says there has been some marked revival of interest the past few days in the demand for cement securities, and particularly in the capital issues of the Associated Company, which have been heavily dealt in, with the result that they have undergone substantial appreciation. To account for this, the market has fallen back on the usual talk about a combination with Continental producers; but though this theory is generally accepted as being adequate, it has, in the opinion of the writer of the article, really little to do with the present activity in the share market. Buying of cement securities is, he says, due to influences which are of a general and, it is believed, more permanent character than any trade amalgamation, which, as history shows, is always liable to break down. That is to say, the rise in cement securities is almost entirely attributable to the advance which has taken place in the quotations for cement itself; while this latter movement arises from the increased trade demand. Consumption, he argues, is at present fully up to the supply, if not ahead of it; while the companies have no reserve supplies to fall back upon. Though there are no signs of any slackening demand at present, it is pointed out that it will be better, in considering this factor, to be guided by precedent; and under ordinary circumstances there should be a decline in consumption during the next three or four months. But should this prove to be the case, the producing companies will still have as much as they can do to fill the contracts already on hand; while should circumstances permit of the turning out of any surplus stock, advantage will be taken of the opportunity to prepare for what is believed will prove to be an increased volume of business next spring. The statement of the position here set forth will doubtless be regarded as good news in many quarters; and additional comfort is to be found in the assertion that the contracts now being fulfilled are of a nature that may be regarded as permanent—that is to say, there has been a considerable accession of business from quarters which have not hitherto relied to any appreciable extent upon cement for the carrying on of their operations.

Mr. H. W. B. Cotterill, Assoc.M.Inst.C.E., has been appointed Resident Engineer for the new reservoir works which are being carried out by the Cardiff Corporation. Mr. Cotterill was a successful student in the Engineering Department of what is now the University of Sheffield, and was articled to Mr. E. M. Eaton, M.Inst.C.E., Consulting Engineer to the Sheffield Corporation. For nearly ten years he was an assistant on the engineering staff of the Little Don Valley works; being chief assistant to the Engineer, Mr. William Watts, M.Inst.C.E., on the Langsett reservoir for the last three years of that period. After leaving Sheffield, he was for a short time an assistant to the Water Engineer of Cardiff (Mr. C. H. Priestley, M.Inst.C.E.), and left that appointment to take charge of the scheme for the improvement of the water supply of Blaenavon. In September, 1908, he returned to Cardiff; and since that time he has been in charge, under the Water Engineer, of the preliminary work for the new undertaking. The contract for the first portion has been let for £201,000; and Mr. Cotterill was unanimously appointed Resident Engineer in connection with it, on the recommendation of Mr. Priestley.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 420.)

Consols were again the focus of attraction or attention last week. But whereas the previous week they were shrouded in the deepest gloom, last week they emerged from the clouds; and if they did not quite shed a radiance around, they were at any rate a bright spot in themselves. True, they have not yet fully recovered their lost ground; but it may fairly be hoped they are on the road to it. Thus encouraged, the Exchange had a more cheerful appearance, and business was better generally. Monday was rather inactive in view of the Exchange being closed the next day, and many markets were listless; but Government issues were supported. On Wednesday, markets were some little time getting into swing; but the tone was quite promising. Gilt-edged issues were in demand, and Consols rose $\frac{1}{4}$ for the account. Railways advanced here and there, and Americans entered on an upward course. On Thursday, the cheerful disposition was more pronounced. The gilt-edged class were well supported, and prices advanced. Consols gained another $\frac{1}{4}$ for money and for the account. Railways were a shade better; and the Foreign and American Markets were firm. South Africans, however, gave way. On Friday, the bright tendency was well maintained, and the demand for Consols and the choicest quality was marked. Railways were rather uneasy over labour questions; but the advance of Americans progressed. Saturday was a quiet day. Consols were firm and unchanged; and the general tone was very good. In the Money Market, there was scarcely any movement at first; but in the latter half of the week rates grew harder. Business in the Gas Market was quite on a normal scale of magnitude; but it was devoid of any marked feature, and there were but few changes in the quotations. In Gaslight and Coke issues, the ordinary was fairly busy, and was very steady; all transactions being within the narrow limits of $104\frac{3}{4}$ and $105\frac{1}{4}$. The secured issues also were busy and unchanged; the maximum marking from $87\frac{1}{2}$ to $88\frac{1}{2}$, the preference from 103 to $103\frac{3}{4}$, and the debenture from $80\frac{3}{4}$ to $81\frac{1}{2}$. Very little was done in South Metropolitan, and the price was firm at from 121 to $122\frac{1}{2}$. The debenture realized $80\frac{1}{2}$ and $81\frac{1}{2}$. In Commercials, the 4 per cent. changed hands at $106\frac{1}{2}$ and 107, and the $3\frac{1}{2}$ per cent. at 102. Among the Suburban and Provincial group, Alliance and Dublin was done at $89\frac{1}{2}$ (a rise of 1), ditto debenture at $96\frac{3}{4}$, British at from $44\frac{1}{4}$ to $44\frac{7}{8}$, and Ilford debenture at 98 and $98\frac{1}{4}$. On the local Exchange, Liverpool "B" was done at 164—a rise of 1. In the Continental companies, Imperial was rather inactive but firm; prices advancing from $187\frac{1}{2}$ to $189\frac{3}{8}$—a rise of 1. European fully-paid marked from $23\frac{3}{4}$ to $24\frac{1}{8}$ (a fall of $\frac{1}{4}$), and ditto part-paid from $17\frac{7}{8}$ to $18\frac{1}{8}$. Union was upset by an unsatisfactory dividend announcement. One transaction was done at 85, and another at 90; the quotation being nominally 80-100. Among the undertakings of the remoter world, Bombay marked $6\frac{1}{2}$, Buenos Ayres debenture $97\frac{1}{4}$, Cape Town debenture $89\frac{1}{2}$ and 90, Monte Video $12\frac{3}{4}$, Oriental 140, Primitiva from $7\frac{9}{32}$ to $7\frac{7}{16}$, ditto preference from $5\frac{3}{16}$ to $5\frac{5}{16}$, ditto debenture $98\frac{1}{8}$, and River Plate debenture $98\frac{1}{4}$.

ELECTRICITY SUPPLY MEMORANDA.

The Despotism of Municipal Ownership—"Electrician" Catching at Straws—Anguish—A Misinformed Local "Guardian"—Is it a Bait?—The Answer of Outside Experience—Prices and Other Points.

It is a matter for regret that the Electrical Press should take so much to heart the successes of gas in street lighting. It should be recognized that the gas industry has a very serious fight in front of it, with the hands of the majority of electricity undertakings in the country in the hands of municipal authorities who are also the road-lighting authorities. Through this circumstance the gas industry is not receiving fair play, nor is the public lighting being treated on those business principles that obtain when competition has not the weight of municipal possession thrown upon one side only. Under such conditions just treatment for private enterprise, and a frank consideration of the position between the rivals, are difficult to obtain. In some cases, the management of the public lighting is placed in the hands of the Electricity Committee; and the difficulties of private enterprise are then made greater. It is so at Croydon; and there the lamps in another eight roads are to be converted from gas to electricity. Financial and efficiency questions matter little. The Electricity Committee determine; and the Town Council bows its head in silent compliance without venturing to give the matter the judicial consideration that, as representatives of the ratepayers, and not the puppets of the Electricity Committee, they should bestow upon this public service. The Committee have shown that they are the heads of the Council, and not the Council the heads of the Committee. The Committee are autocrats of the first water. They intend to both propose and dispose; and their appearance before the Council in this matter is only a necessary formality. The Committee have made up their minds for the future. "In many streets," says Alderman Miller, the Chairman, "electric cables are lying idle, so far as public lighting is concerned; and in these the Committee propose from time to time to make the change

to electricity." That is their manner of proceeding. The Town Council have not perhaps heard of the serviceable rule laid down by Mr. H. Ross Hooper, of the Local Government Board, that "no change should be made in the system of lighting purely out of feelings of sympathy."

Poor "Electrician!" How terribly it is upset by the march of gas in public lighting; and what foolish things it is led to say by trying to evade facts, and relying for support for its attitude upon every straw that the wind happens to carry its way. The leader columns of the "JOURNAL" recently contained an article on the subject of inverted gas-burners; and it will be remembered that a certain respected firm read into what was said much more than the words gave them warrant for doing. In the course of a letter received from that firm, the remark was made that the inverted burner "throws a powerful light on a restricted surface immediately beneath the burner itself, leaving the rest of the room in comparative gloom." The "Electrician" gleefully hugs this statement, and commiserates with "Poor Westminster!" Is the staff of the "Electrician" so heavily pressed hunting for straws that time cannot be spared to run along to Westminster one evening, and have a look at Victoria Street, Vauxhall Bridge Road, and the streets at the back of the Tate Gallery, in Ashley Gardens, and elsewhere, to ascertain the truth on their own behalf? In the streets named, they will readily obtain a view of high-pressure lighting by inverted lamps of 1800-candle power, and of two forms of low-pressure inverted lamps. There would be some sense in doing this, but their present action comes within a category that is diametrically opposed to sense. Glad enough is the "Electrician" (and we since see the same is the case with the "Electrical Times") to find someone saying something about light concentration in which gas is concerned. To have the rival suffering from the old bad complaint of electric lamps is just what is wanted by electricians so as to have the lights in the matter of diffusion placed on equal terms. But it is better to go and see the actual state of things, than expose ignorance by adopting other people's views.

There is also great anguish of soul displayed in the electrical papers over the adoption of gas for lighting and heating in the meeting and demonstration rooms at the headquarters of the Society of Medical Officers of Health. Our electrical contemporaries want to limit the installation to as narrow a point as possible. They smile at the idea of gas lighting being adopted in the meeting room and electric fans being used. But it is quite clear they do not understand the position. The Electricity Publicity Committee suggests the use of fans where electricity is used for lighting for keeping the house healthy; and verily the advice is greatly needed. But in the meeting room of the Society of Medical Officers the electric fans are not required because gas has been adopted for lighting, for the lamp is a self-ventilating one, and nothing can pass from it into the air of the room. The fans are used for drawing air in from the exterior of the building when a meeting is going on, passing the air through filtering material, over radiators heated by hot water supplied from gas-boilers, and then into the room; a third fan being employed on the other side as an extractor. If further warmth is wanted, an ordinary gas-fire is in readiness for duty. But in the two demonstration rooms inverted gas-burners have been installed; and no electric fans are used there for ventilating purposes. Thus the three rooms that are in greatest use when the meetings are being held at headquarters, are now illuminated by gas, and gas is the fuel used for heating the rooms. From these plain facts all the verbosity of the Electrical Press cannot detract in any way.

Local papers have great influence in swaying public opinion within the area of their circulation; and, that being so, there should be in them as little show of partisanship as possible, unless there is very positive proof that there can be substantiation and sound defence. In the controversy between gas and electricity, the local papers are taking a large part; but there are few that have adopted the such distinctly partisan attitude as the "Sheerness Guardian"—so partisan and dogmatic, in fact, that what is written will no doubt be viewed, and properly, with the deepest suspicion. The "campaign" opened in the town by the Sheerness and District Electric Power and Traction Company (which is one of those titles with a fullness that ill-fits the small character of the business done by the concern) offering to convert 75 incandescent gas-lamps to metallic filaments at a cut price. Then the services of the "Guardian" were enlisted—a paper, for aught we know, that may be owned by someone with an interest in the Electric Power Company, and possibly, too, the someone may be a member of the District Council. Anyway, the character of a three-column article in the "Guardian," with electrical inspiration and colouring in almost every line, is such that one might be excused the impression that the paper had passed over into the possession of the Electric Power Company, lock, stock, and barrel. Now let us tell the gentleman who is responsible for the article in question, that the "Guardian" office is not the only fount of knowledge on this particular subject of Gas *v.* Electric Lighting, that Sheerness is not the only place of note on the face of the globe, and that experience of a pretty large order has been gathered outside that town. Now, Mr. Editor, do not raise any protest against the suggestion as to contracted vision on your part; your own article is condemnatory in view of the existence of an overwhelming experience attesting that many of your statements are altogether truthless if intended to have common application. If that is declared not to be the intention, then it will clearly be an admission that what is done elsewhere with modern incandescent gas-burners can be done in Sheerness.

Before we go any further, it may be suggested to the District Council that this offer regarding the conversion of 75 public gas-lamps may be nothing but a sprat to catch a mackerel. It may, in fact, be simply the first move towards trying to get the Council to purchase the concern. This is only surmise; but if it be true —well, we suppose the business men on the Council will take good care to look carefully into the value of the property (track, rolling stock, lighting business, and prospects) before they land upon the ratepayers a property that it may not be to their advantage to possess. We reiterate that it is not known that this is the ulterior motive of the Company in trying, through the public lighting, to get the Council into closer relationship with themselves; but we say it is possible. However, as to the offer for the conversion of 75 public lamps to electricity, it is hoped the Council will not do anything hastily; and that before making any change they will give the Gas Company an opportunity of making an offer and display of modern lamps—say, of the inverted order, such as are going into the streets of Westminster, Hackney, Bethnal Green, Finsbury, and Stoke Newington. In Westminster alone over 7000 inverted gas-burners have just been put into the street lamps. Is this incorrect, Mr. "Guardian"?; and does it bear out the assertion that London is returning to electricity? The answer will doubtless be that in Marylebone, Hampstead, and Shoreditch the streets are being fitted by electric lamps, to which we retort that these are areas in which municipal trading in electricity has been carried to such a point that the cheaper illumination offered by the Gas Company has been brushed aside, in order that the Councils may, as they put it with faltering tongue in dragging local government down to such a poor level of excuse, patronize "their own shop."

But as to the Sheerness offer for the conversion of the 75 lamps. The bait has been well chosen. The "Guardian" claims that there will be a saving of 15s. 4d. per lamp per annum if it is accepted. There will be nothing of the kind. The Council are to pay for the running of a special cable and make the conversion at a cost of £287 10s.; and there is also a suggestion as to other additional expense—all representing outlay exceeding the stated annual cost. The offer excludes lighting and extinguishing, includes the maintenance of lamps, but not lanterns and columns. Under these conditions, the annual cost of the 75 lamps of 50-candle power (the Editor of the "Guardian" assures this is British candle power, and not Hefner units—we should like the name of the lamps), lighted from a quarter of an hour after sunset to 1 a.m., is £1 5s. 8d., and for 100-candle power lamps £2 2s. 7d. If the 50-candle power lamps run from dusk to dawn, the charge is proposed of £2 2s. per lamp per annum, and for 100-candle power lamps £3 13s. Now the average cost of the incandescent gas-lamps is said to be, in the article in question, £2 1s.; the Secretary and General Manager of the Sheppey Gas Company (Mr. H. Barber) states that the price is £1 18s. 7d. This is for 80-candle power lamps compared with the 50-candle power ones offered by the Electric Company. But the writer of the article in the local paper doubts this statement as to the candle power of the incandescent burner. He speaks about some doubtless highly respectable gentlemen who have been using their eyes in making illumination tests by studying wall surfaces and reading newspapers near the lamps. Highly amusing is all the puerile and empiric writing that is presented in the three columns. There is much talk of fractured mantles, and of depreciating illuminating power with mantles. If all that is said is true, then the lanterns of Sheerness must be in bad order, and the maintenance not what it should be. If the lamps are properly looked after— and that is not a heavy task—those of the inverted type should give 20 to 25 candle power, while the upright ones should afford 15 to 18 candle power, per cubic foot of gas consumed. Opposed to all the frothy statements in the local newspaper stands the fact that the Gaslight and Coke Company are under a penalty in Westminster of 5s. per lamp per night for any infraction of their contract illuminating power. How are they able to do this if the assertions of the "Sheerness Guardian" are true, and have common application? The fact of the matter is that the writer of the article has been labouring under excessive partisan zeal, or accepting information without having the technical knowledge to put it to the test, and so has let himself slip altogether from a common-sense position. While he is explaining his attitude in this matter, perhaps from the big store of assumed knowledge he will tell us why competitive experiments in Victoria Street (Westminster), Beckenham, Bradford, and elsewhere have bestowed the laurel and public lighting contracts on gas in preference to electric lighting? "Electric light throws its beams the farthest." Really! Is that why electric light did not succeed in the competitive trials referred to, or because the statement made by the "Guardian" is an inversion of the truth?

We have suggested that the offer of the Electric Light Company is a bait to the local Council, though when all charges are thrown in, they will find their outlay is a fairly expensive matter. Calculating out the prices proposed for current and lamp maintenance to a "per unit" basis, it is found that, as there are 2173 lighting hours in a year from dusk to 1 a.m., the charge for the 50-candle power lamps is equal to 2d. per unit, and for the 100-candle power lamps 1·6d. per unit; and regarding the all-night lighting (4327 hours per annum) the charge is equal to, for the 50-candle power lamps, 1·8d. per unit, and for the 100-candle power lamps 1·6d. per unit. If the people of Sheerness have an opportunity of

seeing these figures, they will observe that they are not by any means those that they are called upon to pay privately for electric current. The local paper publishes some rubbish about a local consumer who gives an "interesting comparison from his own experience," whereby a "32-candle" incandescent gas-lamp costs 1d. per four-and-a-half-hours' use, whereas a 32-candle power electric metallic filament lamp costs 1d. for $5\frac{1}{4}$ hours. Did that consumer photometrically measure the lamps? Now let us see. Will our local journalistic friend deny that a 50-candle power inverted gas-lamp can be run on $2\frac{1}{2}$ cubic feet of gas per hour; while in some places 2 feet will suffice? If he does, there are plenty of places where proof can be offered to him if he knows how to read a photometer and test gas-meter; and, of course, a man with so much knowledge, and with the power of dogmatic assertion so fully developed, will not deny his ability to read a photometer. With gas selling at 3s. 2d. per 1000 cubic feet, 1d. will purchase 26 cubic feet. Is that true, Mr. "Guardian"? And dividing 26 cubic feet by $2\frac{1}{2}$ cubic feet, it is seen that a 50-candle power inverted gas-lamp can be run on a pennyworth of gas, at the price named, for 10·4 hours. Is there anything wrong with that? Or take the slot-meter price of 3s. 10d., the hours work out to eight-and-a-half for 1d.; while with electricity at 4d. per unit (we do not know the flat-rate in Sheerness) a 50-candle power metallic filament lamp on a pennyworth of electricity will only run for some four hours. Is there anything wrong with that, misleading and misnamed "Guardian"?

There is more in the article we should like to tackle, but have already devoted to it more attention than it is really worth. But there is one point. It was properly suggested that a breakdown of the electricity supply would put the streets in darkness where conversion had taken place; whereupon the electrically well-informed man wrote: "The likelihood of such a thing happening is extremely remote, and not more to be feared than the blowing up of a gasometer [*sic*] or the bursting of the principal gas-main into the town." Records show no less than 25 failures in electricity supply areas last year. The "Guardian" writer can perhaps tell us how many holders and leading gas-mains in this country blew up or burst in the same period. As there are already so many matters for the learned writer to corroborate or reply to, we had better now stay our hand.

FROM VIRGIN SOIL.

Lighting, Power, and Water Supply at First Garden City.

STANDING on rising ground in First Garden City (known under the more formal style of Letchworth), and looking round on the picturesque scenes—produced by the combination of Nature's handwork, and of the skill and art of the surveyor, the architect, and the builder—one is struck by the beauty that abounds in whichever direction one gazes. All the houses have a touch of old English character about them. Nestling among trees on the well-wooded slopes of the 3818 acres comprising the estate, are the houses of those well favoured in the things that go to make life pleasant; in broad avenues elsewhere are seen the houses, with ample space about them, of the middle classes; and in a section of the district near the factory area are pretty and well-kept houses for the families of artizans employed in the industries that have been planted in the place. There are the factories, too, designed to be in keeping with the surroundings—an object-lesson to all that it is not necessary that factories should be externally smoke-begrimed and ugly, that it is a mistake to suppose that cleanliness and a pleasing environment are incompatible with practicality and utility, and that they err who fancy the worker should be condemned, in order to get the best work out of him, to dwell and labour in surroundings against which life—life in its fullest sense and meaning, life most in accord with Nature's law—rebels. As survey is made of what has been accomplished here in the short space of a septennium, it all seems impossible that this was virgin soil at the beginning of the period, and that a town on novel lines—conceived, planned, and developed to such a degree—could by this time have been brought to such a state of self-contained perfection. As the writer surveys the varied and picturesque scene, the Resident Engineer (Mr. A. W. E. Bullmore) remarks that, when the area was acquired to give effect to the ambitious scheme of its promoters, it embraced the villages of Norton and Letchworth, and part of the village of Willian; and the population was then not more than 400. To-day, there are between 1300 and 1400 houses in First Garden City, including shops and public buildings; and, in addition, 29 factories and workshops. And he adds that not a single manufacturer who has established himself there with his workpeople has gone away; on the contrary, the tendency is for the manufacturers to extend their buildings and increase the number of their workpeople. The population by the way is to-day estimated at about 7000.

THE DEVELOPMENT OF THE GAS-WORKS AND BUSINESS.

The evolution of this Garden City scheme from conception to present material presentment has been a matter of considerable interest. There is an air of completeness in every detail—including the provision of the gas, electricity, and water supply. We have had something to say about these services on previous occasions—the last time on Nov. 26, 1907; but there have been wonderful developments since in the businesses which had to start on most speculative terms. It is easy to make provision for such services when there are certain existing facts to form some sort of guide; but in First Garden City there was nothing of the kind. No one could predict whether this or that would happen; whether success or failure was to be the fate of the what some people chose to refer to, with more or less covert contempt, as Utopian. Success has been the result; and success has been built up at such a pace that there has been nothing to do but spend, spend, spend to keep in line with it. But there is no help for this sort of thing in such unique circumstances. What it means is that profitable business (calling for capital expenditure somewhat frequently) is being built up more rapidly than could have been anticipated; but all the better will this be when a period of more settled conditions follows the years of initial and constructive work. Fortunately, in connection with the gas-works, a Gas Engineeer (Mr. Charles Hunt) was appointed, who has taken quite a paternal interest in the development *ab initio* of the gas supply for a town then unmade and for a community then scattered we know not where. He chose a site from the virgin acres that would admit of considerable works extension if needed; and on it he placed a plant (which was set to work in 1905) equal to 6 million cubic feet production per annum, and capable of step-by-step expansion. But it was not long—barely two years—before necessity claimed an ascent to 20 million cubic feet productive capacity; and now the works are just emerging from further additions that bring the annual productive capacity to 70 million cubic feet, or thereabouts.

TOTAL AND DAYLIGHT GAS CONSUMPTION.

This is not surprising when building and population development is considered; and the chances are that there will be a considerable immediate increase in both lines of development in view of factory extension, and the increase in workers that will be brought into the area. If we exclude the remote villages, it may be said that practically every householder in Letchworth is a gas consumer—certainly 99 per cent. of them are, and 97 per cent. have cooking-stoves. Remember that in 1904, there were no gas-works here; and there were barely any houses that required a gas supply. By the end of September, 1909, there were 1168 consumers—499 ordinary, 662 prepayment, and 7 with gas-engines; and on Sept. 30 this year, these figures had advanced to 1236 consumers—530 ordinary, 699 prepayment, with still 7 gas-engines. The yearly advance of gas consumption is peculiarly interesting. From the commencement of business in 1905 to Sept. 30, 1906, the consumption was 5 million cubic feet; in the year ending Sept. 30, 1907, $17\frac{1}{2}$ millions; Sept. 30, 1908, 22 millions; Sept. 30, 1909, 26 millions; Sept. 30, 1910, 31 millions. But a curious thing is the growth year by year in the proportion of daylight consumption to the total. In the first twelve months (or rather more) to Sept. 30, 1906, the daylight consumption was equal to 4 million cubic feet; to Sept. 30, 1907, it was $7\frac{1}{2}$ million cubic feet; 1908, 12 million cubic feet; 1909, 15 million cubic feet; 1910, 19 million cubic feet. When it is borne in mind that 97 per cent. of the consumers in Letchworth proper use cooking-stoves, that there are seven gas-engines in use, that printing works employ gas in the daylight hours for melting the metal for their Linotype machines, and other works employ bunsen burners for various other operations in which heat is required—the reason for such a relatively large daylight consumption is easily explained. But taking the proportion that was sent out in the daylight hours during the past financial year, to Sept. 30, it is seen that it is about 60 per cent. of the total output. We rather fancy such a percentage of daylight output over a year is rather unusual. One or two other particulars about distribution and business expansion are that, when the works first started, the mains laid equalled 4 miles, while to-day there are about $13\frac{1}{2}$ miles of mains, to which there are also connected 140 public lamps, all fitted with incandescent gas-burners. The price charged for gas for domestic purposes is 3s. per 1000 cubic feet net; while a sliding-scale for power is applied ranging from 3s. to 2s., according to quantity consumed.

THE EXTENSIONS AT THE WORKS.

There is no necessity to again describe the gas-works, which are a model of economical construction for a plant of moderate output; and the original plans of Mr. Hunt provided for extension, in view of the future being an entirely unknown quantity, on most economical and easy lines. The retort-house has been extended, so that it is exactly double the length that it was before. This work has been executed by Messrs. Davies, Ball, and Co., of Letchworth, who, as a matter of fact, have been responsible for all the building in connection with the extensions. Originally, the house started with a bed of three retorts, and one of five. These two beds had to be converted to one of six and one of seven retorts. Two more beds of sixes were put in; and these in turn were converted to beds of sevens. The retorts are 18 in. by 15 in. Ω section, and 9 ft. long. In the new bench there are four settings of eight retorts, 21 in. by 15 in. by 9 ft. long. Messrs. F. C. Sugden and Co. are the contractors for the retort-settings and all their mountings. The productive capacity of the old portion of the house is about 150,000 cubic feet, while that of the new portion is at least 200,000 cubic feet; so that the house is now equal to a daily output of 350,000 cubic feet. There is nothing special to describe about the new settings, beyond saying that they are a form of Klönne settings, with Hudson producers. In the old settings, there has never been the slightest trouble with the heats; and using second-class Derbyshire coals, 10,500 cubic feet of gas are at present produced from them per ton. But with the new

settings, it is believed that a higher result will be achieved. The new bench has had a tar-tower applied; and the idea has been adhered to by Mr. Hunt of carrying the foul main inside the house as far as possible. Only once has there been trouble with naphthalene; and that was on an isolated occasion at one of the gasholder outlets. There has never been any sign of naphthalene on the district; and therefore, there is no disposition to depart from the plan of keeping the foul main as far as possible inside the retort-house, as has been the case from the first. The yard connections have been increased from 8 to 10 inches.

Then new exhauster and boiler houses have been built. These are each 30 ft. by 20 ft. The exhauster-house walls are lined with enamelled white-faced bricks, with a dado of green-faced bricks; the floor being red tiled. The whole makes an excellent finish. In this house is a single set exhauster of 20,000 cubic feet per hour by Messrs. R. & J. Dempster, Limited, and already a bed has been provided for a second set when requirement demands. In the boiler-house is found a boiler, 5 ft. 6 in. by 18 ft., by Mr. John Thomson, of Wolverhampton; and by its side, is space for another when needed. But we take it this boiler will suffice in the matter of steam provision for some time to come. Among other additions is a Livesey washer, by Messrs. Westwood and Wrights, and a Holmes scrubber-washer.

It is seen that there is ample room on the site for future extensions. Work that is also now proceeding and forming part of the present scheme, is the alteration of the railway sidings, and the installation of new condensers. The four 8-feet square existing purifiers will no longer answer all the needs, and a set of four 12-feet square boxes are about to be laid down. In connection with them Messrs. Morris and Bastard's runway will be used for dealing with the purifying material. The gasholder capacity has also been extended from time to time until now there are two two-lift holders, having a combined capacity of 150,000 cubic feet. These holders and the extensions were the work of Messrs. Westwood and Wrights. Other additions include a new station meter by Messrs. Parkinson and W. & B. Cowan, as well as a 12-inch governor by them, supplementing the old 6-inch one.

Reserve Fund for Repairs, Maintenance, and Renewals

In an undertaking of this kind, with small beginnings and an unknown future, it was an excellent thing the First Garden City were well advised. For in such a scheme as this, with nothing to guide, there was the opportunity for profuse extravagance. Not only the larger financial considerations, but the smaller ones, were carefully weighed by Mr. Hunt. On his advice, there is an innovation in the matter of a reserve for repairs, maintenance, and renewals, which it would be well, for the equalization of these charges year by year, if other concerns could adopt, just as the First Garden City, have been able to do, being altogether unfettered by parliamentary ordinances of any kind in relation to their gas, water, and electricity supplies. Mr. Hunt's proposal (which was accepted as sound and protective) was that, from the outset of the undertaking, there should be set aside out of the profits of the year a sum equal to 5d. (later increased to 6d.) per 1000 cubic feet of gas sold per annum as a repairs, maintenance, and renewals fund, to be drawn upon every year for repairs and renewals and upkeep generally—the surpluses being allowed to accumulate. When, for instance, plant of any kind is done away with, it is credited to capital, and charged to this fund. After charging the fund with repairs, maintenance, and renewals for the last financial year, the balance was £744. The same plan, it will be seen later, has been applied to the water undertaking. There is no doubt that the principle of this reserve is right—a *pro ratâ* charge being made on a basis that has the merit of uniformity over the business year by year, and so constituting repairs, maintenance, and renewals a uniform charge, and not an erratic one, year by year. There is the element of fairness about this that makes it commendable.

A Well-Known Firm Transferring its Manufactory.

Mention has been made of the number of factories that have been established at First Garden City—factories that are extensive and factories with world-famed names along the tops of the façades of the premises. Who in the gas industry is not acquainted with the name of Messrs. Ewart and Sons, Limited? Ewart's gas geysers are known far and wide; and the firm are going to transfer to Garden City a large part of their manufacturing work in this line, together with their employees. For the purpose of the erection of the factory, some 3 acres of land have been taken close to the gas-works; and the new premises will occupy a superficial area of about an acre. It is expected that the firm will employ some 300 men here, and will be good patrons of both the gas and electricity undertakings. The workmen, too, will be wanting gas in their homes.

The Electricity Power Station.

Speaking of the electricity power station, a few words should be said about the extensions there, as they show there is scope for both gas and electricity services in a self-contained community such as we have in this First Garden City. There is no denying the fact that for certain purposes—particularly for intermittent work, and not long runs—electric power has advantages that gas has not; whereas for long runs and good working loads, the gas-engine with gas at a reasonable rate has yet to be beaten. When last describing the plant (towards the end of the year 1907), it was mentioned that it consisted of two 100-brake horse power gas-engines, with two sets of suction-gas plant. Coupled up with these are two dynamos, each capable of a continuous output of 65 KW. of 500 to 550 volts continuous current. The accumulator battery then also consisted of 260 cells, and could give 300 ampère hours in ten hours. Since then a new battery of double this capacity, and a new booster for it, have been put in. And, of more importance, the station has been practically duplicated by the installation of a 225-horse power oil-engine, directly coupled to a 150-KW. dynamo. Considerable economy is expected from the oil-engine; but it has yet to be proved. However, what with suction-gas plant and engines and an oil-engine at the electricity station, suction-gas plant and an electric motor at the water-pumping station, and town gas as a stand-by to the engines at the electricity station, Mr. Bullmore (in whose hands, as Resident Engineer, are entrusted the day-by-day management of all the public services here) ought to get some comparable working records under similar conditions of considerable interest.

The electricity is only being supplied in the factory area for power purposes; and the works that use electrical energy are also permitted to employ a certain proportion of it for lighting. The output of electricity has been progressive, in just about the same way as the gas supply, though, owing to the supply being for power purposes only, the average revenue per unit is small, and up to now the station has hardly paid its way. But there is no doubt as to the convenience of the supply to the factory owners; and it is satisfactory to learn that it is expected that this year there will be no loss after writing off depreciation. In all, fifteen factories are taking current. The year 1908 was the first of the service; and then the sale was 54,836 units. In 1909, the sale was 109,521 units; and in 1910 (it will be remembered the financial year ends with September), 170,350 units. Most of the increase has been obtained from existing factories through the extension of premises and their output.

Extension of the Water-Works.

A few words now as to the development of the water-works. Practically every house, shop, and factory throughout the area of the "city" is connected to the water-distribution system; and the demand, as in the case of gas, has developed at a fast rate. When describing in 1907 the plant that delivers water to this novel creation, it was stated that the pumping plant consists of a 35-horse power suction-gas engine and producer plant, driving high-service and borehole pumps of the Glenfield and Kennedy type—the two pumps working simultaneously. Since then a new borehole has been sunk by Messrs. Legrand and Sutcliffe; and the pumping plant and house have been exactly duplicated, except that the plant is driven, in this instance, by a 35-horse power electrical motor furnished with energy from the central power station. It will be of interest to learn at some future time the relative cost of working—conditions being so uniform and therefore so comparable—by electricity and suction gas. Each set of plant is equal to raising 120,000 gallons of water per day. The reservoir capacity is equal to 250,000 gallons; but an additional reservoir is now in contemplation. The water-mains have, like the gas-mains, been considerably extended. Beginning seven years ago with a system running through 4 miles of roadway, it extends now to 17½ miles. Regarding charges, for domestic purposes 5 per cent. on the rateable value is paid; and as the rateable value is low, the consumers get water at a very reasonable rate. Factories are charged by meter. It may be mentioned that the principle of transferring from revenue a fixed sum to a reserve account for repairs, maintenance, and renewal of works and mains also obtains in connection with the water undertaking. In this case 2d. per 1000 gallons distributed is set aside for the fund; and after charging repairs, maintenance, and renewals up to the end of Sept. 30 last, the balance in hand was £550.

These are the highly interesting developments in which we are concerned in connection with this remarkable scheme, which—under the able general management of Mr. W. H. Gaunt, the Company's agent—each year brings closer and closer the financial success which we hope will be its reward with a substantial fullness. The lines of development, it is seen, were as fundamentally sound as the intentions were socially beneficial.

We have received the "Mechanical World" Pocket Diary and Year Book for 1911. This useful little work has reached the twenty-fourth year of publication; and the present issue contains some 32 pages more than its immediate predecessor. A new section is on the "Constructional Details of Gas-Engines." The rest of the matter consists of useful engineering notes, rules, tables, and data. The number of illustrations has been increased by one-half, and the whole work thoroughly revised. The book is published by Emmott and Co., Limited, of Manchester.

Mr. Joseph Tysoe has, we regret to note, written to the Greenwich Borough Council resigning the office of Alderman. In the course of his letter, he stated that he had delayed taking the step in the hope that it would not be necessary; but he felt that, as he was still unable to take his fair share of the work of the Council, he ought not to occupy his position any longer. He very greatly regretted the severance from the work of the borough, but was advised that a quiet life and avoidance of excitement must be his chief care. The resignation was accepted, on the motion of Mr. Shaw, seconded by Mr. Scarr; both speaking appreciatively of Alderman Tysoe s services.

GAS IN THE KITCHEN.

)NCE more the time has come—and gone—for the holding of ıe annual Cookery and Food Exhibition, which is deservedly one f the most popular of the many shows that take place at the :oyal Horticultural Hall, Westminster. It is not many weeks ince the doctors had an exhibition in the same building; and ow there are the cooks. This is the order in which the respec- ve displays are customarily arranged; but it will occur doubtless) many to question whether that is the proper sequence. The octor after the cook is, we imagine, the more general experience f the order of things; but, then, that is not in connection with ıch cooks as were to be seen displaying their art last week at ıe twenty-first exhibition organized by the Universal Cookery nd Food Association for the extremely praiseworthy purpose of preading a better knowledge of the various substances used as ɔod and the best and most economical methods of cooking. 'hese are both objects which appeal to everyone; for we must ll have food, and good cooking is little, if any, less important ıan good food. But for the gas industry, "the best and most conomical methods of cooking" is a phrase which possesses double significance. In addition to being of interest to them ersonally, it concerns them from a business point of view; for an they not, in the commodity which they dispense and the pparatus they supply, place at the disposal of the housewife, rofessional cook, or bachelor, the "best and most economical ıethods of cooking?" This is where our connection with the 'ood and Cookery Exhibition arises.

Larger, perhaps, than its predecessors—and certainly not less opular—this year's show attracted crowded attendances during ıe few days that it remained open. The commercial group in- luded food and food products, kitchen and dining-room acces- ories, and culinary literature; and in other groups, domestic ookery and army and navy cookery were dealt with. Competi- ions there were without number; and the heavy programme of ractical demonstrations drew some large and evidently practical udiences. The artistic confectionery group produced hundreds f specimens that were the marvel of those who beheld them; ut perhaps equally remarkable were the entries in the banana ookery competition. For those who have not studied its possi- ilities, it might be hard to suggest a more uninteresting article f diet than the banana; and yet in the hands of the practised ook, the methods of serving it are evidently as varied as are the olours in a peacock's tail. When the art of cooking has attained o such a degree of perfection that even the banana can be trans- ormed into a table delicacy which would sorely tempt the most astidious gourmet, it is easy to realize how important it must be hat the very best apparatus for the purpose should be employed. This is where gas comes in; for it admits of an exactness in ooking operations which is unattainable by any other system of ıeat raising—besides possessing undeniable advantages from the oint of view of economy.

Gas is in the habit of being adequately represented at these ookery exhibitions; and this year's fixture has proved no ex- eption to the rule. From afar off, attention was drawn to the Horticultural Hall by means of a large gas sign (which, by the way, if memory serves, replaced an electrical one formerly in oosition); and outside the premises there were some samples of he new Westminster inverted incandescent gas-lamps. Within he building, the Gaslight and Coke Company had constructed, on the first floor, a model gas kitchen, which was the scene of ı large number of demonstrations of various kinds. There was a special charge for admission to these demonstrations (made by the Cookery and Food Association, and not by the Gas Company); but ladies were anxious to pay what was asked in greater numbers than could be at all times accommodated in the room, which would hold perhaps 150 persons. Here are some of the subjects of the demonstrations: Sugar modelling; a *recherché* supper; ice carving; to-morrow's dinner, and how to cook it; lace piping and lace modelling; simple breakfast and supper dishes; dressed vegetables. When the writer visited the kitchen, Mr. Edwin Schür was proving to a packed audience the extreme simplicity of his particular method of decorating cakes with sugar paste; and the moment that he had done, a fresh crowd streamed in to gather ideas from Mrs. C. Marshall in connection with tempting little breakfasts and suppers. How clean and bright everything was, and how unlike the traditional kitchen! Why, the intent ladies, with pencils and notebooks in hand, might have been listening to a lecture on comets, instead of watching actual cook- ing operations under practical conditions! Excellently lighted by means of eleven "N.I.C.O." inverted burners, having a total consumption of some 33 cubic feet of gas (beside which the electric lights looked dim and dull), the place struck one as being truly a model of what a kitchen should be. And yet everything had to be arranged by the Gas Company's staff in a very short space of time, and without driving a nail into the walls of the building. The paper, in imitation of glazed tiles, gave a pleasing effect to the contents of the kitchen; and a long row of copper stewpans, &c., of various sizes, supplied by Messrs. Jones Bros., of Down Street, Piccadilly, W., must have been the envy of many a housewife who cast her eyes on them. There was a Main enamelled treble-oven gas-range, with a continuous hot-plate, fitted with numerous ring burners and two small griller or toast- ing burners; and, in addition, there was a Main double gas- griller—one side of which can be used for meat, and the other for fish. A Sugg stock-pot stand, in solid cast iron, with two atmo- spheric burners, and a Sugg gas-heated boiler, also of cast iron, with a porcelain enamelled interior, were other articles. The Davis Company were represented by a gas-heated meat and vegetable steamer, with doors fitted with india-rubber, to make them steam-tight, and so arranged that when open each forms a shelf to pull the tray out on; a hot-closet; and one of the new "gilled" circulators, with thermostatic regulator. The attractive appearance of the kitchen will be gathered from the accompany- ing photograph. Every part of the apparatus was in full working order. The exhibition was opened by the Lord Mayor, who visited the model kitchen, and was extremely interested in all the appliances to be seen there.

Other gas-cookers were in use in one annexe, where a number of competitions and cooking displays took place. There were four Main double cookers, and a Sugg high-pressure gas-boiler, to give 100 gallons of boiling water per hour. At the time of our visit, a scone-baking competition on three of Fletcher's hot-plates was in progress. In the annexe devoted to the Shipping Federa- tion, Limited, there were also Main double and single cookers, and a Wilson "Blackpool" boiler, for the purpose of showing the methods of cooking food in the merchant service.

Among the stands in the body of the hall, Messrs. R. & A. Main showed the "St. Nicholas" gas-fire and one of their new "D.S.O." series; and they also had on view the "Pilgrim" cooker—a steaming closet, in which the steam is raised in a copper water container by means of a gas-burner at the bottom. There is a steam-tight door, with a special facing and locking handle. It is made in two sizes, and claimed to be economical, efficient, simple, and cheap. Messrs. Arden Hill and Co. showed

Model Kitchen Constructed by the Gaslight and Coke Company.

the "Janus" gas-oven, specially adapted for baking bread and confectionery, the "Zenith" automatic high-pressure boiler, for delivering hot water to any part of a building, fitted with patent automatic valve; and the "Mars" gas-heated steam-radiator. Jones and Still's patent automatic boiling-water apparatus, and other appliances for hotels and restaurants, were exhibited by Messrs. W. M. Still and Sons; and a grease proof sink (which can be fitted with a gas water-boiler with ball-cock attachment), by Messrs. Frank Staines and Co. A gold medal was awarded to Jackson Boilers, Limited, for their gas-heated boilers, which are made in various styles for different uses. The café fountain water-boiler produces, it is claimed, a steady flow of boiling water five minutes after lighting the gas; and it is constructed to deliver boiling water only, as required, without steam pressure. The gas-burners under the counter are controlled from the boiling-water tap; and on the top of the apparatus there is fitted a patent steam condenser. The three stock sizes deliver respectively 150, 200, and 250 pints of boiling water per hour.

AIR ANALYSIS AND FLUELESS GAS-HEATED STEAM RADIATORS.

By H. James Yates, F.C.S., M.I.Mech.E.

The radiator form of flueless stove is now some twenty years old. It first took shape as a condensing radiator having an open gas-fire with fire-clay lumps. Some years later came a similar radiator without the open fire; and later still the same stove appeared as a non-condensing hot-air radiator. Eventually there was produced the gas-steam type which has become so familiar within the last half-dozen years or so, and has since been followed by several varieties of hot-air radiator. Following on the advent of the gas-steam radiator, there has rapidly arisen a great increase in the application of gas heating by flueless stoves of this class to a wide variety of domestic and industrial uses. Among the reasons for this were, no doubt, the fact that a reliable automatic control of the gas consumption in a quick-heating radiator was rendered possible, for the first time, by the medium of steam being introduced, with a consequent degree of economy in fuel and a resultant minimizing of the combustion products much beyond anything that had till then been attained. A further reason which has doubtless made for the popularity of the gas-steam type was that the products of combustion being kept out of the interior of the apparatus, there was no internal deposit to remove; and this, coupled with the absence of corrosion, meant an indefinitely prolonged life for the stove. Owing partly to the automatic control and partly to constructional arrangements to that end, the flame is effectually kept from contact with any part of the apparatus, and the invaluable feature of perfect combustion is ensured under all conditions.

It has been necessary to briefly recall these details to lead up to the very important question of flueless stoves in relation to the purity of the atmosphere. Section 6 of the Factory and Workshops Act states that the means employed to heat a workshop must be such as shall not interfere with the purity of the atmosphere; and from time to time doubts have arisen in official quarters as to the position of flueless gas-radiators in relation to this clause. As a matter of literal interpretation, no doubt, it might be argued that flueless stoves of any kind could be brought within the four corners of such a clause; but, obviously, a matter of so great importance and wide application must be viewed in a broad way, and providing that the combustion itself is perfect—*i.e.*, that no carbonic oxide is produced—the matter would seem to resolve itself into practically a question of the number of parts of carbonic acid per 10,000 parts of the atmosphere of the apartment.

The normal quantity of carbonic acid found in the air is, as is well known, from three to five parts per 10,000. Indoors, the respiration of the occupants naturally adds to this figure; and the Departmental Committee on Ventilation in Factories recommended, in 1902, that the maximum limit of carbonic acid permissible in the atmosphere of workshops should be fixed at twelve parts per 10,000 in the daytime, and twenty parts after dark, where gas or oil was used for illuminating purposes. Another Departmental Committee—that on Cotton-Weaving Sheds—recommended, last year, that these limits should be raised, in the case of dry weaving sheds, to fifteen and twenty-three parts per 10,000 respectively. It is important to remember, in passing, the wide distinction, as regards effect on health, between carbonic acid produced by respiration, and carbonic acid produced from inorganic sources. Carbonic acid produced by respiration is accompanied by a certain proportion of organic matter; and it is this latter which is the really serious factor to be guarded against. So that the carbonic acid respired is objectionable much more on account of this organic matter accompanying it—of the presence and proportion of which it is the index—than on its own. And, on the other hand, carbonic acid which results from inorganic combustion does not contribute organic matter to the atmosphere.

Obviously, therefore, the question is mainly one of analysis of the atmosphere of any particular apartment where the point may arise; and this has been recognized and acted upon by my Company, both in the devising and perfecting of gas-heated steam-radiators and in the working out of the method necessary for thoroughly establishing this form of gas-heating in the public confidence.

The following particulars show the practice they adopt in such cases. Of the two methods of analysis available (the gravimetric and the volumetric), the former involves prolonged work on the spot, and the taking about of considerable apparatus. The volumetric method, therefore, which is substantially as accurate for all practical purposes, is the one they have employed—particularly as it admits of samples of the air being taken on the spot, and returned to the works' laboratories for analysis. In order to accumulate the necessary data to work on, they have collected a large number of samples of air from various classes of apartments all over the country, and under all sorts of conditions. Each person taking samples has to fill up a "Report Schedule," and return it with the samples.

It will be seen from the form [on p. 391] that the schedule has been carefully drawn up so as to call for every particular of information which could possibly modify the result in any way. Their practice is to take the air samples in each case on two separate days on which the weather conditions are as nearly as possible the same. On the one day the radiators are kept entirely out of use; and the samples are taken just before the people leave at the end of the day. On the other day, the radiators are kept burning all day; and the samples are, again, taken about the same time. On neither day are the normal ventilation conditions of the apartment interfered with; and on both days samples are taken in several different parts of the room (the same places each day), and the results of the analyses of same are averaged so as to give one result for each day. The difference between the two days' analyses represents the effect of the radiators on the atmosphere of the room. Taking all the results thus obtained, one with another, they have found that generally the increase of carbonic acid on the second over the first—*i.e.*, with the radiators burning—is only about five parts per 10,000.

In this way they have established a definite constant factor for the contribution of carbonic acid by the gas-steam radiators. In most cases the total proportion of carbonic acid in the room at the end of the day (including the five parts contributed by the radiators) has fallen substantially short of the maximum of twelve parts per 10,000 put forward by the Departmental Committee. Where the analysis shows the total amount of carbonic acid to be excessive, it has invariably proved that the particulars in the report showed the ventilation conditions to be inadequate, except in one or two cases where the premises were found to be entirely unsuited for this form of apparatus, and where they would never have been installed had the makers been first consulted. In the former instances, they thereupon advised the owners to make the necessary improvements in the ventilation; and in the latter, to remove the stoves altogether. Flueless radiators are not intended for use in living rooms or in small apartments where the occupants are many and the means of ventilation few. Outside these limits, there is sufficient scope in all conscience for this type of apparatus, which possesses the indispensable quality of economy to be so marked a degree.

In the course of these analyses, an interesting sidelight has presented itself. In certain cases, the proportion of carbonic acid in these instances has proved to be actually less at the close of the day's full use of the radiators than on the previous day without them. This is due to the sluggishness of the normal ventilation being stimulated by the heat of the radiator.

The gas-flame has the valuable hygienic advantage, not only of killing a number of the micro-organisms that may be present in the air, but, by virtue of the naked flame, of burning up and destroying a considerable quantity of the organic matter exhaled by the human occupants of the room.

Reference may be made here to the fact that it has been found that, with the gas-steam radiator, a room can be heated with less gas than is needed to light it. Taking a workroom 30 ft. by 20 ft. by 15 ft. high, provided that no very close application to the work were needed, it would require six incandescent burners, each consuming 4 cubic feet of gas per hour, to light the room. If there were any bench-work or book-work to be done, for this size room it would require at the very least ten of these burners, consuming 40 cubic feet per hour. This room can be heated by means of two gas-steam radiators, only consuming 20 cubic feet per hour. It will thus be found that the amount of carbonic acid added by the gas-radiators to the atmosphere of a room is extremely small—particularly in proportion to that produced by the means of lighting, or by the number of human beings ordinarily engaged in a workroom of the size named.

Mr. J. W. Turner, Gas Manager to the Scunthorpe Urban District Council, was recently appointed to a similar position with the Abercorn District Council. On receiving notice to this effect, the Scunthorpe Council decided to advance Mr. Turner's salary by £30, with annual increments of £10 up to a stated amount, and to offer him a four years' engagement. These terms have been accepted.

AIR ANALYSIS REPORTS.

FORM G.

JOHN WRIGHT & CO.,
Essex Works, Birmingham.

IMPORTANT NOTE —It is absolutely essential that the person taking the sample of air should be careful to fill in every one of the particulars provided for in this form, excepting, of course, the Laboratory Report, which is to be left entirely blank.

Where a sample of the outside air is being taken, this must, in every case, be done on the ***Windward Side*** *of the Building.*

Bottle No. Firm's Name Business

Address

DESCRIPTION OF ROOM.

On Which Floor.	Height. Feet.	Co. tents. Cub. Ft.	No. of Occupants.	Space per Person. Cub. Ft.	VENTILATION.															LIGHTING.					HEATING.				PROCESS.	
						Windows.						Doors.						Ventilators	Fireplaces.	Electric.		Gas.		Oil.						
					Aspect.	No.	Sizes.		Open during Test.	Open before Test.		A No. to Outer Air.	B No. to Inside Building.	Open during Test.		Open before Test.		No. and description. State if open during Test, and what period, if any, before Test.	State how many and how used, or if closed up.	Arcs in Use.	Glow Lamps in Use.	No. of Incandescent Lights Burning.	No. of Ordinary Lights Burning.	No. of Lamps Burning.	Nature of Apparatus.	No. Used during Test.	No. Used before Test.	No of Hours Used before Test.	Nature of Work. State if any chemical process giving off fumes.	Give particulars of any steam, gas, coke, or coal heated plant in room. State if in use during or before Test and if the latter, how long.
							Ft.	Ft.		No.	Hrs.			A	B	No.	Hrs.													
					N.																									
					S.																									
					E.															No. in use before Test.										
					W.															No. of hours in use before Test.										

CONDITIONS OF TEST.

Date.	Hour Work Started.		Hour Sample Taken.		Position in Room.*	Temperature.	Weather.			Special Conditions, if any, such as "Wind blowing from direction of Sewage Works, 200 yards off."	REMARKS.
							Wind.		Atmosphere.‡		
	A.M.	P.M.	A.M.	P.M.			Direction.	Force.†			
											Sample taken by— .... Date despatched ....

LABORATORY REPORT (For Head Office use only).

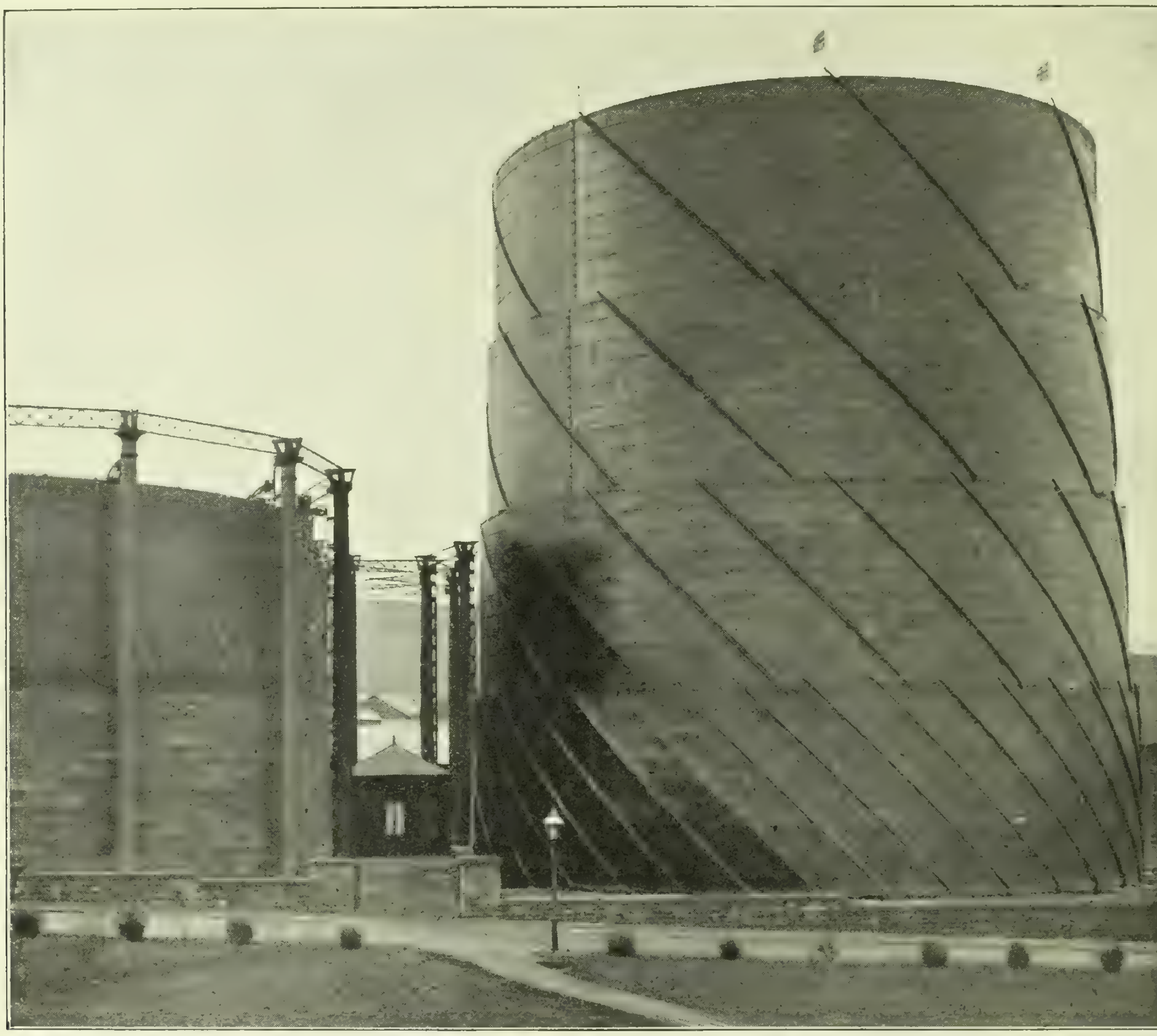
Vols. of CO_2 per 10,000.		Micro-Organisms Per Litre of Air.		REMARKS.
Inside Room.	Outside Air.	Bacteria.	Moulds.	
				Reported by........................ Date..................

* Refer to mark or letter on rough plan [back of form]. † State if "gale," "blowy," "light breeze," &c.
‡ State if "rain," "fog," "mist," "snow," "dull," "bright," "frosty," &c.

[P.T.O.*

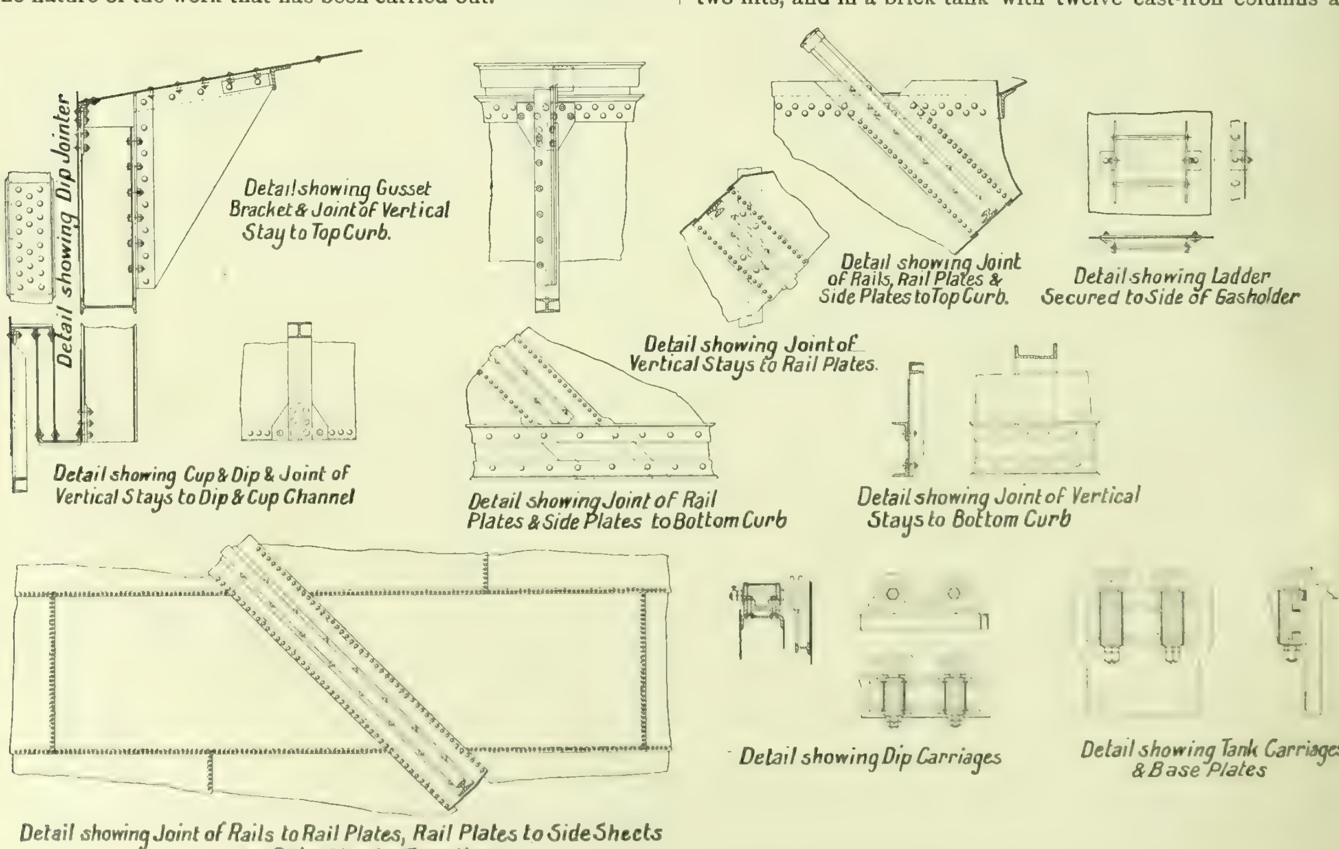
* The back of the form is reserved for the Analyst to give a rough plan of the room, showing in what part the sample was taken; and, if possible, he is to give a rough plan of the rest of the same floor.

A SPIRAL-GUIDED HOLDER AT OLDHAM.



Yesterday afternoon, there was inaugurated at Higginshaw Gas-Works of the Oldham Corporation a new spiral-guided gasholder; and a report of the proceedings which then took place will appear in the next issue of the "Journal." Meanwhile, we are able to give particulars and illustrations which will show the nature of the work that has been carried out.

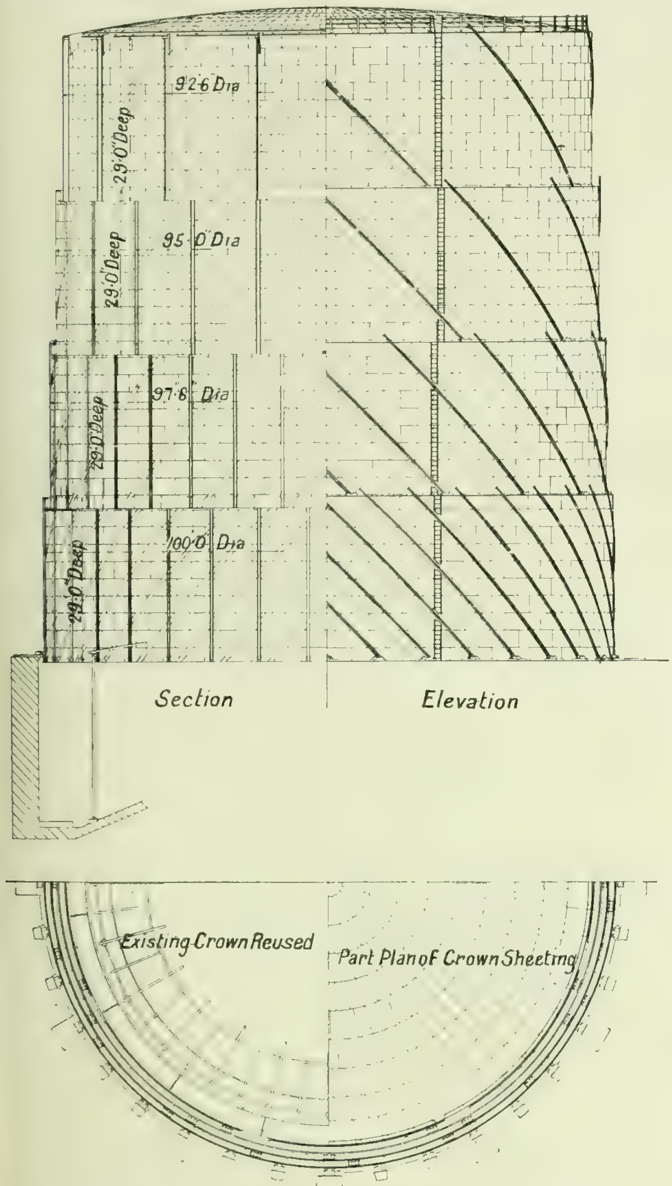
The Corporation had at their Higginshaw works a group of two-lift gasholders, guided by cast-iron columns. The first holder was erected in 1872; and, in consequence of its bad condition after 37 years' continuous work, the Corporation last year decided to replace it with one having four lifts. The holder which has been demolished was 100 feet in diameter by 29 feet deep, with two lifts, and in a brick tank with twelve cast-iron columns and



Details of the Spiral Guided Holder at the Higginshaw (Oldham) Gas-Works.

one row of lattice girders. Mr. T. Duxbury, the Corporation Gas Engineer, prepared plans for a new four-lift holder guided by lattice standard columns; and alternative tenders were also invited for a holder of the same size on the spiral-guided system—the outer lift in each case being 100 feet diameter, and each lift 29 feet deep. After carefully considering the tenders, and taking into account the large saving to be effected and the Contractors' guarantees with regard to the safety of the proposed new structure, the Corporation, on the advice of their Engineer, decided on placing a contract with Messrs. R. Dempster and Sons, Limited, of Elland, for a holder on the spiral-guided system.

The first, or inner, lift is fitted with 8 spiral rails, the next with 12, the next with 18, and the outer lift with 36, each of which is securely attached, by Dempster's well-known method of continuous diagonal plates. It might be here stated that the plates and rails are each in one length, without any intermediate joints; and wherever they cross the vertical stays, which are arranged in suitable numbers, they are securely attached thereto. The old gasholder was guided by twelve cast-iron columns. The existing twelve piers were utilized for securing twelve of the main carriages guiding the outer lift; and in between each of these main



Higginshaw (Oldham) Gasholder on Gadd and Mason's System.

piers were arranged two intermediate base-plates and carriages These base-plates were so designed as to be properly secured to the existing tank walls with the minimum of disturbance. The opportunity was also taken advantage of to replace the existing 18-inch inlet and outlet pipes by new ones with a diameter of 24-inches, built to special shape, so that they could be let into the tank wall without interfering with the diameter of the outer lift.

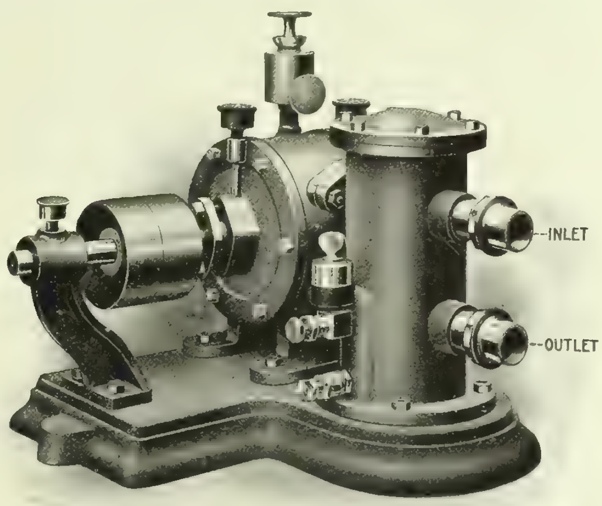
The work has been completed just within contract time. When fully inflated, the holder gives a pressure of 15⅝ inches; and the height is 109 feet from the top of the coping to the top curb of the holder, or 115 feet to the top of the crown. The proportion of the height to the diameter of the holder is notable; it being higher than engineers would at one time have considered safe. This, however, is simply a matter of calculation; and an ample margin of safety, we are assured, has been provided to enable the holder to withstand the severest gales that are encountered in this country.

A casual examination of the photograph of the holder here reproduced will convince one that the structure conveys the idea of strength. In fact, when it was fully inflated for the first time, a gale of wind was blowing; and the pressure-gauge indicated no variation in the pressure. We are informed that not one of the carriages required adjusting after they were fixed in the first instance; and we must confess that we have never examined a finer piece of work, as, although the holder was newly painted, not a single hammer mark or buckle was discernible.

Finally, it may be mentioned that all the work was carried out under the supervision of Mr. Duxbury, assisted by Mr. Dudley, the Station Superintendent.

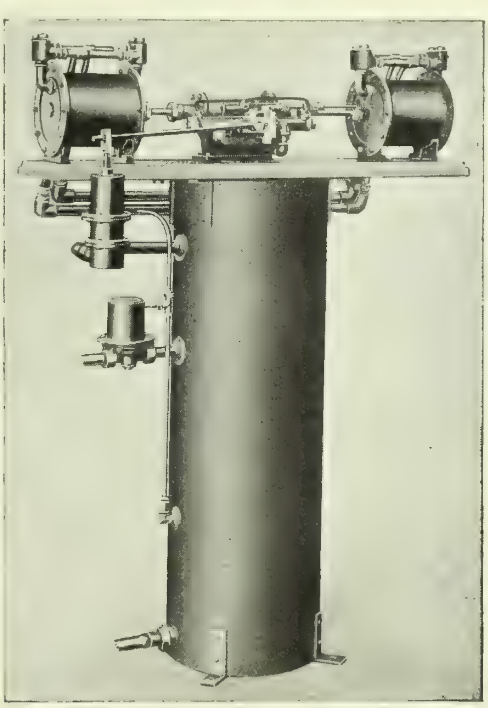
TILLEY'S HIGH-PRESSURE GAS LIGHTING AND HEATING SYSTEM.

In connection with the London and Southern District Junior Association's gas exhibition, which was noticed in last week's "Journal," brief reference was made to the high-pressure gas lighting and heating system of the Tilley High-Pressure Gas Syndicate, Limited, of No. 53, Kingsland Road, N.E. This is a system which had previously been alluded to in our pages; but it does not appear that any extended account has been given of the advantages claimed for this particular mode of compressing and consuming the gas. These details we are now in a position



Belt-Driven Gas Compressor.

to supply; and, in doing so, attention may first be given to the gas-compressors, which, it is maintained, are the most simple and perfect on the market—comprising, as they do, the latest patents granted for this purpose. They may be belt driven, electrical-motor driven, or water driven. The first illustration shows a belt-driven compressor. This comprises a rotary pump and valve-chamber fixed on one bed-plate. There is no gas storage reservoir; and the working of the valve can be instantly regulated during the time the plant is running. When the compressor

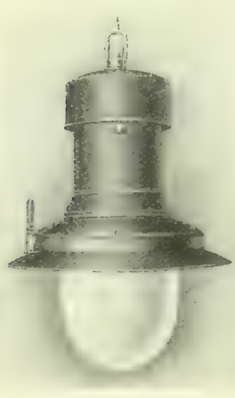


Water-Driven Gas Compressor.

is stopped, a full bore of low-pressure gas is, by the automatic action of the valve, immediately supplied to the service, without the aid of any supplementary bye-pass arrangement. The pressure, which is said to be absolutely steady, can be regulated by means of weights in the valve-chamber. For lighting, say, from 54 to 60 inches is desirable; while higher pressures can be utilized for certain trade heating appliances. The compressors are made in various sizes—with capacities of 500 cubic feet per hour and upwards; and as they require but little driving power, they can be driven by small gas-engines, electric motors, or from existing shafting. Then, again, they occupy but small floor-space; and a further advantage is that they are practically noiseless.

As stated, the Syndicate have also a patent water-driven compressor, which is eminently suitable for smaller installations, or for use where power is not easily obtainable. All that it is necessary to do is simply to connect it up with the ordinary water service; and this plant possesses the special advantage that the water, not coming in contact with the gas, can afterwards be used for other purposes. The gas compression can be adjusted up to 50 inches; but it is claimed that when working at from 36 to 40 inches, an efficiency of over 50 candles per cubic foot of gas can be obtained by the use of any of the lamps which will presently be referred to. This form of compressor is entirely automatic; the quantity of water employed being regulated by the number of burners at the time in use. An even pressure is maintained; and the apparatus is quite noiseless in operation. A special feature is made of simplicity in construction and working, and the small amount of attention required by the plant. In fact, it is well suited for lighting shops, factories, laundries, &c.

Patent inverted lamps designed for use with this system are supplied by the Syndicate; and they are constructed for lights of from 500 to 1500 candle power with single burners. Among the advantages which are put forward for these lamps (which it is stated have an efficiency of 60 candles per cubic foot of gas consumed at suitable pressures) are the means adopted for the perfect mixture of the gas and air, both of which are heated before reaching the point of combustion. The regulation is external, while the burner nipple or injector is readily removed from the top of the lamp for cleaning or renewal purposes. The place of ordinary gauze in the burner-nozzle is taken by a specially constructed nickel grid. In addition to the ease with which this can be cleaned, it, of course, does away with any question of the incineration of gauzes through the great heat at this point. There are also made smaller gas-lamps of similar construction, having lighting values of from 100 to 300 candle power; and high efficiency upright burners, of various candle powers up to 1500, are provided. For attachment to the lamps of either system, automatic high and low pressure bye-passes and distance igniters are furnished; and it should be mentioned that special care is taken in connection with the mantles used, so as to ensure the combination of high efficiency with durability.



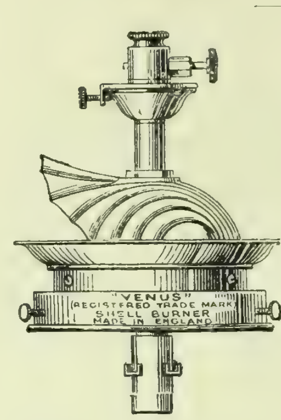
The Tilley High-Pressure Inverted Lamp.

In conclusion, we may remark that the Syndicate are devoting particular attention to the manufacture of heating appliances for laundries and other trade purposes.

Physical Basis of Steam and Gas Engines.

This was the subject of a paper read by Mr. Frank Foster at the Manchester Engineering Exhibition, which closed last Saturday. After briefly outlining the types of large gas-engines, the author turned to a consideration of the difficulties to be met by their makers; one of these being their cost as compared with steam-engines. As there seemed to be an impression that the high prices of gas-engines were artificial, he said it might be as well to point out the physical basis upon which they rested. In a standard compound steam-engine, the maximum steam pressure in the high-pressure cylinder would be 155 lbs. per square inch, and 20 to 30 lbs. in the low-pressure one. The maximum effective pressures would be 140 lbs. and 35 lbs.; while the mean effective pressures would be about 64 lbs. and 16 lbs. Thus the ratio of maximum effective to average pressure was 2·2 for each cylinder. In a gas-engine the maximum pressure might be 350 lbs.; and some cases as high as 500 lbs. had been registered. The mean effective pressure was only 30 to 32 lbs., so that the ratio of maximum (assumed at 350 lbs.) to mean was about 11 lbs., or five times that of the steam-engine; and, of course, the parts had to be strong enough to withstand the maximum pressure. By putting two cylinders in tandem, the connecting-rod, main frame, and crank-shaft were not subjected to any higher stresses; but the intermediate frame, back piston-rod, cylinder barrels, and valve-gear remained as before. Hence, even in this case, the ratio of maximum to average pressure for the whole engine was nearly 4 lbs., as against 2·2 lbs. for the steam-engine. Further, the severe conditions under which the gas-engine worked necessitated more expensive materials than in the case of steam-engines. The wonder was that gas-engines were so cheap.

THE VENUS "SHELL" BURNER.



The Venus "Shell" Burner.

The accompanying illustration shows the Venus "Shell" burner of Mr. B. Cars, of Tabernacle Street, E.C. It is supplied in polished brass, steel bronze, and oxidized copper. The burners have heavy, cast-brass gas-regulators, fitted with reliable stuffing-boxes, making any leakage of gas next to impossible. Each burner has an anti-back-lighter, gives a steady, pure light equal to some 80-candle power, and has a consumption of 3 cubic feet of gas per hour. The burners are all fitted with square lug-nozzles, taking ordinary inverted mantles and ordinary inverted globes.

ARTISTIC GAS-FITTINGS AND OTHER THINGS.

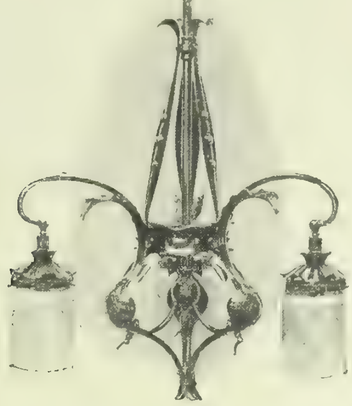
It is always a pleasure to be able to record business expansion, whether in the manufacture and distribution of gas or in the trade of individual firms who provide appliances for consuming the gas; and fortunately it is by no means infrequently that we are able to avail ourselves of this pleasure. An opportunity now occurs; for, in the course of a recent interview, Mr. George Hands made it abundantly clear that the business of Messrs. G. Hands and Co., whose temptingly fitted show-room in Farringdon Road was some time ago the subject of an appreciative notice in our columns, is a rapidly developing one. Very material evidence of this is forthcoming in the fact that the firm have now found it necessary to issue a catalogue which, for size, get-up, and attractiveness of the contents, is worthy to take its place by the side of any that we remember having seen in connection with the gas-lighting business. The compilation of nearly 200 pages of prices, particulars, and illustrations is a big task, as others have found before; and the fact that it has been thought requisite to undertake the work, shows how great is the variety of articles there are to choose from.

It is a long while since the firm first established a reputation in the industry for the supply of artistic fittings; and one can assert with confidence that the future is likely to enhance this reputation rather than to diminish it. Mr. Hands firmly believes that one of the best ways of combating the electric light is by providing gas consumers with really handsome fittings. The show-room is filled with brackets, pendants, &c., in hand-beaten art metal work; and the illustrations on p. 395, taken practically at haphazard, will give some indication of the elegant character of the goods to be seen there. But if the fittings are to be of a high order of excellence, it is most desirable that they should be protected from any possibility of discoloration; and this it is claimed is accomplished by the use of the Hands patent "Cool" inverted burner, which can be had in various sizes. In addition to the fact that it will not cause discoloration of the fittings on which it is used, another advantage possessed by it—as the name implies—is that it is always cool for the adjustment of the air or the gas. The stated lighting efficiency of these British-made burners is 80-candle power for 3 cubic feet of gas per hour. The "Cool" burner is, we learn, making its way among gas undertakings in a highly satisfactory manner. In speaking thus of artistic fittings, it must not be thought that they are all of an expensive kind. Far from this being the case, the requirements of every class of consumer are catered for in every style of gas lighting appliance.

Another speciality is the "L'Fin" inverted cluster burner, also of British manufacture, and made in three sizes, and for two or three lights. The burner-head (which is made entirely of china, so that there is no chance of discoloration) can be lifted off in a moment for cleaning purposes; and every part is interchangeable. The cluster is suitable for street-lamps, church lighting, and domestic use; and it is said to possess a very high lighting efficiency—about 100-candle power for a consumption of 3 cubic feet of gas per hour. The firm's "Whitelight" mantle, too, is in great demand. The chief feature of this is the special mesh of the mantle stocking, which is formed by a number of straight ramie threads crossing each other horizontally and vertically—thus forming a square network on the principle of a piece of linen, loosely woven. "These straight threads," it is pointed out, "really form small firm cells capable of great resistance, being very elastic. The construction is such that, instead of the weight of the mantle hanging on a single thread, each of the straight threads carries only its own weight—this fact being the explanation of the enormous durability and power of resistance which the 'Whitelight' mantles undoubtedly possess." The inverted mantle is of the same texture and thickness in every part, having only one vertical seam right round it; and a perfectly uniform light is emitted from all portions.

An important feature of the catalogue is the section devoted to

The "Wyndham."



The "Bromley."

The "Rhyl."

SPECIMENS OF MODERN ART GAS-FITTINGS.

specially designed inverted fittings suitable for churches, public buildings, schools, &c. This is well worthy of careful study by those who are, or are likely to be, concerned with the problem of lighting such places in an efficient manner by means of absolutely up-to-date fittings. The range covered is of the widest imaginable; and so there should be found among them something to suit every style of building. Another division deals with fittings for prepayment meter installations; and there is also a comprehensive list of small gas-fittings and gas-works tools, which is quite a new departure by the firm. Soon we shall be having with us the Coronation rejoicings; and suitable opportunity will then present itself for the fitting up of illumination devices for gas. Well, even of these Messrs. Hands and Co. offer a variety of patterns—some the most simple and others the most elaborate that could be desired. Finally, a word must be bestowed upon the well-known patent outdoor lamps of the "Dreadnought" type, which have been adopted by some of the largest gas undertakings for hiring-out purposes. These have been often tried, and have not been found wanting.

LIVERPOOL ENGINEERING SOCIETY.

Extracts from Inaugural Address of Mr. Edward Allen, M.Inst.C.E.

THE Engineer of the Liverpool United Gaslight Company—Mr. EDWARD ALLEN, M.Inst.C.E.—is the President of the Liverpool Engineering Society for the current session; and at the opening meeting of the Society last Wednesday he delivered his Inaugural Address, which was devoted mainly to the progress of the Company and the industry with which he is connected.

Mr. Allen began by expressing his full appreciation of the honour conferred upon him by his election as President, and by thanking members of the Society for this mark of their favour. He said he could not but feel that the appointment had, to some extent, been influenced by his official connection with one of the largest and most important industries of the city—the Liverpool United Gaslight Company. If this assumption was correct, he was placed under a double obligation of gratitude and fidelity, and would gladly acknowledge this graceful recognition of the important public position occupied by the Company. In this connection, he thought it might be interesting to give some particulars of its history during a period which had nearly reached a century; and this he proceeded to do, as follows.

HISTORY OF THE LIVERPOOL UNITED GAS COMPANY.

In the year 1815, a gentleman of the name of Hargraves, who represented himself as having been Engineer to a London Gas Company, came to Liverpool and called upon several influential gentlemen with the object of forming a gas company. He was fortunately able to gain the support of a Mr. Varty, a local coach-builder, who took the matter up with so much zeal and ability that on the 16th of October, 1815, the first meeting of subscribers was held at the Crown Inn, in Redcross Street.

A small plant was erected on Mr. Varty's premises in Dale Street, from which gas was supplied to two large lamps, each containing three lights, situated at the front of the Town Hall. These were first lighted on Jan. 23, 1816, and excited much attention; large crowds of people gathering to see the brilliant illumination obtained from coal gas. Mr. Varty states that he saw several persons touching the iron gas-pipe to ascertain whether it was hot, with the idea that fire was being conveyed through the pipe. Some alarm was caused among the directors of insurance companies, who feared the use of gas would lead to conflagrations.

This exhibition and others enabled capital to be raised. Gas-works were erected at the corner of Hatton Garden and Dale Street, and gas-mains were laid in the streets during 1816. The first supply of gas to the public took place on Jan. 3, 1817.

The capital subscribed in 1816 consisted of 200 shares at £30—£6000; and this was doubled the following year. The revenue from gas and the residual products sold the first year amounted to £2585. It may be interesting to note that the present capital is nearly £2,000,000, and that last year's revenue almost reached the sum of £640,000.

As soon as possible, the Directors sought and obtained statutory powers. The first Act of the Company—58 Geo. III., cap. 66 (May 23, 1818), authorized them to raise £50,000, in 500 shares of £100 each, and all other powers necessary for carrying out the objects of the Company.

The success of the Company led to the formation of a rival undertaking; and in 1822 a Company was enrolled to supply the town with gas manufactured from oil, and works were erected at Rose Hill. The cost of this gas (about 45s. per 1000 cubic feet in the earlier years and 30s. later) heavily handicapped the undertaking; and in 1834 the Company went to Parliament and obtained permission to manufacture gas from coal and any other materials whatever. In the years 1843 and 1844, unsuccessful attempts were made to form a third gas company under the auspices of the Guardian Society.

While competition may be good for business generally, this cannot be said of gas undertakings operating in the same area; and the experience in Liverpool was such that ultimately, in 1848, by the advice of the corporate authorities, the two Companies amalgamated, and hence the present title—"Liverpool United Gaslight Company."

In regard to the offices, it is interesting to note that those of the old Company were situated in Dale Street from its formation until 1849, when a removal was made to Newington. In 1854, the Dale Street premises were sold to the Corporation, and the present Police Courts built on the site. The new Company removed their offices from Rose Hill to Queen's Square; and in 1849 the business of the united Company was transferred to the very handsome premises, already referred to, erected in Newington. The site was acquired by the Cheshire Lines Committee on June 24, 1870, and the Gas Company's business was carried on temporarily in Cornwallis Street until the new offices in Duke Street were entered on July 1, 1872.

As to the works, the original installations of each Company were discarded at an early period in favour of more commodious and convenient premises situated in Eccles Street and Athol Street, on the Leeds and Liverpool Canal; and though the plant and apparatus have been from time to time supplanted by those of modern design, most of the old buildings remain intact, and are a credit to those who erected them eighty years ago. In 1847, additional works were erected in Caryl Street (then called Harrington Street); and they were opened on Oct. 16, 1847. Then followed the Wavertree works, opened on Oct. 1, 1856. These were the first of the Liverpool works to have the advantage of being connected to a railway system. The development of Liverpool to the north which followed the extension of the docks, and the growth of the township (now Borough) of Bootle, led to the erection of the Linacre Gas-Works, opened in October, 1867. The next and latest addition to the works of the Company was at Garston, at the extreme southern end of the area of supply. Gas was distributed from these works in March, 1895.

The Engineers to the Company have been few in number. The first was Mr. Sadler, whose son (Mr. John M. Sadler) was a member of this Society for many years; but he appears to have resigned in 1902. Mr. Sadler was one of the pioneers in the navigation of the air, and, like many of the brave and clever men who have lately been labouring in this field of engineering, he lost his life while ballooning, and joined the "noble army of martyrs" to the cause of science. He was succeeded in 1822 by Mr. John King, a son of Mr. Joseph King, of Liverpool, the compiler of the well-known "Tables of Interest." On his death, in 1826, the Directors invited his brother, Mr. Alfred King, to take the position. He accepted the invitation, and for forty-one years held the appointment, with eminent ability and success.

It may safely be said that few names will be longer identified with the history of gas lighting than that of Alfred King.

The industry owes much to him for improvements in the processes of the manufacture and distribution of gas; and to his great skill and foresight, his business capacity, and his high personal character is largely owing the success of the gas undertaking in this city. At his death, in 1867, the Directors appointed his son, Mr. William King, to be Engineer to the Company; and after thirty-seven years of very able and faithful service, he retired from the position in 1904. He is a member of this Society, as well as of the Institutions of Civil and Mechanical Engineers. He has long been a distinguished leader in the gas industry, and a recognized authority in his profession.

Progress of the Gas Industry.

The gas industry has made enormous strides since William Murdoch lighted the works of Messrs. Boulton and Watt at Soho, Birmingham, by means of coal gas, in 1803. There are now undertakings in every centre of population in this and all other civilized countries. English enterprise established gas-works on the Continent at a very early date; and even to-day there are gas-works in France, Germany, Italy, and other countries, owned and carried on by English companies.

The present position of the gas industry in the United Kingdom may be indicated by the following statistics, taken from the Board of Trade returns.

Number of undertakings (authorized) . . .	790
Capital employed (paid up and borrowed) . .	£130,708,693
Gas made	189,918,737,000 cub. ft.
Coal used	15,394,307 tons.
Average number of persons employed weekly	64,584

These figures demonstrate the important position of gas manufacture among the industries. It would be difficult to form an estimate of its value for business and social purposes. Originally introduced as a source of light, it is now largely used to provide heat and power. As a rival to coal for these purposes, gas has made rapid progress and is deservedly popular.

One of the great problems yet remaining to be solved is that of purifying the atmosphere of our large towns. Professor A. H. Church recently drew attention to the destructive action of London rain on stone buildings, and more especially on portland stone; and he mentioned that annually something like 500,000 tons of sulphuric acid are deposited over the London area as a result of the enormous combustion of smoky coal. Professor Cohen, of the Leeds University, contributed a paper to the Health Congress last year on the "Quantity and Nature of Impurities in the Atmosphere of Leeds and Surrounding Districts,"* and said that "he found by experiment that the production of soot from coal varied from ½ to ¾ per cent. from boiler furnaces, but reached an average of 5 per cent. from domestic chimneys." These results have been fully confirmed by a variety of observers. So long since as the year 1881, Sir William Siemens, F.R.S., said: "I am bold enough to go so far as to say that raw coal should not be used as fuel for any purpose whatsoever, and that the first step towards judicious and economic production of heat is the gas-retort or gas-producer, in which coal is converted either entirely into gas or into gas and coke, as is the case at our ordinary gas-works." It is evident, therefore, that the gas industry provides a simple solution for the great "Smoke Problem;" and so far as it is made use of, it is a public benefactor.

Engineers and the Gas Industry.

It is interesting to engineers to know that their profession not only finds occupation in providing and operating the plant and machinery of gas-works, but in manufacturing the multitudinous appliances in which gas is used for various purposes. In reference to the former, it is gratifying to know that the spirit of improvement was never more evident than at the present time. The old plant is giving place to the new. The process of carbonizing coal was originally carried on by means of vertical iron retorts. These gave way to iron ovens; then followed horizontal iron retorts, shortly to be changed to those of fire-clay.

At this stage there was a period of rest, slightly disturbed in some places by the substitution of mechanical stokers for hand work. An attempt to introduce retorts set at an angle ("slopers") was at first a failure; but on the early faults being removed, the system found favour. In the meantime, greatly improved mechanical stokers were invented, which enabled horizontal retorts to once more lead the way. Within the past few years, however, vertical retorts have reappeared; giving a larger make of gas per ton, and lower costs of working, than have previously been obtained. The oven has also been revived, and claims many advantages. Not to be outdone, the horizontal retort, working with full charges of coal over a lengthened period, is stated to be the most satisfactory carbonizing vessel. What has been said about carbonizing plant may also be applied to plant used in the other processes of gas-works.

The battle is still raging; and while the "survival of the fittest" applies as truly in the works of Science as in those of Nature, it is difficult for an engineer to foretell the result. There is one admirable feature in the struggle for supremacy that is seen in the conduct of gas engineers. Nothing is kept secret; each man is willing to show his plant and process to his neighbour, and to compare results. Unlike manufactured goods that compete in every market, the products of a gas-works are for local consumption, and every community may benefit by any improvement invented elsewhere.

* See "Journal," Vol. CVIII., p. 613.

Progress in Allied Industries.

The spirit of progress is not confined to gas-works, but permeates the allied industries. The old fishtail and batwing burners, having a duty of (say) 4 candles per cubic foot with the best quality gas, are giving place to incandescent burners having a duty of 60 candles. The pattern of gas-bracket or chandelier which obtained for many years is thrown on to the scrap heap, and the light, graceful, and artistic fitting which harmonizes with the brilliant light is now provided.

The limits of this address do not permit more than the briefest reference to the recent improvements in gas-cookers, gas-fires, and gas-engines. The skill of the engineer and the learning of the chemist have been devoted to these appliances with remarkable success; and the practical or effective calorific value now more nearly approaches the theoretical quantity. Success in this direction, however, can only be achieved when the gas made by all undertakings is of uniform composition. The shape of flame given by 20-candle gas is very different from that of 14-candle gas, and therefore a gas-fire that is highly efficient with the latter quality may be very imperfect with the former, though its calorific value is greater, for the simple reason that the shape and size of the fire-clay or other refractory material have been made to suit the flame formed by the lower-quality gas. The same thing applies with even greater force to incandescent burners, as the best effect can only be produced when the hot zone of the flame is in complete contact with the mantle.

In the gas industry, as in others, efficiency and economy can only be attained by standardization. It is gratifying to know that the old "rule-of-thumb" methods are being replaced in all branches of engineering by rules of exact science. The prejudice in favour of what was called "practice" as against "science" is passing away, and we are finding that these should not be considered as in opposition, but that our "practice" should be based upon "science." Credit for this is due to the greater facilities given for technical education in the day schools and the evening classes promoted by Education Committees, as well as in the universities and colleges of our country. In this way the level of the artisan has been greatly raised, and he has been able to respond to the higher calls made upon him.

Special Training in the Gas Industry.

Mr. Allen next referred to the vast amount of attention which has of late years been given to special training in the gas industry. In this connection, he mentioned the classes on "Gas Engineering" and "Gas Supply" held under the auspices of the City and Guilds of London Institute; the research work carried on at the Leeds University in memory of the late Sir George Livesey; and the lectures recently arranged by the University of Manchester as the result of the movement initiated by the Junior Gas Association of the district, and supported by the Manchester District Institution of Gas Engineers. It would thus be seen, he said, that the gas industry is throbbing with life and vigour, eager to solve its problems, and to place in the hands of its master (the public) the most perfect light, heat, and power that can possibly be produced from gas at a minimum cost. He added that the same spirit of enthusiasm was found in every branch of engineering; and the Liverpool and kindred societies existed for the purpose of promoting its growth, and guiding it into right channels.

Closing Remarks.

In conclusion, the President apologized for the lack of attention to the many important branches of engineering the members of the Society represented, and explained that the omission was not due to any want of appreciation on his part, but rather to a feeling that one could be more interesting, and speak with more authority, when dealing with his own special subject.

Retirement of Mr. Henry Austin.

It may be remembered that at the annual co-partnership dinner of the employees of the South Metropolitan and South Suburban Gas Companies at the Crystal Palace in July, Mr. Henry Austin, an Employee-Director of the first-named Company, referred to his approaching relinquishment of the position, and took the opportunity of bidding the co-partners farewell, and wishing them "success and double success." We learn from the Company's "Co-Partnership Journal" for November that the event alluded to takes place this month. In recording the fact, the Editor (Mr. Walter T. Layton) says: "For full twelve years Mr. Austin has represented his fellow-employees with conspicuous ability and with a whole-hearted devotion to the Company and the co-partnership movement. Sir George Livesey, in speaking of the profit-sharing meeting on Nov. 21, 1889, alluded to 'our friend Austin, who was the orator of the occasion.' Years have intensified, rather than toned down, the enthusiasm of our senior representative on the Board; and it is generally recognized that co-partnership has no abler advocate in the ranks of the Company's employees. The best wishes of all co-partners will go with him into his retirement; and we feel certain that he will still be a welcome visitor at the social gatherings of those whom he has so long represented."

AMERICAN GAS INSTITUTE.

Fifth Annual Meeting.

In accordance with the arrangements previously announced [see *ante*, p. 245], the fifth annual meeting of the American Gas Institute was held in New York from the 19th to the 21st ult., under the presidency of Mr. W. H. Bradley, Chief Engineer of the Consolidated Gas Company. The following particulars of the proceedings are taken from a summary by a correspondent of the "American Gaslight Journal."

The members assembled shortly after ten o'clock on the morning of the first day, in the hall of the Engineering Societies' Building. The principal feature of the sitting, was, of course, the President's Address, which dealt largely with the question of maturing and spreading the interests of the Institute. Our contemporary says one might well have supposed the address to have been "the work of a well-trained man of letters, or the tabulation of facts by a barrister of fame, rather than the compilings of one whose active life has been intimately bound up in the practical working out of engineering problems, the magnitude of some of which are remarkable even in this age of wonderful achievement." The reports submitted by Committees and other standing bodies, notably those from the Boards of Directors and the report of the Trustees of the Gas Educational Fund, showed that the Institute is progressing smoothly in every respect. There were fourteen items on the programme for the morning sitting; and only two of them had to be deferred on account of the temporary absence of members of Committees.

The papers which attracted the greatest attention on the first day were those of Mr. J. Hawley Taussig and Mr. J. M. Morehead; the former dealing with the "Utilization of Waste Heat in Water-Gas Apparatus," and the latter with the "Determination of the Calorific Value and Operating Conditions from Analyses of Industrial Cases." A paper by Dr. A. C. Humphreys, bearing the title of "The Public Deceived by Faulty Data and Misleading Analyses of Data," was scholarly and convincing. "The Lighting and Ventilating of Gas Appliance Display Rooms," by Mr. T. Scofield, described, with the aid of the screen, the Consolidated Gas Company's display at their City House. Three other papers similarly illustrated were "The Laying of the 48-Inch and Two 36-Inch Gas-Mains under the Harlem River," by Mr. C. C. Simpson; "Pneumatic Caulking with Lead Wool of 30-Inch, 36-Inch, and 48-Inch Gas-Mains," by Mr. C. C. Simpson, jun.; and "The Laying of a Pair of 30-Inch Cast-Iron Mains under the Passaic River," by Mr. A. H. Strecker. Other business transacted was the presentation of the Wrinkle Budget by the Editor (Mr. R. C. Congdon), and the award of the Beal Medal for the best paper at last year's meeting to Mr. W. H. Fulweiler, for his communication on the "Physical Theory of Coal Carbonization."

The election of officers resulted as follows:—

President.—Mr. D. M'Donald, Louisville.
First Vice-President.—Mr. W. C. Morris, New York.
Second Vice-President.—Mr. J. D. Shattuck, Chester (Pa.).
Secretary and Treasurer.—Mr. A. B. Beadle, New York.

The technical proceedings of the second day included a paper by Mr. W. J. Clark, of the West Chester (N.Y.) Lighting Company, on "The Cultivation of Friendly Relations between the Public and the Lighting Company." Our contemporary's correspondent says the discussion on this paper was one of the best that was ever had before any technical society. A noteworthy incident of the day was an invitation by Mr. J. W. Ellis, President of the Providence (R.I.) Gas Company, to members to visit the Providence plant, to see in successful operation a vertical retort plant of the Didier-March type, as installed by Mr. F. J. Mayer. An important communication submitted was one by Mr. H. W. Alrich, on "Brick, Concrete, and Steel Tanks for Gasholders," the first portion of which appears elsewhere. The papers, of which a list has already been given, will be noticed more fully in subsequent issues of the "JOURNAL."

The banquet on the evening of the second day took place in the ball-room at the Hotel Astor, and was a brilliant gathering; and the social functions of the meeting were all successful.

Electrolysis was found to be the cause of the pitting of a 6-inch main removed from one of the streets of Beaumont (Tex.). The Telephone Company of the city, according to a report of a Committee of the National Board of Fire Underwriters, formerly experienced trouble from this cause in connection with their underground cables. These are now bonded at each manhole to an overhead return feeder to the street railway power-house; and tests have shown that troubles from electrolytic action are obviated.

The report presented at the recent annual meeting of the Junior Institution of Engineers furnishes evidence that the organization continues to do good work. In the past session there were nine ordinary meetings for the reading and discussion of papers; and a large number of visits were paid to engineering works. At the close, the membership was 1089. The new President is Sir J. J. Thomson, F.R.S., of Cambridge; and Mr. J. Wylie Nisbet has been elected Chairman of the Council. The Secretary of the Institution is Mr. Walter T. Dunn.

THE PHENOMENA OF EXPLOSIONS IN GAS AND OTHER INTERNAL COMBUSTION ENGINES.

By DUGALD CLERK, F.R.S., M.Inst.C.E., F.C.S.

[A Lecture delivered at the Manchester University last Saturday.]

The experimental determination of the properties of gaseous explosions presents very considerable difficulties, which require for their solution serious expenditures both of time and money.

Until recently no urgent commercial need pressed for exact knowledge on the subject. The steam and hot-air engines hitherto used dealt with their working fluids at comparatively low temperatures; and, accordingly, chemists and physicists, with a few honourable exceptions, had not applied themselves seriously to the exact determination of the necessary constants required to understand the behaviour of the gases formed in gaseous explosions at high temperature.

The study of the history of nearly all important inventions proves quite clearly that very considerable practical success may be attained prior to the existence of any really exact scientific knowledge. The steam-engine, for example, attained to a relatively high development long before the science of thermodynamics came into existence. Newcomen's engine was produced early in the Eighteenth Century; and was considerably used in England until a study of its defects suggested to James Watt that better things might be done. Watt experimented at the Glasgow University with an old Newcomen model, and produced a condensing steam-engine with a separate condenser. In this work he was aided by a knowledge of the researches upon the latent heat of steam made by Black, Professor of Chemistry in the University of Glasgow. Watt added to that knowledge, however, by means of his own experiments on the pressure and temperature of steam; and he considered that he had established that the quantity of heat required to convert a given weight of water into saturated vapour was the same whatever the pressure of the vapour might be. This supposed property was known as "Watt's Law" for many years, although it was afterwards shown to be wrong. Errors in his theories, however, did not prevent him from improving the principles and construction of his steam-engine; so that Watt lived to see his engine applied to all the great duties of the mine, the water-works, the factory, and the steamship. He also saw the beginning of the steam locomotive. All this practical progress was made at a time when scientific men still believed in the material theory of heat, and no science of thermodynamics had come into existence.

The story of the gas-engine shows the same imperfect knowledge and the same considerable practical success attained, notwithstanding ignorance. In 1876, for example, Dr. Otto thought his success due to the use of stratification in his engine; while, in actual fact, stratification had nothing whatever to do with it. His success was wholly due to correct mechanical detail, and the effective use of compressed gaseous mixtures. The history of the dynamo shows the same thing—crude and imperfectly understood machines attaining great success; and the development of the steam-turbine in its early stages shows considerable success based on relatively imperfect knowledge.

Pure science seldom supplies motive sufficiently powerful to induce the necessary expenditure of means and labour always required for exact quantitative work. The requirements of industry have really given rise to most of the exact science of to-day. Under the stimulus afforded by the growth of the steam-engine, physical constants for steam, air, and other gases and liquids have been exactly determined. Indeed, the whole science of thermodynamics appears to have originated in its study. Quantitative electricity as an exact science is largely indebted for its present position to the industrial requirements of electric lighting and telegraphy.

In inventions, practice generally exists first, without adequate explanation, and science concerns itself, in the first instance, with an attempt to explain practice by theories. In modern times this attempt to explain is partly experimental, partly mathematical; and the experiments and consequent deductions lead to the discovery of new facts which themselves both aid explanation and require explanation. All important inventions thus arrive at a stage when further progress can only be made by minute study and a complete knowledge of many facts which had not been required in the early stages. The internal combustion motor has arrived at this stage. Further progress becomes more difficult, and a full knowledge (in the scientific sense) of all the properties and phenomena of the working fluid is necessary to furnish guiding ideas for future changes.

An interesting discussion was held in 1907 at the Leicester meeting of the British Association between the Engineering and the Chemical Sections upon the properties of gaseous explosions. Chemists, physicists, and engineers took part in this discussion; and Continental investigators were well represented—including Dr. Holborn, of Berlin, Dr. Haber, of Carlsruhe, and Dr. Boudouard, of Paris, representing M. Le Chatelier, whose early work is so well known. The state of knowledge as to gaseous explosions was shown to be somewhat indefinite—conflict existing as to material facts; and it was felt that co-ordination among investigators was urgently required. A British Association Committee was formed, which includes practically all the investigators of Britain who interest themselves in the internal combustion

engine, with the idea of overcoming difficulties by frequent meetings and discussions between physicists, chemists, and engineers. This Committee has now been at work for three years, and has issued three reports, which have greatly added to our knowledge. The reports have attracted considerable attention and interest, both on the practical and the scientific side. Judging from some letters and articles in the Press, many practical men do not clearly appreciate the bearing of the work of the Committee upon the development of the internal combustion motor. Accordingly, this lecture will be devoted to indicating some of the practical points upon which accurate scientific knowledge can help us as engineers desiring to improve internal combustion motors of all kinds.

But first it is desirable to remind you of a few of the leading facts as to gaseous explosions within closed vessels. When a mixture of inflammable gas or vapour and air is confined within a closed vessel and ignited, the act of combustion causes the pressure to increase because of rise of temperature. With a mixture of coal gas and air having just enough gas to consume all the oxygen of the air, the mean temperature at its highest is about 2000° C. The whole vessel becomes filled with flame, which near the cooling walls is at a lower temperature. But at the centre of the vessel, the temperature may be higher by about 300° C. If the mixture be ignited at atmospheric pressure and temperature (16° C.), the maximum attainable pressure is about 100 lbs. per square inch above atmosphere, or 115 lbs. per square inch absolute. If the initial temperature be kept at 16° C., and the density increased before ignition, then double density gives double maximum pressure after explosion, treble density treble maximum pressure, and so on. This has been found to be approximately true up to initial pressures of over 1000 lbs. per square inch by Professor Petavel, of this University.

The temperature of explosion appears to increase slightly with increase of density; but further experiments are required on this point. Reduction of the proportion of inflammable gas present reduces the maximum temperature attained by combustion; and therefore the maximum pressures fall also. At a certain dilution, it becomes impossible to fire the inflammable mixture. The weakest mixture which can be fired by the electric spark gives a maximum temperature of about 900° C.

The rate of cooling of the gaseous explosion depends largely on the capacity of the explosion vessel. Thus in a small vessel of 0·183 cubic foot capacity used in Clerk's experiments, the temperature fell from 1600° C. to under 600° C. in 0·5 second; while in a large vessel used by Hopkinson (6·2 cubic feet capacity), it fell from 1600° C. to just under 1100° C. in the same time. That is, the small vessel lost 1000°, and the large vessel only 500° in the same time.

The rate of cooling also changes rapidly with increased density. Increasing density diminishes the temperature fall in unit time, although it also increases the rate of flow per square inch exposed. This has been fully proved by Bairstow and Alexander's closed-vessel experiments, and by Clerk's experiments within a working cylinder.

The rate of increase of pressure due to combustion depends on the dimensions of the vessel, on the density of the mixture, and on its temperature. Increase of density increases the rate of ignition within limit. Increase of initial temperature rapidly increases the ignition rate, and increase of volume diminishes it.

In large-cylinder engines, it is customary to ignite at two or more points in the combustion space; and even in small rapidly-running petrol engines, double ignition is sometimes adopted. Ignition can be controlled, however, so that the explosion is completed within the range of from one-tenth to one-hundredth of a second. Professor Harold Dixon's interesting investigations on the conditions of ignition in small glass cylinders have thrown much light upon this important question.

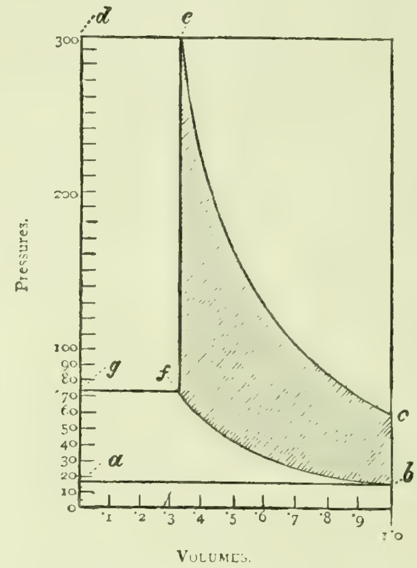
During the period elapsing between the beginning of ignition and maximum pressure, heat is lost to the enclosing cold walls in several ways, which are under experimental examination at present. Heat is lost by convection, by turbulence (due to explosion), and by radiation. During cooling also heat is lost by convection and radiation.

Combustion is now known to be incomplete at maximum pressure; but although much experiment has been devoted to this point, the amount is not yet determined with accuracy. It may account, however, for as much as 5 per cent. of the total heat of combustion of the gas present.

The specific heat of steam and carbonic acid is known to increase rapidly with temperature, and that of air to increase very slowly.

With these facts in mind, the engineer is in a position to consider some of the problems which arise with large and small gas-engines; and accordingly the practical points shall now be considered. [Mr. Clerk showed lantern slides illustrating, by curves and tables, the various points indicated.]

The Institution of Civil Engineers' tests in 1905 proved, among other things, that an engine of about 50 H.P. using coal gas converts practically 30 per cent. of all the heat present in the gas into brake-horse-power; and 35 per cent. appears as indicated power within the cylinder. Professor Hopkinson's experiments at Cambridge have carried the indicated thermal efficiency as high as 37 per cent. for short runs of a 40 H.P. gas-engine, also using coal gas. These efficiencies are very high; but, naturally, engineers still desire to improve upon them. To do this, it becomes necessary to have accurate knowledge as to the disposal of the balance of the heat, amounting to 65 per cent. of the thermal value of the gas. In fact, it is necessary to prepare an accurate balance-sheet of heat given to the engine and heat accounted for in different ways by the engine. Such balance-sheets have been prepared for very many years; but, unfortunately, careful examination has shown them to be unreliable. It is a very difficult matter to determine accurately the division of the balance between, for example, cylinder loss during explosion and expansion and exhaust loss due to heat carried away by the exhaust gases. Fairly accurate balance-sheets are now available; but considerable doubt still exists, which can only be settled by accurate knowledge of the properties of the working fluid.



t absolute temp. °C. at	b	p absolute pressure at	b
tc ,, ,,	f	p ,, ,,	f
T ,, ,,	e	p° ,, ,,	e
T' ,, ,,	c	v°₀ volume at	b
Here $v_0 = v$.		v ,, ,,	c
		v ,, ,,	f

Fig. 1.

The information required to enable a complete balance-sheet to be prepared is best appreciated by considering a gas-engine diagram such as is shown in fig. 1. Assume the compression line B F to be complete; then, to produce the working stroke, heat is to be added to the working fluid at the point F. Assume the pressure to rise from F to E at constant volume. The temperature at the point F is known approximately, and from it can be calculated the temperature at E. It is necessary to know first the total amount of heat required to raise (say) one cubic foot of the gaseous mixture (nitrogen, oxygen, carbonic acid, and steam) from the lower temperature to the upper, neglecting all considerations of chemical action and assuming no heat loss during the temperature rise—that is, we must know the specific heat of each gas through the whole range of the temperature of the explosion. Specific heat for such purposes as discussing gas-engine diagrams is best expressed in terms of mechanical energy necessary to heat up one cubic foot of gas at standard temperature and pressure through 1° C. This cubic foot degree may be called the volumetric heat; and this term is recommended by the British Association Committee.

Three experimental methods have been adopted for the determination of:—

(1) Constant pressure experiments (Regnault, Wiedemann, Witkowski, Lussana, Holborn and Henning). In these experiments the gas under examination is heated from an external source and is at atmospheric pressure.

(2) Experiments in which both volume and pressure are varied; the gas being heated by compression. [Experiments by Clerk, within a gas-engine cylinder, and by Harold Dixon within tubes, belong to this class.

(3) Constant volume experiments. To this category belong the explosion experiments of Mallard and Le Chatelier, Clerk, Langen, Petavel, Hopkinson, and others, and Joly's determinations with the steam calorimeter.

In the explosion experiments, the gas is heated by internal combustion. The values obtained by the three methods differ to some extent, as will be clearly seen by referring to fig. 2, which shows the results obtained by Holborn and Henning, Clerk, Langen, Mallard, and Le Chatelier, as applied to a gas-engine mixture containing nitrogen and oxygen 83 per cent., carbonic acid 5 per cent., and steam 12 per cent. Holborn and Henning's experiments were only carried to 1200° C. Clerk's experiments are shown to 1200° C., although he measured up to 1500° C., and Mallard and Le Chatelier's and Langen's values are taken to 2000°C. The black line shows the values provisionally adopted by the Committee for the purpose of the first report. It will be seen that for the lower values the black line passes between Holborn and Henning's results and those of Clerk, and for the upper values it passes through the experimental points that were

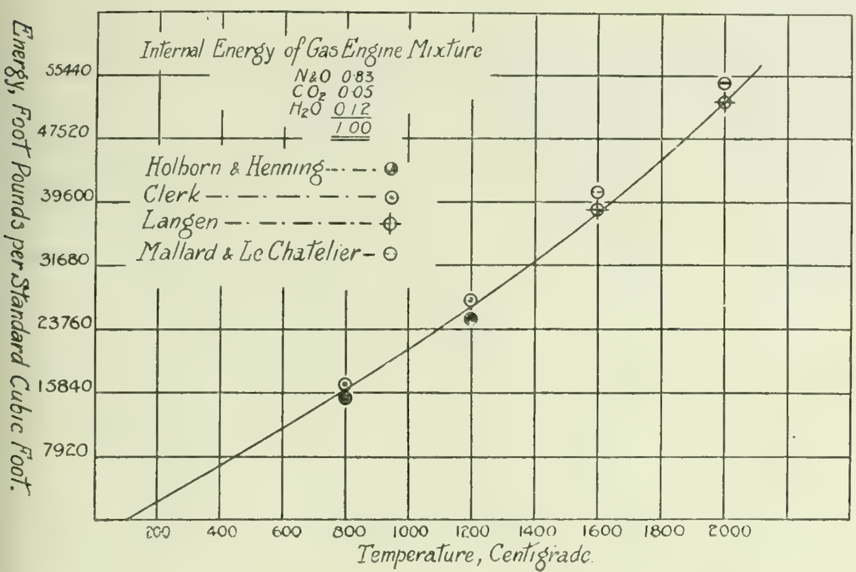


Fig. 2.

Another method, however, has been devised of studying the heat loss occurring at different parts of the stroke. Fig. 3 illustrates a new type of indicator diagram which has been used by Clerk to enable the heat loss to be studied within the cylinder. This peculiar diagram is taken by so acting on the valve-gear of the engine as to hold the exhaust valve closed instead of allowing it to open for exhaust at the usual time, and, further, by preventing the charge inlet valve from opening during a series of revolutions. By doing this, when the pressure reaches the point A (fig. 3) the whole contents of the cylinder are retained instead of being discharged; and the piston re-compresses them up to the point B. Expansion then goes on from B to C, compression from C to D, expansion from D to E, &c. In this way, the piston alternately compresses and expands the hot gases contained within the cylinder during a series of revolutions, bringing the volume back to a constant point at each "in" stroke. The pressures indicated at the points B, D, F, H, and J enable a cooling curve to be drawn showing the heat loss throughout the whole stroke at different mean temperatures.

For example, there is obviously a fall in temperature between B and D This fall has been incurred during an "out" stroke, expanding the hot gases from B to C, and during an "in" stroke compressing them from C to D—that is, the loss B D has been incurred during an "out" stroke and an "in" stroke, and each successive "out" stroke and "in" stroke is losing less heat, as is shown by the diminishing distances D F, F H, and H J. By measuring these distances, and allowing for certain work areas, it is possible to construct cooling curves for any part of the stroke, which enable the amount of the heat loss and its distribution to be calculated.

determined by Langen. The results of Clerk and Mallard and Le Chatelier thus appear to be higher than the Committee think they should be.

A large part of the work of the Committee is devoted to the discussion of these values; and interesting suggestions have been made as to the cause of the deviation between the different observers. Hopkinson rather favours the accuracy of the lower numbers of Holborn and Henning; while Callendar favours the higher numbers of Clerk. Experiments have been made by Swann and Clerk, by entirely different methods, on the volumetric heat of atmospheric air and carbonic acid at temperatures up to about 100°C.; and these concur within $\frac{3}{4}$ per cent. in both sets of observations, and both give results between 2 per cent. and 3 per cent. above the older standard values of Regnault. The values cannot be taken yet as completely settled; but probably the black line shown on fig. 2 is within 5 per cent. of the true value. As gas-engine mixtures are always dealt with at temperatures above 100°C., the table shows the total energy values of the gas-engine mixture considering the energy at 100°C. to be zero. The values given are foot pounds per cubic foot measured at 760 mm. mercury pressure and 0°C. From this table it is possible to get the energy value of the increase of temperature on the diagram, the line F E, with approximate accuracy. If, then, we know the total heat present in the form of inflammable gas, it becomes possible to say how much heat is lost during the explosion process before maximum pressure is attained, if we assume that combustion is completed at the point E.

Much time and thought have been devoted to this question; and it is now known that combustion is never quite complete at the point of maximum pressure. Experiments made by Clerk and Hopkinson by entirely different methods support the conclusion that, although specific heat of carbonic acid and steam undoubtedly increases largely during rise of temperature, in addition to this it cannot yet be said that combustion is entirely complete at maximum temperature. Further experiments are in progress to determine this difficult point with accuracy; but it is not possible to give definite figures at present.

It has also been found very difficult to arrive at a true solution of the amount of heat lost during this explosion period. Experiments by Callendar and Hopkinson on the radiation loss from flames (Callendar from open flames; Hopkinson from the explosion flame within a cylinder) show clearly that radiation loss has been hitherto under-estimated. It appears probable that a loss of even 5 per cent. of the total heat of combustion may be incurred by radiation during the minute fraction of a second which elapses between the start of the explosion and the attainment of maximum pressure. At the present time, Hopkinson, Callendar, and Watson are all working on this problem.

Neglect incomplete combustion and radiation loss, and consider the simplified problem of heat loss during the expansion or working stroke. If the varying volumetric heat of the gaseous products of combustion be known through the whole temperature range, then an adiabatic expansion line can be drawn from the point of maximum pressure to the termination of the stroke, which will represent truly the fall in temperature due to work done upon the piston. A comparison of this line with the line shown by the actual indicator diagram at once determines the heat loss incurred during the expansion stroke. Even assuming this adiabatic line to be perfectly known, there is still some difficulty in determining the heat loss accurately, because the determination rests upon measurements of relative pressure at the "out" end of the piston stroke when pressures are low; and a small error of the indicator or of reading has a considerable effect in distorting value. Given a perfect indicator and perfect means of measurement, the comparison of the actual line and the ideal line enables heat loss to be determined throughout the whole of the expansion stroke and divided up for each tenth of a stroke.

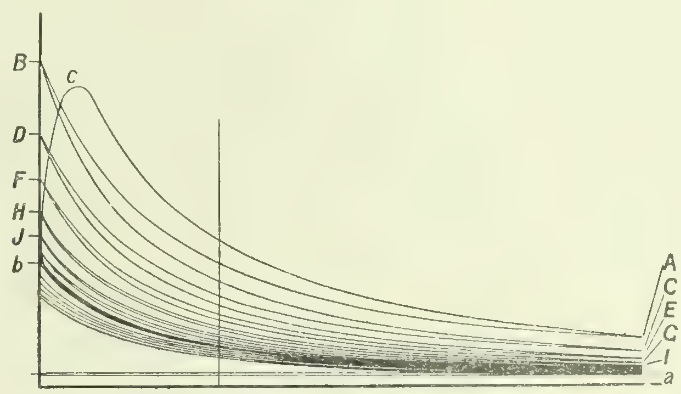


Fig. 3.—Diagram of Explosion and Alternate Compression and Expansion of Hot Gases in Engine Cylinder.

Clerk's earlier experiments were made upon an engine which had a cylinder 14 inches diameter and 22-inch stroke. The exhaust and inlet valve levers were supplied with longer pins than usual, so that the rollers mounted on these pins could be moved into or out of range of the exhaust and inlet valve cams. When each roller was caused to slide to one end of its pin, the cam passed clear of it, and the lever was not operated; when at the other end of the pin, the roller engaged with the cam and the lever operated in the usual way. A spring-and-trigger gear was so arranged that the rollers could be put out of range of the cams at any required instant. By this contrivance the engine could be run in its normal way in accordance with the Otto cycle either at a light or at a heavy load; and any given explosion could be selected for the purpose of the experiment by operating a trigger at the proper moment. By this device, it was possible to run the engine at its normal speed under the usual propelling explosions, and to select at any given moment any particular charge, move the rollers out of the range of the cams immediately the charge entered, and so obtain an explosion and expansion stroke in the usual manner with the usual charge. When the exhaust period was approached, however, the exhaust valve remained shut, as already described; and, accordingly, the hot gases were retained in the cylinder, and compressed by the return stroke of the piston into the combustion space at the end of the cylinder. The energy of the fly-wheel was sufficient to keep up the rotations of the engine (with but little fall in speed) during the short period of observation. The piston was thus caused to move to and fro, alternately compressing and expanding the hot gases contained in the cylinder.

This method of experiment proved that in the ordinary working of the gas-engine the total temperature fall during the expansion was unequally divided throughout the stroke. The temperature fall on the first 3-10ths of the stroke was equal to that incurred on the last 7-10ths of the stroke. These experiments also showed very clearly that, for equal mean temperatures, the heat loss varied greatly throughout the stroke—the higher the density, the greater the heat loss per square inch of surface exposed. Dividing the piston stroke into the first 3-10ths and last 7-10ths for equal

mean temperatures, the rate of heat-flow per square foot per second at the 3-10ths end was proved to be from 2·5 to 2·8 times that obtained for the whole stroke.

It is interesting to compare the temperature fall, due to heat loss, on the complete expansion lines for the whole stroke, and the partial expansion lines for the 3-10th stroke shown by a vertical line on fig. 3. Call the various 3-10ths points on the expansion lines beginning at B, D, and F, as B^1, D^1, and E^1; then the particulars for these three expansions are as follows:—

		Mean Temperature in Time.	Temperature Fall due to Heat Loss.
1	Complete expansion line B C	930° C.	155° C.
	Partial expansion line B B^1	1190°	92·5°
2	Complete expansion line D E	690°	93°
	Partial expansion line D D^1	900°	55°
3	Complete expansion line F G	560°	65°
	Partial expansion line F E_1	700°	31°

In all these cases except the last, the heat loss in the first 3-10ths is greater than that on the last 7-10ths; and the rate of heat flow is very much higher at the "in" than at the "out" end of the stroke.

This investigation is being pursued, and already useful values have been obtained, which enable the engineer to realize the enormous rate of heat flow from the gases at the highest temperature and density to the enclosing walls. This variation in rate fully accounts for the difficulties experienced in preventing cracks at the breech-ends of large gas-engines. To obtain accuracy in these values, it has proved necessary to design new types of indicator. Clerk's earlier experiments on the new diagram were made with a Richard's Casartelli mechanical indicator of the type very commonly used for gas-engine work. His later experiments have been made with an optical indicator.

Other experiments have been made on cooling after explosion within a closed vessel, which show clearly that the rate of heat flow increases with the density, although the actual temperature fall diminishes with increase of density. The effect of increasing the capacity of the containing vessel or cylinder has also been determined. The larger the vessel, the slower is the temperature fall due to cooling; but the heat flow through the walls is increased because the mean temperature maintained is increased. These matters are receiving full attention, and more definite information is being obtained.

So much for the heat loss on the expansion line. The heat contained in the gases before opening the exhaust valve may be determined if the temperature be known. The exact measurement, however, presents similar difficulties to those just discussed; and, accordingly, measurements have been made of the whole heat contained in the exhaust gases by condensing these gases in the calorimeter as they leave the engine. Hopkinson has conducted most valuable experiments of this kind; and in the Institution of Civil Engineers' tests of 1905 a similar calorimeter method was adopted. These experiments, however, proved that the calorimeter method showed less heat in the exhaust than would have been expected from the temperature immediately before opening the exhaust valve. This difference in heat loss was proved to be due to heat leaving the exhaust gases in the water-cooled passage surrounding the exhaust valve—that is, it was proved to be caused by the water-jacket taking heat from the exhaust gases, instead of allowing the whole of the heat to pass on to appear in the calorimeter.

Notwithstanding these difficulties, careful examination of standard tests has proved the balance-sheet of the 14-inch by 22-inch gas-engine referred to to be as follows:

Indicated work	34·6 per cent.
Heat in exhaust gases	49·3 ,,
Heat loss in expansion	16·1 ,,

Similar results were found by Hopkinson in his experiments with another engine using higher compressions. Hopkinson's results showed:

Indicated work	37·0 per cent.
Heat in exhaust gases	42·0 ,,
Heat loss in expansion	21·0 ,,

Knowing the properties of the expanding gases, it becomes possible to find how near we have attained to perfection for the given conditions. Clerk's examination of the same engine proves that had the cycle operated perfectly without any heat loss whatever, the indicated efficiency would have been 39·5 per cent. The actual indicated efficiency was 34·7 per cent.; so that the engine converted 88 per cent. of the heat which it possibly could have converted into indicated work. The complete suppression of all heat losses due to conduction, &c., on the explosion and expansion strokes could only increase the indicated efficiency from 34·7 to 39·5—that is, improve it by about 13 per cent.

From this short examination, it is evident that, so long as expansions remain as at present, no great further increase in the gas-engine thermal efficiency of the internal combustion engine can be hoped for. Increasing expansions means increasing engine weight very largely to gain a small increase in efficiency. It is quite possible to design and construct an engine working with coal gas which would give an indicated thermal efficiency of about 50 per cent.; but such an engine would probably have a lower mechanical efficiency—probably about 80 per cent.—so that the brake efficiency would only be about 40 per cent. It is not likely that such an engine would be commercially successful. The increased first cost would not be justified by the greater economy. Unless some other method can be adopted of increasing power by utilizing the exhaust heat, coal-gas engines are likely to remain at their present standard. The principle of compounding, it is true, might be applied to the gas-engine, and longer ranges of expansion obtained; but such complication will only be justified in comparatively large engines, such as are not likely to be operated by coal gas.

Speaking to gas engineers who are naturally desirous of extending the use of coal gas for motive power, it would appear that their efforts to reduce the selling price of coal gas are more important than those of the engine designer. There seems to be more likelihood of reducing the cost of coal gas to the power consumer by (say) 20 per cent. than there is of increasing the brake efficiency of a coal-gas engine by this amount.

So far as the small gas-engine is concerned, close approach has been made to standard type. Practically all difficulties have been overcome, both from the engineering and the commercial standpoints. Small gas-engines are now even more reliable than small steam-engines, as may be proved by comparison of results given by various insurance companies. Scientific work is more vitally required in the case of the large gas-engine, where the conditions as to temperature, pressure, and unequal expansion due to heat are of the severest kind. Study of the various problems of volumetric heat, heat flow, radiation, incomplete combustion, dissociation, &c., are all required to produce easier conditions of operation while maintaining or increasing thermal efficiency. Inventors of this generation may not succeed in producing sufficiently easy conditions for commercial success in very large gas-engines; but their work, and that of the scientific investigator of the present, will undoubtedly provide the engineer of the future with means of solving problems so far unsolved by the engineer of to-day.

BRICK, CONCRETE, AND STEEL TANKS FOR GASHOLDERS.

By HERBERT W. ALRICH.

[A Paper presented to the American Gas Institute, October, 1910.]

Since the inception of the gas industry there have been holder tanks constructed of many types and many materials. While there are still tanks occasionally built of unusual design, the practice of the present time is represented most frequently by two types of tank and three materials. Tanks above ground and tanks below comprise the types; while brick, concrete, and steel are the materials. However, these materials are not regarded as being all suitable for either type of tank. Only very unusual conditions could furnish sufficient reasons for placing a large steel tank entirely below ground; and no brick or concrete tank of large size has ever been built without a backing of earth. Hence we may state that the prevailing practice is confined to either steel tanks above ground or masonry tanks below.

The construction of the earlier gasholders required no origination in tank design. Adaptations from existing practice in cisterns were sufficient. An increase in the size of holders accompanied the extended use of gas; and the construction of the tanks was successively identical with the several types of water-tanks of corresponding size.

Until the seventies, the tanks built in this country did not often exceed 100 feet in diameter nor 30 feet in depth. Bricks were as well made as they are now; and were very much cheaper. Bricklayers worked ten hours for $2·50. At the same time wrought-iron plates of the thickness necessary for tanks of suitable depth, more than 60 feet in diameter, were not being manufactured anywhere in the world. The remarkable skill with which cast iron was then applied to structural purposes testifies to the high cost of wrought-iron construction at that time. Under such conditions, the standard tank in this country became a brick pit constructed either entirely below the surface of the ground or with the earth embanked against its outstanding portion. They were generally located upon a site where the ground formation was favourable.

It still sometimes happens that when planning a holder a site may be selected the geology of which is suitable for the type of tank it is desired to build. More frequently, however, we are confronted by conditions which permit little freedom, and dictate the question of the kind of tank there shall be built upon the ground. The different formations that are encountered are too numerous to classify, and often too composite to describe. Among those of frequent occurrence may be mentioned sand, clay, rock hardpan, and mud. Given any one of these conditions or a combination of them, and the advocates of brick tanks will present their claims.

It is doubtless proper to consider the advantages of any type of tank in favour of which there may be a local sentiment; but the writer is convinced that there is one type of tank superior to all others and preferable for almost any conditions to be found in the United States. The brick tank seems to be regarded as the criterion of prudence and conservatism; but an examination of these claims does not disclose them as being very well founded. Brick tanks are a survival of an era of non-theoretical engineering when the designing was done by the master mason, with results which while not dangerously bad, were not economically good. It is true that considerable mechanical reasoning was applied in the

design of these tanks. But this reasoning was not developed in connection with any definite theory of the behaviour of the material; and there resulted no rational mathematical determination of what, and how much, the tanks were expected to withstand. Forty years ago some formulæ were devised for computing the resistance of a masonry tank to the bursting pressure of the water. Very strangely, however, the method does not appear to have been extensively applied until engineering knowledge had advanced past the point where the assumptions necessary to the formulæ were possible to accept.

All engineering structures are subject and liable to the action of forces tending to destroy them. In addition to providing for the proper resistance of the forces a structure is intended to withstand, there must also be anticipated those other forces that may be circumstantially exerted against it.

When force is applied to a structure, there follows, as a result of the elasticity of all materials, a change in the dimensions and a bending of the component parts. The consequence of these deformations is a distortion of the geometric form of the structure as a whole.

If the applied force be continuously increased, the deformations will correspondingly increase until the limit of elastic behaviour of the material is reached, when failure must occur. The elastic properties of all materials commonly used in engineering structures have been extensively investigated for the purpose of establishing the relation between the extension and compression of the substances and the forces whose effects these deformations are. Thus if the forces to which a structure will be subjected and the elastic properties of the materials are known, we may, with reasonable accuracy, foretell the nature and amount of the deformations. Conversely, if we observe the nature and amount of the deformations, we may compute from them the forces acting upon the structure. Or, disregarding entirely the forces producing them, the deformations of a structure may be accepted as an index of its safety.

The distribution of the force applied to a structure among its component parts is somewhat independent of the amounts of material they severally contain. The distribution is influenced more directly by the forms of the parts, and the manner in which the force is applied to them. If the amount of force applied to a structure be considerably increased, there will usually result a change in the manner of distribution. Hence, when designing, the elastic behaviour of a structure must be investigated to determine the extent to which each component part participates in the work of resistance.

This investigation of the effect of force upon matter, or, in other words, of loads or pressure upon a structure, is the theme of analytical mechanics. When applying this science to designing, we have principally to discover the stress or amount of force exerted against each component part of the structure and the relation of this stress to the strain—that is, the shortening or elongation of the component part caused by the stress.

Since the seventies, many brick tanks have been built in this country approximating 185 feet in diameter and 42 feet in depth. The stress conditions existing in a tank of this size will now be considered.

When investigating the strength of a tank, the force we have principally to consider is the effect of the retained water. This hydrostatic pressure produces a state of stress in one of the simplest forms. It is a force acting outward, normal to the surface, and uniform at all points around the entire circumference. If the wall were perfectly elastic, it would become infinitely thin. Thus the nature of the stress is seen to be pure tension, though if the tank be other than truly cylindrical, there will be additional stresses induced by the bending of the wall as the hydrostatic pressure tends to correct the circle.

The resistance of the tank wall is exerted against the internal bursting pressure in two ways, and two only—first, the resistance of the material to the circumferential stretching; and, second, the adhesion of the annular bottom surface of the wall to the foundation. This adhesion to the foundation results in a restraint upon the lower part of the wall, preventing it from expanding in diameter in obedience to the internal pressure. Practical considerations always require a greater thickness at the top of the wall than that necessary to resist the tension. This excessive section materially reduces the diametral expansion at the top. It is similar in effect to the restraint exerted on the bottom of the wall by the foundation. An exaggerated representation of the elastic deformation of the wall is shown in the sketch, fig. 1.

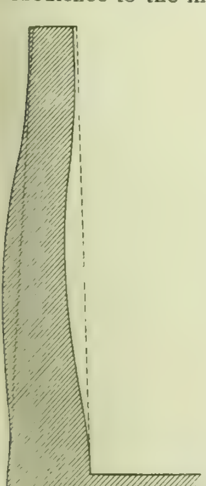


Fig. 1.

Before computing the necessary wall thickness, it is first necessary to determine the distance above the bottom at which the restraint of the foundation ceases to be effective. The exact determination of this distance would involve much calculation. However, with the proportions obtaining in gasholder tanks, this may be taken as a height lying within that on which the total circumferential hydrostatic pressure is equal to the resistance to shearing of the bond of the tank wall to the foundation. As this height is evidently a function of the wall thickness, an assumption must be made.

It will be taken at 12 feet, making the depth from the top of the tank to the plane of the maximum ring tension 30 feet. The shear consequent upon this assumption will now be investigated.

Let—

D = diameter of tank = 185 ft.
h = depth to plane of maximum tension = 30 ft.
H = depth of tank = 42 ft.
S = tension in layer of brickwork 1 in. high.
T = thickness of wall in inches.
U = permissible unit tension.
V = pressure on 1 in. of circumference 12 ft. high.
w = weight of water per cub. ft. = $62\frac{1}{2}$ lbs.

Then—

$$V = \frac{h + H}{2} \; \frac{w}{144} \times 12\,(H - h) = \frac{30 + 42}{2} \times \frac{62{\cdot}5}{144} \times 12 \times 12 = 2250 \text{ lbs.}$$

This pressure of 2250 lbs. must be resisted in shear by a sectional area of the masonry bond 1 inch along the circumference, and having the thickness of the wall for its other dimension. The writer does not know of the resistance of masonry bond to this form of stress having been experimently determined. However, judging from the ease with which brick may be loosened from the top of a wall of high-class masonry, it is reasonable to consider in this connection the weight superimposed upon the lowest course of brick. In the case of a wall 42 feet high, at 120 lbs. per cubic foot the bottom brick would be under a pressure of 35 lbs. per square inch. If we assume the safe resistance of the bond to shearing to equal 100 per cent. of friction, there is derived for the minimum wall thickness to resist horizontal shear 5 ft. $4\frac{1}{2}$ in. As we would anticipate, the wall having a thickness rather greater than this, the distance of 12 feet may be regarded as a conservative assumption.

Considering next the thickness necessary to resist the ring tension, we have—

$$S = \frac{12D}{2} \times h \times \frac{w}{144} = 1110 \times 30 \times 0{\cdot}434 = 14{,}450.$$

Also—14,450 = TU.

The solution of this last equation requires us to assign a tensional value to brickwork. All the recorded tests of which the writer has knowledge were made in compression. These with a variation of several hundred per cent. compel us to believe that brickwork is one of the most uncertain factors in engineering.

In the designing of the brick tank 285 feet in diameter built at Manchester in 1909, the ultimate resistance was taken as 220 lbs. per square inch. This is the value given by Trautwine for the "average ultimate tensile resistance of brick." The various compression tests have uniformly indicated that brick alone develops a higher resistance to crushing than bricks and mortar. This would seem to be necessarily true in tension, though the writer finds no record of its experimental determination.

The numerous tension tests of 1 : 3 cement mortar indicate an average ultimate unit resistance of 175 lbs. Applying this value and 220 lbs. for brick proportionately to a vertical section of masonry, there results 208 lbs. as the value of the combination.

The New York "Building Code" limits the permissible unit tension induced by bending to 30 lbs. If, however, we avoid a charge of prejudice, by solving for T with U = 100 lbs., there is derived 12 feet for the required thickness of the wall at a point 12 feet above the bottom. This would be unthinkable.

Of tanks approximating the size here assumed, the writer has observed two that were 6 ft. 6 in., three 7 ft., and one 8 ft. thick. If we solve our equation for U taking $\frac{T}{12} = 7$ feet, there results a unit tension of 172 lbs., or 83 per cent. of the probable ultimate. If the tank were slightly elliptical, instead of perfectly cylindrical, there would be an additional increment of tension induced by the tendency of the wall to correct its curvature when subjected to the hydrostatic pressure. This stress would be greatest at the ends of the axes and zero at four points between. The question may be raised as to whether this stress is important. It is certainly safer to investigate than to guess.

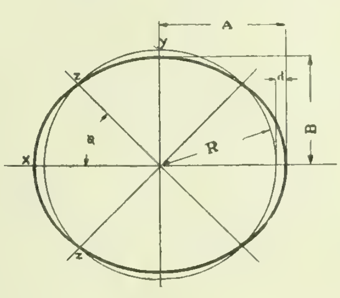


Fig. 2.

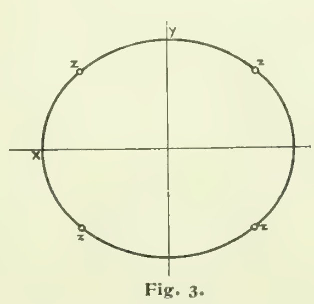


Fig. 3.

In fig. 2, there is represented the elliptical curve to which the tank is assumed to have been built, superimposed upon a true circle of the same perimeter. We know from analytical mechanics that the tension in the shell of any vessel with a curved perimeter, in equilibrium, is P R, in which P = the unit pressure at any

point and R = radius of curvature at that point. From analytical geometry, the radius of curvature at $x = \frac{B^2}{A}$, and at $y = \frac{A^2}{B}$. The tension at x for equilibrium would be $P\frac{B^2}{A}$. The actual tension is P A. Likewise the tension at y for equilibrium would be $P\frac{A^2}{B}$; while the actual tension is P B. Evidently $\frac{B^2}{A} < A$ and $\frac{A^2}{B} > B$. Hence equilibrium can only exist through a correction of curvature which indicates the existence of a bending moment, or internal stress in the wall must resist the bending.

As the radius of curvature of the ellipse passes through all values from $\frac{B^2}{A}$ at x, to $\frac{A^2}{B}$ at y, there is one point at which it equals R. Referring again to fig. 2, if we imagine the ellipse to change in curvature until it coincides with the circle, there is a point Z which undergoes no radial dislocation. Hence this is the point of constant curvature and no moment.

Referring now to fig. 3, we may conceive of the elliptical tank as a system of curved links, pin-connected at the points Z, and acted upon by the uniform internal pressure P. Within the limits of conditions applying to this problem $\frac{A+B}{2}$ varies from R by less than any assignable difference. Also we may determine (from the equations of the two curves referred to as the axes of x and y) that the angle ϕ does not differ materially from 45°.

Taking moments at x, we have

$$P\left[(\sin\phi\,R)^2 - \frac{(\sin\phi\,R)^2}{2} - \frac{(A - \sin\phi\,R)^2}{2} - (\sin\phi\,R)(A - \sin\phi\,R)\right] =$$

$$P\left[(\sin\phi\,R)^2 - \frac{(\sin\phi\,R)^2}{2} - \frac{(\overline{R+d} - \sin\phi\,R)^2}{2} - (\sin\phi\,R)(\overline{R+d} - \sin\phi\,R)\right] =$$

$$P\left[0{\cdot}5\,R^2 - 0{\cdot}25R^2 - \frac{(0{\cdot}086R + 0{\cdot}586Rd + d^2)}{2} - (0{\cdot}207R^2 + 0{\cdot}707Rd)\right] =$$

$$P(-Rd - 0{\cdot}5d^2) = \text{moment at } x.$$

A similar process shows the moment at $y = P(Rd - 0{\cdot}5d^2)$. Hence the moment at x is negative, tending to send the wall outward and crack it on the inside. It will be observed that the moments at x and y differ only by the value of $2\,P\,(0{\cdot}5\,d^2)$; and this term is plainly negligible. Hence the moment at either point may be taken as P R d.

Assigning a value of 1½ inches to d, the moment at a depth of 30 feet $= \frac{30 \times 62{\cdot}5}{144} \times \frac{12 \times 185}{2} \times 1{\cdot}5 = 21{,}700$ lbs. With $\frac{T}{12} = 7$ feet, then the additional increment of tension = 18·5 lbs., making a total tension of 190·5 lbs. This is 91·60 per cent. of the probable ultimate.

There have now been considered the nature and amount of the stresses imposed upon the tank wall by the internal pressure, and the deformation of the masonry from the resulting strains. It is evident that for a brick tank of large size there must be provided external assistance; for any such thickness of masonry as would safely withstand the pressure unaided is economically impossible.

In the designing of brick tanks, the analysis originated by M. Arson, a French engineer, still seems to be universally applied. This analysis first appeared in a contribution by M. Arson to the "Société des Ingenieurs Civils." It was printed in their "Transactions" about 1870. Dr. Pole translated the article; and Newbigging's works gave it currency. Though the world has constantly been moving since that day, and experiment and reason have been joined to establish theory, masonry tanks are still calculated upon principles which, if followed to their logical conclusion, would result in a wall with twice the thickness at the top that it had at the bottom. "Calculated" we have said—not "designed"; for it would appear that no tanks were ever so built. From this, we may conclude that instinct has prevailed over reason, and spared us the consequences of M. Arson's theory. The knowledge of the mechanics of materials in M. Arson's time was somewhat limited; hence his method disregards entirely the elastic behaviour of the material. By this theory, the pressure is resisted by the moments of stability (taken collectively) of a number of segmental elements similar to staves, of which the wall is conceived to consist, and also by the resistance of the masonry to being cracked down from the top at each end of a diametral line as the tank tended to split through the centre, and each half overturn.

To accept this reasoning would require us to assume that the circumferential stretching is necessarily accompanied by the wall leaning outward about the toe of the base—in other words, that there can be no outward horizontal elastic movement unaccompanied by a bodily upward lifting of the whole wall. The fallacy of this is apparent upon the inspection of any brick wall that has bulged. In fact, we might deduce from the theory of long columns that the weight of the wall could assist in its own destruction.

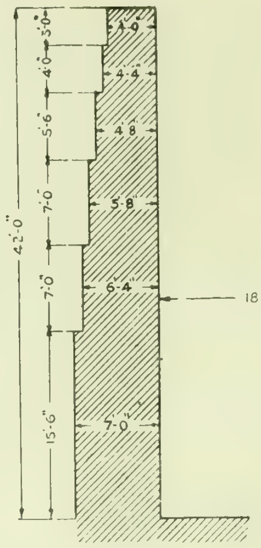


Fig. 4.

Such an analysis was made in designing the large brick tank at Manchester already referred to. The wall was imagined as being subdivided into a number of segmental elements. The summation of the moments of stability of these was assumed as co-operating with the tensional resistance of the ring in resisting the bursting pressure. An examination of the relation of stress to strain under these two conditions of loading will show that their simultaneous existence is impossible.

Fig. 4 is a cross section of the wall of three of the tanks observed by the writer. The average unit tension in a ring at the top 1 foot high $= U = \frac{\left(\frac{w}{2} \times \frac{D}{2}\right)}{121} = \frac{\frac{62{\cdot}5}{2} \times \frac{185}{2}}{12 \times 48} = 5$ lbs.

Let—

E = modulus of elasticity of brickwork.

d_1 = increment of increase of radius—that is, the outward movement of any point in the tank circumference at the top of the wall due to ring tension.

Then—

$$d_1 = \frac{12\pi D \times \frac{U}{E}}{2\pi} = \frac{12 \times 185 \times 5}{2E} = \frac{5500}{E}.$$

If an element of the wall measuring 1 foot along the circumference be now considered as a vertical cantilever, it would first deflect elastically until the adhesion of the wall to the base had been destroyed. This outward bending would not involve the wall being lifted bodily. Taking 208 lbs. again as the ultimate tensile resistance of the masonry, the hydrostatic pressure, F, that the wall can withstand up to the limit of its strength will now be computed.

Let—

I = moment of inertia of cantilever

Then—

$$F = \frac{3U\left(\frac{2I}{t}\right)}{12H} = \frac{3 \times 208 \times 14{,}112}{504} = 17{,}500 \text{ lbs.}$$

The actual total pressure F_1 against the cantilever would be:

$$F_1 = \frac{H^2 w}{2} = \frac{42 \times 42 \times 62{\cdot}5}{2} = 55{,}200 \text{ lbs.}$$

The deflection d_1, at the top of the cantilever, due to the load F is:

$$d_1 = \frac{F(12H)^3}{10EI} = \frac{17{,}500 \times 128{,}024{,}064}{10 \times 592{,}704 \times E} = \frac{379{,}500}{E}$$

The modulus of elasticity of brickwork E is a very uncertai[n] quantity. All attempts to determine it have produced values s[o] unrelated as to be quite meaningless. Fortunately, however, th[e] solution of our problem does not require us to assign to it an[y] value. There have been derived two expressions for d_1. Fro[m] the ring, $d_1 = \frac{5550}{E}$; from the cantilever, $d_1 = \frac{379{,}500}{E}$. In bot[h] of these E relates to the same mass of masonry; is a commo[n] denominator; and may be eliminated. Comparing the numera[-] tors, it will be found that the imaginary cantilever would deflec[t] $\frac{379{,}500}{5550} = 68{\cdot}4$ times as much in resisting $\frac{17{,}500}{55{,}200} = 31{\cdot}7$ per cen[t.] of the pressure as the ring would expand in resisting all of i[t]. From this, we may deduce that the extent of this form of resis[t-] ance on the part of the wall of our tank is $\frac{0{\cdot}317}{68{\cdot}4} = 0{\cdot}0046$ or less than one-half of 1 per cent. of the pressure. In th[e] case of the Manchester gasholder, the proportion is very muc[h] less. This cantilever theory contains a fatal defect—it disregar[ds] the fact that the curve to which a cantilever deflects when loade[d] does not, and cannot, coincide with the curve to which a tank [is] distorted by internal pressure. Fig. 5 is an exaggerated repr[e-] sentation of the two curves.

If we imagine a tank built of staves rigidly fixed at the bas[e], the hydrostatic pressure would bend them outward, opening [up] the joints between. If hoops were then added so as to clo[se] up the joints, the staves would be drawn back into the position th[e]

Fig. 5.

originally occupied. The bending in them as cantilevers would then disappear, and the resistance they had offered to the water pressure would vanish with it. The hoops represent the ring tension in the masonry.

The only condition under which the cantilever action is approached is when the wall is made thick enough to reduce its deflection at the top to correspond to the expansion in diameter.

In the case of the Manchester tank, it would have been over 29 feet thick at the bottom. As tanks are built to hold water and not to practice a theory, such proportions are hardly to be contemplated.

The next step in M. Arson's method is to determine the ring tension by assuming a tendency to split the wall down from the top and overrun the halves about a diametral line, as shown in fig. 6.

M. Arson's formula (which is still in current use)

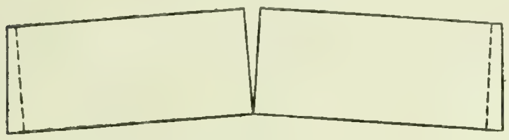


Fig. 6.

for this imaginary resistance is U H^2 T, which he reduced from the form $\frac{H}{2}$ (2 U H T), in which T = thickness of wall in feet. It could be shown that the true expression for this moment of resistance, if it actually existed, would be $\frac{2\ U\ H^2\ T}{3}$; but such computation is unnecessary, in view of the fact that the resistance of the earth to the tank being depressed into it in the manner indicated by fig. 6 would be one hundred times as great. Inspection of fig. 6 will also suggest the relation between the wall thickness at the top and bottom consequent upon M. Arson's theory.

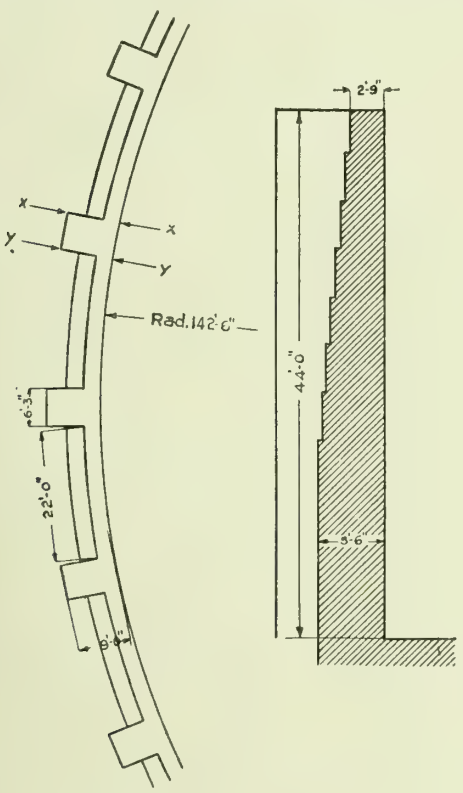


Fig. 7.

Further discussion of M. Arson's formulæ for the resistance of the masonry seems not to be justified in view of Dr. Pole's comment in translating that it is "only an adjunct of minor importance." However, in the calculation with which the method was illustrated 42·5 per cent. of the resistance was contributed by the masonry.

"The real element of resistance is the earth backing," continued Dr. Pole, referring to Arson's formula based upon an assumption that the thrust of the earth against the tank wall has the same intensity at the surface of the ground that it has at the bottom of the well. Since engineers have known otherwise for ages, it is remarkable that such an analysis ever found acceptance. It is astonishing that it is still in use. Does anyone living believe that the uppermost foot of an ordinary sand bank is capable of exerting a horizontal thrust equal to twenty times its own weight?

Arson's formula for the moment of the total earth pressure against the diametral plane = W H (D + 2T)$\frac{H}{2}$ = $\frac{W\ H^2\ (D + 2T)}{2}$, in which W = weight of earth per cubic foot.

Though we should go as far as to regard the earth as exerting full fluid pressure, the moment of its thrust would then be less than seven-tenths of the value deduced by Arson in his numerical example.

Fig. 7 is a vertical section and plan of several segments of the Manchester tank taken from a paper by Mr. Frank H. Robinson, the Engineering Assistant at the Manchester Gas-Works. The paper was printed in the "Journal of Gas Lighting" of Nov. 30, 1909. When computed by Arson's method, this tank had a factor of safety of but 2·5. Mr. Robinson objected to Arson's method because it does not include the additional resistance offered by the adhesion of the base of the wall to the foundation, nor that which he supposed to be contributed by the buttresses. If this be the extent of Mr. Robinson's objections, the remedy is a simple one. It is only necessary to extend Arson's analysis to include them. There is then derived a factor of safety of 2·9 instead of 2·5.

Mr. Robinson's remedy for the low factor of safety was to investigate other stress conditions, under which he deduced a factor of safety of 16. While doing this, he overlooked the necessity of showing that the stress conditions assumed by M. Arson had neither a prior nor simultaneous existence. Until this is done, the factor would remain 2·9. If while investigating the strength of a simple beam which had a factor of safety of only 2·9 against failure in bending, would it add to our sense of security to discover that its resistance to shear was sixteen times that imposed upon it? Right there is the defect in Mr. Robinson's analysis. He considered each panel of the wall included between two buttresses as a dam, overlooking the fundamental fact that it could not so act until it had failed in tension.

An examination of Mr. Robinson's formulæ is more amusing than profitable. They ignore not only the most elementary principles of analytical mechanics, but the laws of Nature as well. These formulæ only deserve our attention because they appear to have been used in designing one of the very largest tanks in the world.

As has been stated, Mr. Robinson analyzed the tank as a series of dams—each segment of the wall included between two buttresses being computed as independently stable. Taking moments about the base, Mr. Robinson assumed the following elements of resistance:

1. Moment of resistance of earth backing.
2. Moment of stability of wall due to its own weight.
3. Moment of shearing resistance through the planes $x - x$ and $y - y$.
4. Moment of resistance of the adhesion to the foundation.

The existence of these elements of resistance in the stability of a dam is fully established; but the formulæ developed by Mr. Robinson for computing their values offend ordinary mechanical instinct. Mr. Robinson repeats Arson's error of assigning the same value to the resistance of the earth-backing at all depths. As such a property does not even appertain to all kinds of rock, it evidently never can be possessed by earth. The acceptance of Mr. Robinson's first equation would require us to believe the uppermost layer of earth 1 inch thick (literally the surface of the ground) would resist a force of 100 lbs. per lineal foot tending to shave it off. A soil possessed of such stability would be a rare and remarkable formation. It could not be excavated by usual methods; it would necessitate the rock drill. The assistance of a brick wall in retaining the water would be unnecessary.

It is only when Mr. Robinson's equations Nos. 1 and 3 are considered in connection with one another that his method is properly appreciated. From equation No. 1 the moment of resistance of the earth pressure against the length of 22 feet (fig. 7) is 25,560,000 ft.-lbs. Hence the moment of resistance of the earth pressure against the buttress would be $\frac{6\cdot25}{22} \times$ 25,560,000 = 7,270,000 ft.-lbs. The buttresses, like the wall, also derive stability from the adhesion to the foundation and from their own weight. If these elements be valued (applying Mr. Robinson's methods and unit values as disclosed by his equations Nos. 2 and 4), there results 9,270,000 ft.-lbs. Adding this amount to the stability contributed by the earth backing, or 7,270,000 ft.-lbs., there results 16,540,000 ft.-lbs. as the total moment of stability of the buttresses when computed by Mr. Robinson's methods and applying his unit-values. Now this 16,540,000 ft.-lbs. would measure the entire extent to which the buttress could assist the adjacent wall; but Mr. Robinson's equation No. 3 contemplates an overturning moment more than sixteen times as great, or 276,000,000 ft.-lbs. being resisted by this same buttress! Thus vanishes over 80 per cent. of Mr. Robinson's factor of safety of 16. If we substitute the theories and methods of modern engineering for those of Mr. Robinson, we find that after the tank had failed in tension, it would have a factor of safety against overturning of about 2·5.

(To be continued.)

THE MANUFACTURE OF MIXED GAS.

An article in a recent number of the "Journal für Gasbeleuchtung, by Herr R. Terhaerst, the Manager, and Dr. H. Trautwein, the Chemist, of the gas-works at Nuremberg, raises again the much-discussed question of the relative economy of the manufacture of water gas by: (1) Steaming in coal-gas retorts; and (2) the use of special water-gas generators. The authors refer to the inconclusive character of previous discussions on the question, and proceed to say that their article has been prompted chiefly by points raised in the paper published a few months ago by Herr Debruck, of the Düsseldorf Gas-Works, and in the discussion on that paper [see "Journal," Vol. CX., p. 500].

The authors first say that in the discussion on Herr Debruck's paper, and frequently elsewhere, it has been assumed that there is special difficulty in securing a uniform admixture of water-gas with coal-gas, and that disturbances and difficulties ensue in the use of the mixed gas for lighting and heating, owing to want of uniformity in its calorific value. Such difficulties were supposed to occur when the water gas was made in separate plant, but not when the mixed gas was produced in the working of vertical retorts. How can this different behaviour of the water gas be explained? The water gas is there, and in about equal proportion to the coal gas, in both cases. Doubtless the phenomena complained of may occur if water-gas plant is primarily used to take up the fluctuations in the output of gas in the evening, with the result that for a relatively short time a larger quantity of water gas is added to the coal gas directly in the holder.

Thorough mixing of the two gases cannot be expected from such a procedure, as the requisite time for admixture is lacking. It is conceivable that in such circumstances, when the output of gas is heavy, water gas itself will be delivered directly into the distributing system. These evils are at once avoided, however, if a proportion of water gas corresponding to the make of coal gas from time to time is uniformly and continuously added to the coal gas in the works' mains, and is thus already mixed with the coal gas when it reaches the holder—that is to say, the admixture must take place by day as well as by night. No difficulties or irregularities occur in this method of producing mixed gas; and, as has been already pointed out, it has been adopted for many years. It has the economical advantages that the water-gas plant is fully utilized, and that it becomes possible to add a much higher proportion of water gas without causing more than comparatively small fluctuations in the calorific value of the mixed gas.

The proportion of water gas to be added depends on the calorific value of the coal gas and the required calorific value of the mixed gas. In the first place, care must be taken that the minimum calorific value fixed for the mixed gas (which, in Germany, is usually 522 B.Th.U. gross per cubic foot) is maintained despite fluctuations which may occur or the necessity for occasionally increasing the proportion of water gas added. Supposing that an average calorific power of the mixed gas is aimed at in working, it is naturally important that the burners for lighting and heating should be regulated to correspond to this calorific value of the gas. Considerable fluctuations in the quality of the gas must be avoided, and transition must not be made rapidly from a supply of neat coal gas of relatively high value to mixed gas containing a comparatively large proportion of water gas. It is only fair to the consumers that the proportion of water gas should be increased gradually over a considerable period, and that the necessary adjustment of the burners should be carried out at the same time.

Corresponding to the change in the specific gravity of the gas, the pressure in the distributing system must be increased. If these conditions are observed, an addition of 20 to 30 per cent. of blue, or uncarburetted, water gas—the proportion depending upon the calorific value of the coal gas—is unobjectionable. As to the permissible extent of fluctuations in calorific value, if the burners have been in the first instance suitably adjusted, fluctuations of 5 per cent. in calorific power are quite unrecognizable, while differences of 10 per cent. do not cause any serious change in the behaviour of the gas on combustion in the burners. It may consequently be assumed that wherever disturbances have occurred when separate water-gas plant has been used, there has been also a comparatively great want of uniformity in the quality of the gas, or perhaps a failure to have the burners properly adjusted. In regard to the charge that the addition of water gas causes deposited naphthalene to be loosened and taken up, so as to cause stoppages in mains and service pipes, the fault must in the first instance be assigned to the presence of the naphthalene in the system. For the rest, the taking up of the naphthalene by water gas is as likely to occur whether the water gas has been made in a generator or in vertical retorts.

Herr Debruck, in discussing the relative merits of separate water gas production and of steaming in vertical retorts in the conditions prevailing at the Düsseldorf Gas-Works, refers to the steam requisite for admission to the retorts being produced in a separate boiler heated by the flue gases from the retort-settings. There is thus assumed to be a saving in the cost of steam production as compared with that for separate water-gas plant. It is, however, admitted that this method of obtaining steam jeopardizes the proper control of the retort-settings, which are very sensitive to changes in the working of the furnaces. In the author's view, this point is specially important; and it is worth noting that if the production of steam in this manner causes only a comparatively small increase in the consumption of fuel for heating the settings, such increase may well represent a higher expenditure than the whole saving or economy of steam from an ordinary boiler. For instance, if the fuel consumption is raised by 1 per cent. for a bench of seven vertical retort-settings, the difference will amount to about 25 tons of coke per month, representing, at 28s. per ton, a value of £35; whereas Debruck assumes the cost of steam from boilers to be ⅓d. per 1000 cubic feet of water gas made, which, for the quantity of water gas corresponding to the production from the bench of seven vertical retorts, is equivalent to £6 11s. Thus, it will be seen that if the fuel consumption of the settings is increased by only 1 per cent., the increased expenditure amounts to about five times the cost of the steam from boilers for separate water-gas plant. The difficulties of irregular working of the settings which are likely to ensue from the employment of the flue gases for producing steam are, however, such that there appears to be no prospect of a general adoption of this method of working.

The relative economy of the working of vertical retorts with or without the admission of steam is generally judged on the basis of the yields of gas and of coke and the fuel consumption. If, however, the duty of two different types of setting, or of methods of working, is being ascertained for comparative purposes, the comparison must obviously be made in, as far as possible, similar conditions of working; and therefore the following points must be observed:—

1.—The same description of coal must be used, and its moisture and ash and yield of coke accurately ascertained.

2.—The make of gas and its calorific value, corrected to standard conditions of temperature and pressure, must be accurately determined. The determination of the calorific power is quite as important as that of the make, as the proportion of water gas which may be added depends on the calorific value of the gas. The calorific value of the gas is the chief factor in judging the relative merits of working with and without steam in vertical retorts.

3.—The coke produced and the consumption of fuel for heating the settings must be exactly determined on the basis of dry coke in both cases. The proportion of ash in, or the calorific power of, the coke should be stated.

4.—The amount of tar and ammonia produced should be exactly determined.

5.—The conditions of gasification (such as the weight of charges and the time taken for working them off, the temperature of the settings, &c.) should be exactly stated; and it is desirable also to know the average proportion of carbonic acid in the chimney gases.

6.—The comparison must be made in normal working conditions with the setting or generator giving its full output.

The authors consider that in such a comparison water-gas plant which has been made of large capacity, with a view to its use in the emergency of a strike or of extensions, &c., and is ordinarily not used to its full capacity, should not be wholly charged in considering the capital expenditure; while the cost of benches of coal-gas plant which are out of action in the summer time should be taken into the account. The extent of the reserve and of auxiliary plant must be kept in mind, and its special cost be included. In comparing the duty obtainable in the different methods of working, it is correct to take the cost corresponding to the extent to which the plant is used in the case in question. Having regard to the points just enumerated as essential for the carrying out of a proper comparison between two methods of working, the authors observe that the calculations made in Herr Debruck's paper, being based on a collection of investigations and results obtained in quite different conditions of working and without regard to the exact determination of the calorific power of the gas produced, do not give average values which are of any utility as a basis of comparison. In Herr Debruck's estimates, also, the amount of coke produced has not been exactly ascertained.

It may be interesting, however, to introduce into his calculation the values obtained at Nuremberg in the manufacture of water gas for the production of mixed gas. The interest and depreciation charges correspond to full use of the plant; and the allowance for repairs is the average over the last four years—viz., £90 per 175 to 210 million cubic feet of water gas made per annum. The charges per 1000 cubic feet of water gas made then are as follows: Interest and depreciation at 6 per cent. 0·41d., repairs 0·1d., wages 0·71d., coke 3·61d., steam for generator and fan 0·89d.; making a total of 5·72d. Consequently, 1000 cubic feet of water gas cost 5·72d., or about two-thirds of the cost of coal gas, which was taken by Debruck at 8·28d. Hence the cost of mixed gas becomes lower the higher the proportion of water gas added, and, working as is done at Nuremberg to an average calorific power of 543 B.Th.U. per cubic foot of mixed gas, a proportion of about 30 per cent. of water gas, which is far higher than was taken by Herr Debruck, becomes admissible. The cost of manufacture of the reduced quantity of coal gas required would be somewhat higher; but this increase in cost would be balanced by the lower charges for fuel for heating the settings and the more favourable returns from bye-products. Taking

into account the charges thus established for coal gas and water gas, it would appear that 1000 cubic feet of mixed gas would cost 7·51d., which compares with the cost of mixed gas produced by steaming in vertical retorts, as computed by Herr Debruck, of 7·61d. per 1000 cubic feet. Thus, notwithstanding the cheaper production of steam for the vertical retorts, the cost of the mixed gas remains higher than when special water-gas plant is used. This confirms the earlier conclusions of the authors.

There is still something to be said in regard to readiness for work and reserve capacity of the plant. It has been contended that vertical retorts present a certain reserve of productive capacity and readiness for work at short notice, because with the same time for working off the charge the capacity is increased by about 16 per cent. when steam is admitted. But this increased capacity is based on the fact that when the retorts are worked with steaming 13,855 cubic feet of gas are obtained per ton of coal; whereas when they are worked without steaming, the make per ton of coal is only 11,925 cubic feet. On comparing the figures quoted for the make in vertical retorts with and without steaming, it appears that without steaming seven settings of vertical retorts with ten-hour charges produce in twenty-four hours 953,500 cubic feet of coal gas. On the other hand, 8½ settings of vertical retorts working with steaming and twelve-hour charges produce in twenty-four hours 1,108,000 cubic feet of mixed gas, which corresponds to a make of 912,350 cubic feet of mixed gas for seven settings. It thus appears that, with the same number of settings, the transition from working without steam to working with steam not only affords no advantage in the quantity of gas produced, but actually results in a reduced output of gas.

This fact finds its explanation in the withdrawal of the settings while steaming is proceeding from the work of producing coal gas. In this respect, working with steaming is at a disadvantage as compared with working without steaming. More gas may be produced per ton of coal with steaming, but, per unit of carbonizing plant in the same time, there is a reduction in the output. An increased output would be conceivable only if the steaming coincided to an extent with the time allowed for carbonization as, for instance, if with twelve-hour charges steam was introduced for 2½ hours. But such a method of working appears, according to previous experience, to be unsuitable in regard to the heating of the settings and the fuel consumption. Even in the most favourable case, if the make with steaming is assumed to be 2508 cubic feet instead of 1930 cubic feet higher per ton of coal carbonized than in working without steaming, which would make the output in twenty-four hours 953,500 cubic feet, or the same as when the retorts were worked without steaming, it will be found that the productive capacity remains about 20 per cent. behind that of the retorts together with a special water-gas generator capable of affording the same proportion of water gas for purposes of admixture.

These figures indicate that special readiness for work cannot be attributed to a vertical retort setting, because an increase in the output per setting per hour of 16 per cent. can in no case be assumed as obtainable. As regards flexibility of working, it is to be observed that a water-gas generator can be made ready for work in two hours at the longest; whereas six days are required to bring a setting of vertical retorts into working condition. While working with steaming appears the most advantageous method on technical grounds of operating vertical-retort settings, nevertheless, in regard to economy, flexibility, and readiness for work, it remains undoubtedly at a disadvantage as compared with the manufacture of mixed gas with special water-gas plant. The results here discussed refer to settings of twelve vertical retorts; and it remains to be seen to what extent they are affected when the change is made to settings of eighteen vertical retorts, which evidently present more favourable carbonizing conditions, especially in regard to the maintenance of the heats and the consumption of fuel. Results published hitherto in regard to the working of these settings, however, are incomplete, in that they do not give exact figures either for the production of coke or the results obtainable when the settings are worked without steaming.

The London and Southern District Junior Gas Association will visit the Brentford Gas-Works next Saturday afternoon; two later fixtures are also announced. On Friday afternoon, the 25th inst., the works of Messrs. W. Sugg and Co., at Regency Street, will be inspected; and in the evening of the same day, at the Westminster Technical Institute, Dr. Harold G. Colman will lecture on "Some Applications of Gaseous Combustion."

Thorianite in Ceylon.—In the course of a report just issued by the Colonial Office, Professor Wyndham Dunstan, the Director of the Imperial Institute, says: "The initial stage of the work of the Mineral Survey of Ceylon may now be regarded as largely completed. It is clear the island contains, in addition to gem stones, a number of minerals of commercial importance, of which only graphite, mica, and thorianite are at present worked. . . . Thorianite is a new mineral discovered as a result of the operations of the Survey, and so far not known elsewhere than in Ceylon. Comparatively large quantities have been profitably exported in recent years and utilized in England as a source of the thoria used in the manufacture of the incandescent gas-mantle. Much remains to be done in discovering new localities in which this mineral is present, and also in devising better methods of recovering it from river beds and alluvia in which it is known to occur."

PROTECTION OF GAS AND WATER MAINS FROM DESTRUCTION BY ELECTRIC CURRENTS.

The "Journal" for Aug. 28, 1906 (Vol. XCV., p. 578), contained a summary of a lengthy report by Dr. F. Haber, Professor at the Technical College at Carlsruhe, on vagrant electric currents in the streets of the town, and their effect on the gas and water pipes. A plan of Carlsruhe was given, showing the tram-rails and water-mains in the chief streets of the town, and the fall of potential observed at a number of test points. An article by Herr Geppert and Dr. Liese, of Carlsruhe, has been published in a recent number of the "Journal für Gasbeleuchtung," describing investigations which they have made on the mains in part of the district referred to in Dr. Haber's report in 1906. Since their observations, following on Dr. Haber's exhaustive examination of the conditions prevailing in Carlsruhe, elucidate certain points of general application in regard to the damage done to gas and water mains by stray electric currents, and present a method by which damage may be avoided, we give to-day a summary of their paper.

Dr. Haber showed that the mains in the Durlacher Allee, in the neighbourhood of the electric generating station, were exposed to great risk. Actually, various fractures of the smaller mains, about 4 inches in diameter, have occurred in recent years. The larger mains of 10 and 12 inches diameter running near the tramways in the Durlacher Allee and Tullastrasse [see plan in "Journal," Vol. XCV., p. 579] were examined from time to time, and fractures were avoided by renewing the mains or taking other preventive measures as soon as their condition required it. Thus, in July, 1906, a 12-inch gas-main crossing the tramway in the Durlacher Allee was found to be strongly corroded at the crossing point. The main was carefully insulated where corrosion had occurred by a thick layer of bitumen wrapped with tarred jute, over which was another layer of bitumen; and where the corrosion was particularly great, the main was strengthened by heavy wrought-iron bands. The main was laid bare again for examination ten months later, and there was found to be heavy fresh corrosion to the right and left of the parts insulated the previous year; so that it became necessary to extend the insulation. In the years 1908 and 1909, a stretch of about 210 yards, in which the gas and water mains were in danger, was protected by a new electrical process which will be described.

Mains are destroyed by electrolysis through the current which passes from them through the earth to the tramway rails. This destruction occurs only when the body from which the current issues acts as the positive pole and is attacked by the oxygen formed by electrolysis. Current which enters a body acting as the negative pole protects it through the hydrogen which is evolved. It is clear, therefore, that pipes will not suffer destruction in the ground if the current is prevented from passing from them or if the current passes into them. The method of protection recently adopted at Carlsruhe secures this effect by means of electrodes which are sunk in the ground at suitable places near, or parallel to, the mains. These electrodes are connected with the positive pole of an accumulator or dynamo giving a low voltage current; while the mains are connected with the negative pole of the same source of current. Provided the potential, which need only be quite low, is sufficient, a current flows from the electrodes through the ground to the mains, and prevents the working current of the tramways passing out of the mains and so destroying them by electrolysis. The effect is to reverse the direction of the current which in unprotected mains passes out of them. The action may be compared with that of a stream of water. If water is flowing from right to left in a pipe, and the left end of the pipe is connected with a main in which the water pressure is higher than that in the pipe, it is clear that water will flow from the main into the pipe and, expelling the water already there, will set up a reverse flow of water in the pipe. It is the same with the current which normally passes from a main into the ground; but when the electrodes referred to are installed, a higher electrical tension is produced in the ground, and the direction of the current between the main and the ground is then reversed.

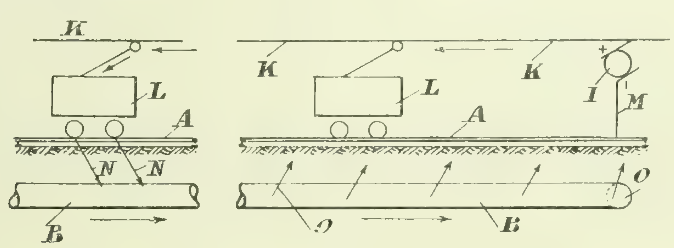


Fig. 1.

The method of protection depending on the foregoing principle is applied in the following manner. The diagram (fig. 1) shows a tramway in which the electrical method of protection has not been adopted. The working current passes from the dynamo I at the generating station through the overhead conductor K and the tram-cars L to the rails A, and returns through them and the conductor M to the dynamo. But part of the current—viz., the stray or vagrant current—passes from the rails through the earth

in the direction of the arrows N to a gas or water main B, which, running parallel to the rails, forms a good conductor of the current towards the dynamo I. In order to reach the latter, however, it passes in the direction of the arrows O back to the rails and through the conductor M to the dynamo. It is at the points O, where the current leaves the pipe, that the latter is exposed to electrolytic destruction.

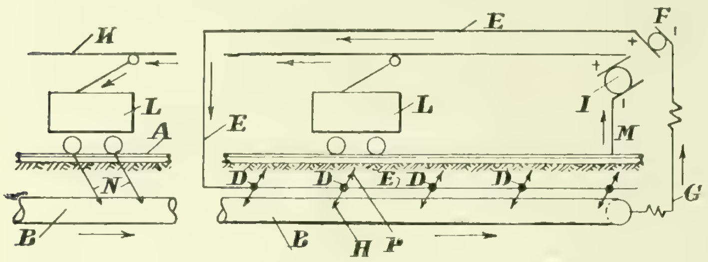


Fig. 2.

Fig. 2 is a diagram of the same system with electrical protection. The electrodes D, sunk in the earth near the main B, are connected by the conductor E with the positive pole of a source of electricity F, the negative pole of which is connected by the conductor G with the main B. Current passes in the direction of the arrows H from the electrodes D in the reverse direction to the vagrant current indicated by the arrows O (fig. 1), and suppresses the latter and thereby protects the main B from corrosion. The portion of the working current of the tramway which enters the main at N passes through the conductor G to the source of electricity F, and thence through the conductor E to the electrodes D, and from them, in the direction of the arrows P, to the rails A, and so to the dynamo I at the generating station. Thus the vagrant current finds its way back through the electrodes D to the dynamo; and it is these electrodes only, and not the main B, which are exposed to electrolytic destruction. It is an important incident that opportunity is afforded for the stray portion of the working current to find its way back readily to the dynamo at the generating station.

When pipes are protected by insulation with bitumen, &c., the electric current is prevented from passing from them at the insulated stretches, with the consequence that it passes in greater measure from the portions of the mains adjacent to the insulated stretches. The insulation with bitumen, &c., at Carlsruhe has not proved adequate; for wherever the insulation was in the least degree faulty, current escaped and caused destruction of the main. The insulation has indeed been harmful in that adjacent non-insulated mains have been more strongly attacked. The protecting electrodes may be either set at intervals in sockets made for the purpose in the ground along the course of the main to be protected, or one or more continuous electrodes may be laid parallel to the main. For these continuous electrodes, disused cast-iron gas-pipes of small diameter with good run-lead socket joints have proved satisfactory conductors for the protecting current. Measurements showed that the resistance of a joint in a cast-iron pipe of 60 m.m. ($2\frac{1}{3}$ inches) diameter was as follows: With a run-lead joint, 0·00033 ohm.; with a lead-wool joint, 0·01 ohm; with a screw socket joint, 0·00066 ohm. The electrodes set at intervals need a rather higher tension current for the proper protection of the main than does the continuous electrode laid parallel to the main. The tensions or falls of potential when protecting electrodes are used at intervals are shown in Table I., which represents the conditions when the tramway is at work:

TABLE I.

Number	1. Volts.	2. Volts.	3. Volts.	4. Volts.
Fall of potential between the electrodes and the main	0	+2	+4	+6
Fall of potential between the main and the immediately adjacent soil:				
Measured at the top of the main .	+0·45	+0·11	+0·07	−0·11
Measured at the bottom of the main	+0·35	+0·03	−0·01	−0·19

It will be seen that when the fall of potential between the electrodes and the main is *nil*, the main is strongly positive relatively to the earth, and is not protected. But as the fall of potential between the electrodes and the mains is increased, the main changes from positive to negative towards the earth, and at 6 volts fall of potential between the electrodes and the main the latter is strongly negative relatively to the surrounding earth. Complete protection of the main would be afforded with about 5 volts tension in the electrodes. Table II. gives similar figures for two continuous electrodes laid parallel to the main:

TABLE II.

	Volts.	Volts.
Fall of potential between the electrodes and the main .	+2	+4
Fall of potential between the main and the immediately adjacent soil:		
Measured at the top of the main	−0·05	−0·45
Measured at the bottom of the main	−0·35	−0·95

It will be seen that complete protection of the main is afforded with 2 volts tension in the electrodes. The tension to be given to the electrodes in any case is determined not only according to the working conditions of the tramway and the main relatively to the rails, but also according to the conductivity of the soil, which can be easily determined by measurement. The power required is quite inconsiderable in relation to the power needed for working the tramway. At Carlsruhe, this method of protection has been applied in the neighbourhood of the generating station to about 110 yards of water-main of 10 inches diameter, about 22 yards of gas-main of 12-inches diameter, and about 77 yards of high-pressure gas-main of 6-inches diameter. The current consumed for protecting these mains amounts to about 11 ampères at 10 volts tension or 0·11 B.T. unit. This current is generated by a small electromotor at the generating station coupled to a low voltage continuous current dynamo which works from six o'clock in the morning till midnight.

The apparatus is provided with a recording volt and ampère meter. The current is conducted to the electrodes by wires carried overhead on the tramway standards. Insulated wires pass from the wires at the standards to the electrodes in the ground. On the standards at suitable places are small boxes with adjustable resistances, by means of which the proper tension is given to the different electrodes, and needlessly high consumption of current is avoided. The connection between the negative pole of the dynamo and the mains is made by means of the gas and water service pipes in the generating station. The electrodes used have been in some cases iron rods, and in other cases, as already explained, old cast-iron pipes. Practical proof of the efficiency of the method of protection is afforded by the case of a 12-inch gas-main which crossed the tramway in the Durlacher Allee. In July, 1906, and in May, 1907, this main was insulated, and in ten months' time was found to be strongly corroded. The main was renewed in April, 1909, and protected by the electrical method. In July last, it was examined and found quite free from corrosion even at the joints, where corrosion is most readily detected. It is thus evident that the method had afforded complete protection over a period of fifteen months.

The authors refer next to the manner in which pipes are corroded by electrolytic action. In addition to deep pittings, there are holes right through the pipe which, however, when the latter is bared, are found to be filled with a soft and easily perforated graphitic material. This material prevents gas escaping freely; but when the ground is opened, there is a strong smell of gas and the earth for a considerable distance is coloured green, and has the well-known smell caused by gas leakage. When the bituminous insulation formerly used was removed from pipes, there were found to be numerous fresh cases of corrosion. In some instances, these occurred where the pipe had been indented with a chisel. Water-mains, which it had been found necessary to renew, were deeply corroded and evidently would have given way in a short time, with the result that not only the water supply but the tramway traffic would have been interrupted.

The gas-mains, though not actually fractured, were a source of danger owing to their unsoundness, as the escaping gas, especially when the ground was hardened by frost, would readily penetrate into the adjacent houses. Examination of the mains showed that they were corroded on all sides, and not merely on the side turned towards the tramway rails. The rails themselves in some cases were strongly corroded, and the method of electrical protection could naturally be applied to them also. But corrosion is of relatively small importance in this case, as the rails can readily be renewed. The electrical protection, however, should be of service in the case of bridges, iron tunnels, conduits, cables, &c. It may be applied locally to the portions of the distributing system which are most exposed to danger of corrosion, and it has the advantage over insulation and other suggested methods of protection that it returns the stray portion of the current to the dynamo at the generating station, and does not merely transfer it to another portion of the distributing system. Insulation of the main, on the other hand, merely results in adjacent lengths becoming more strongly corroded.

The details of the method of protection described are embodied in a German patent (No. 211,612) granted to Herr Geppert.

The Visit of German Gas Engineers to Edinburgh.—At the meeting of the Edinburgh and Leith Gas Commissioners on Monday last week, a letter was read from Herr Prenger, in which he conveyed the thanks of the members of the German Association of Gas and Water Engineers who recently visited the Granton Gas-Works for the kindness they received. The works had, he said, made an impression upon them which would dwell in their recollection.

Southern District Association of Gas Engineers and Managers.—The general meeting of the Association will be held on Thursday afternoon, at the Hotel Cecil, Strand, under the presidency of Mr. C. Stafford Ellery. According to the circular issued by the Hon. Secretary (Mr. W. E. Price, of Hampton Wick), the business will include the election of the President, Vice-President, and officers for 1911, also new members. The President will make a statement on the subject of the Benevolent Fund of the Institution of Gas Engineers; and three papers will be submitted. Mr. A. E. Broadberry will deal with "High-Pressure Lighting;" Mr. P. G. G. Moon with "Sulphate Manufacture for Small Works;" and Mr. T. Price with "District Pressure."

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The Monthly Meeting of the Western District Division of the Scottish Junior Gas Association was held in Glasgow on Saturday last. The PRESIDENT (Mr. J. Frazer, of Provan) occupied the chair; and there was an unusually large attendance of members.

Mr. GEORGE SCOTT, of the Meter Department of the Glasgow Corporation, read a paper on

THE REPAIR OF GAS-METERS.

The author commenced by saying the subject he had chosen might appeal to some more than to others, by reason of the fact that very few gas undertakings in Scotland conducted the repair of meters in their own workshops; but he was satisfied that this could be done more efficiently, more practically, and perhaps more profitably than by employing outside agencies. At the same time, he was not there to dispute as to who were the best people to repair gas-meters, but to describe the best means to facilitate the repair; and as the wet meter was a thing of the past in Glasgow, his paper would be devoted principally to the repair of the tin-cased dry gas-meter. After giving a few particulars as to the arrangements of the Corporation workshops, the author proceeded as follows.

All meters, as they are brought in from the districts of supply by the fitters, are received by the Meter Department the following morning, together with a sheet giving the maker's name, a description of the meter (whether wet or dry), the number of lights, Corporation number, dates of purchase and of last repair, and, of course, the defect. An adhesive ticket is gummed on the side of each meter, giving the fault for which it is brought in. Each maker's meters are kept separate and arranged in sizes to facilitate the checking by the recording clerk and initial tester, whose duty it is to see that the Corporation number and the reading of the index are correct. They are then laid aside so that they may be tested at the same temperature as that of the workshop. All meters when brought in should have the outlet and inlet corked to prevent the action of air on the diaphragms, or any dirt on the valves from solidifying, for by this means the inside of the meter is kept very much in the same condition as when it left the consumer.

The initial or first test is to find out the defect. The testing apparatus used for this is three 5-feet holders and two long tables with 26 wet meters, each having connections to allow a one-light to a three-light dry meter being connected and the one meter run against the other. The one-foot cylinder on the top of the wet meter index is removed, and a round plate with movable pointer substituted. Another pointer is attached to the wet meter index-box which is stationary, to allow of the movable pointer being brought into line with the stationary one. The round plate is divided into one-foot or 100 cent.; the tenths also being marked. The test-table is supplied by a 1-inch iron pipe, and controlled by a governor set to give 7-10ths of pressure. Meters are tested for indication, drawing lights, back-flame, &c. Should a special test be desired by the Surveyor's Department, owing to a disputed index or gas account, the 5-feet holder only is used. All 5-light and 10-light meters are tested by the holders. So far I have dealt with the largest quantities of meters brought in. A special tester is reserved for 20-light up to 500-light meters; the latter being the largest size of meter on the districts.

In testing a meter for escape at the index, it is well to use the sense of smell before applying a light, as this part of the meter often contains an explosive mixture of gas and air. By piercing a small jet hole at the top corner of the meter, the danger of having the glass or index blown in one's face can be lessened. Meters measuring slow have very often dirty valves, covers lifting, or bent valve wires or arms. Those measuring fast with back-flame have porous diaphragms. The result of the initial test is marked on each meter, then copied on to the sheets, and in due time filled into the meter register. They are now passed on to the washers to have their outside case cleaned; this making it easier for the foreman to make his selection of the different kinds of jobs. After the meters have been selected, they are built up in rows with the back dates to the front; and each meter when being placed into a job has the Corporation number and the date when brought in for repair put on the workman's line. These meters are placed in boxes to hold six each; the boxes being numbered from 10 to 99. Thus the jobs are placed ready to be given out when required.

We now proceed with the repair of the meter by removing the Government stamp, scraping the paint off the soldering round the top, and piercing two holes in the side (keeping clear of the division), to allow the condensation or liquor to be drained off into the pan used for the purpose. This is thrown out, and the dish washed with warm water and soda. The top is then removed, care being taken that no solder is allowed to run in upon the index. The brass pin is next taken out of the tangent, allowing the valve-plate to be removed with greater freedom. The nuts are taken off the valve-pins and placed on the tray; the repairer marking his initials on the left-hand corner of the meter, and numbering each of them from No. 1 to No. 6. The top and valve plates are marked similarly, so that all may go back to the same meter. If after opening it is discovered that a meter is damaged by damp, it is submitted to the foreman, who decides the nature of repair necessary. The upper part of the meter, containing the two slide-valves, conveys the gas to the several chambers; and it is a very important point that they should be absolutely tight, to ensure that the meter works steadily, and also that no unregistered gas may pass through. We therefore hand them over to our grinders to have the valves ground. By bending the front valve wire up or the valve-guide down, it gives freedom to face the cover and grating together.

The meters are now passed on to the sounder, whose first duty is to examine the nipples, and make sure that they are to the standard size. All 2-light nipples are taken out and replaced with new ones; the thread fitting a 3-light ring, and the tail fitting the 2-light socket. The sounder observes the general condition of the meter; the date of purchase or of the last repair guiding him as to the length of time the meter has been out. He also sees that the top arms have plenty of stretch. When satisfied that all is in good order, he gases the meter. To do this the meter must be worked backwards (owing to the valve-plate being worked off), by connecting the supply to the outlet. The flow of gas being stopped by the back-check, by observing the holder to see if it is travelling a good idea is formed of whether the diaphragms and valves are tight or leaking. When sufficient gas is passed through the meter, the touch-light may be used in the smaller-sized meters to locate escapes in the chambers, diaphragms, or valves. If the meter passes this test and is found good, it is duly returned to the repairer marked "R." Meters found defective are marked "L.D." (meaning leaking diaphragms) and returned to the repairer for a general overhaul. A meter repairer has always two jobs on hand; and while he is proceeding with the general repair of one, the other is with the grinder and sounder. He is held responsible for each meter to the finish of the repair. He takes the valve-covers out, placing them on his tray, scraping the paint off the soldering round the backs and fronts; and, using a very warm soldering-iron, he runs the solder off, inserts a sharp blade at the corner, and the backs and fronts of the meter come off easily. These are initialed and numbered the same as on the left-hand corner of the meter. He then wipes out any loose liquor in the bottom of the meter, and tins the edges well. This is found to be beneficial when putting the meter together again. They are next thoroughly washed out with crude naphtha and dried with coloured waste. The diaphragms are then sounded by placing a piece of putty over the port leading to the inside, and pressing the disc. If there is a small leak, the repairer will hear it blowing; and should the escape be difficult to locate, by putting water into the inside he will observe it at once by the bubbles. If the leak be in a favourable place, the parts can be drawn together by a silk thread. The gas-ways are now sounded by putting a piece of putty over the two centre ports and sucking the outlet. By placing the thumb over the hole in the centre of the valve-box and sucking the inlet, the repairer will discover whether or not the gas-ways are tight. If satisfied that all is correct, he makes an incision in the disc to admit a 3-inch circle being cut out; or, if it has been opened before, he has the circles run off with the soldering-iron.

The diaphragms are oiled from the inside with black lead and oil—the oil to soften and preserve the leather; the black lead to fill up the pores. There are great differences of opinion among meter makers as to what is the best oil for this purpose. The mixture we use is from the recipe of the late Dr. Russell, the City Analyst; and it has proved most satisfactory for more than twenty years. It is made up as follows: Palm, 1 qr.; olive, 1 cwt.; racked cod oil, 1½ cwt. The palm oil is well heated, and then mixed with the other oils. It is given out to the men in ½-gallon tins, with ½ lb. of powdered black lead well stirred through it. This is well rubbed into the leather by means of a swab. The meter is then laid on its back to allow the oil to be absorbed well into the leather.

Attention is now given to the meters. All surplus oil is lightly dipped out with a piece of loose waste, the inside of the diaphragms thoroughly cleaned out, going well up into the tongue leading to the inside, and making sure that no oil is left which might be blown up on the face of the valves. The tin circle is soldered on to the disc, the meter laid on its flat, the two rims of the diaphragms placed directly on top of each other, and the hinge-piece placed in its proper position and soldered on to the circle again. The workman puts the putty on the valve-grating, and observes the top arms to see if there is any movement. Should there be an escape, it is at once located. If unrepairable, it is shown to the foreman, who gives the workman permission to replace it by a new one. The meter is now cleaned out round about the outside of the diaphragms; attention being given to the flag wires, motion wires, hinges, and studs. If all is in good working order, we are ready to tack on the backs and fronts; and we proceed with the soldering-up, taking care to make a good job of the corners, to prevent any escape from this point.

We next give our attention to the top portion of the meter, by cleaning the valves and replacing the covers. The meters are then submitted to the foreman for the inspection of the cranks, valve-arms, and valve-pins. If found defective, the valve-arm is bent up, signifying that they are to be taken out and replaced by new ones. The stuffing-boxes are next cleaned out and repacked with new wool prepared with the best Russian mutton tallow; and a leather washer is put on the top and bottom of the packing. They are next of all neatly cleaned with whiting; a pair of bellows

being used to blow out all the loose dirt or whiting. The brass fittings are cleaned with aqua fortis; and all soldering parts are re-tinned. The index is examined and wound up to zero; and the tangent pin loosened from the tack of solder. They are now ready to be replaced in the meters and examined by the foreman. This final examination is to see that the valves are equally divided, the index adjusted and placed in its proper position, the spindle running free and in gear with the worm, the top arms divided by the tangent pin, and the rod wires well packed and able to bear their own weight when lifted without dropping again. They are then passed on to the sounder again, who gases and goes over them with his touch-light, as in the previous sounding test. Finding all in order, the meters are marked with an "R," and handed back to the repairer to have the valve-nuts and valve-plates put on. The repairer's line is now filled in, and opposite the number of the meter he describes the nature of repair, the material used, and the total time he has taken to do the job. This is subsequently entered in the time and material register book by the recording staff.

The meters are now passed on to the final testers, who work in threes—two proving with gas, and one measuring with air. Although they have been examined and the valves divided as nearly correctly as the human eye can make them, the prover's first duty is to run them with ½-inch pressure; making sure that the flag wires and the cranks are properly packed. When he is perfectly assured that everything is right, the top arms are tried to see that they are equally divided and running in unison with the valves. The lights going out at the four points of the tangent proves that the four chambers are perfectly tight, and there is no possibility of gas passing from one chamber to the other. A pressure of 4 inches is put on, and the meters carefully gone over with the touch-light to search for escapes; and if any are found, the meter is returned to the workman to be made good. The variations are now taken out by passing half a cubic foot of gas through, first at ½-inch pressure, and then at 4-inches pressure. If all is well divided, the bearings working smoothly, and there is no collapse in the diaphragms, both the readings should come out very close. The meter may prove to be a little slow on the high pressure, but never fast.

The meters are next passed on to the measurer, who brings the tangent to a point, and, according to the size of the meter, takes a few revolutions against a pointer placed inside. If fast, the tangent pin is drawn out; if slow, it is pushed in. The pointer on the foot circle being set to a given place, and the holder adjusted, he runs the complete 2 cubic feet. When the meter is found to be reading correctly, a tack of solder is given to the tangent pin to keep it from shifting, and a small brass pin inserted into the tangent pin to prevent the top arms from coming off. The meters are now ready for the topper, who solders on the top and seal cup, and also puts leather washers on the couplings. They are then returned to the testers, and gassed and tested for escape at the index. Then the couplings are reversed, and the meters are tested to see if they will go out at the back-check. The prover now fills in his portion of the workman's line—the date when the meter was proved, and by whom. It is passed on to the painter, to be coated first with quick-drying paint. The date when it was last brought in is painted on the inside of the index-cover, for future use if required in tracing the history of the meter. It then receives a second coat of paint, and is allowed a night to dry; and next morning it is sent to the Board of Trade stamping office.

At this point we complete our work with regard to the meter. But it may not be out of place to give a few figures regarding the amount of work that has been accomplished in this department during the past financial year, beginning June 1, 1909, and ending May 31, 1910. We began with 10,440 ordinary and 283 prepayment meters in stock. We received from the districts for the year, 26,245 ordinary and 9091 prepayment meters; making a total of 46,059 meters in stock. Of these, 11,051 were found good and repainted. We repaired for the year 18,704 ordinary and 1956 prepayment meters. We also altered from ordinary to prepayment 1110 meters; making the total of repairs for the year 32,821. Of the total meters in stock, 5982 were found to be unfit for repair, and were condemned. The new meters received from the makers for the year were 1966 ordinary and 5686 prepayment —a total of 7652. All these were examined and badged, and then sent to the repaired meter stock. The average number of meters repaired and repainted was 631 per week. The faults usually found in ordinary meters are "drawing lights," "fast," "slow," "not indicating," "bound and damaged." The faults usually found in prepayment meters are "cases damaged," "cash-boxes damaged," "lamps and hasps damaged," "valves not closing," "valves not opening," and "prepayment gear broken."

Before concluding, I should like to say that in the case where a meter is brought in from the district, and after being examined is found to be unrepairable, it is the foreman's duty to condemn it. It is usually taken to pieces, and all the parts found good are cleaned and utilized for repairing purposes on some other meter. I should like to add that a gas-meter is undoubtedly one of the most interesting, yet mystical, apparatus in existence. But with a little careful study of the index, no consumer need be in any difficulty; and with a little attention to this matter, he ought to see at a glance the quantity of gas consumed. Instructions for this have been printed on all gas account forms; and I may state that invariably the recording of the index is absolutely correct. If the citizens of Glasgow, whose gas is measured with such scrupulous exactitude and impartial fairness, enjoyed the same advantages under the administration of weights and measures in dealing with the food of the people, what a boon it would prove to the whole community.

Discussion.

The PRESIDENT, in opening the discussion, remarked that it said a great deal for the Meter Department of the Glasgow Corporation when they could repair 631 meters per week. If what Mr. Scott had said about the proving of a gas-meter were known to consumers, there would be less grumbling among them about the inaccuracy of their meters.

Mr. J. GRANT (Glasgow) said he thought that to Mr. Scott the thanks of the meeting were due for his very interesting paper. Perhaps some might be disappointed because the paper had been confined to the repair of dry meters; but to him (Mr. Grant) this subject was a very broad one, on which there was room for half-a-dozen papers. More attention should be paid to gas-meters than was usually the case. Any place—the darkest in a house and the dampest in a shop—was considered to be good enough for a gas-meter. The majority of gas-meters were in tin cases; and when they were put in a damp place corrosion was bound to set in, and in a very short time escapes occurred. He had known cases in which meters had been out for only a twelvemonth—300 and 400 light meters, costing from £25 to £40—and had been completely wrecked. He had heard of a self-oiling meter, in which a supply of oil was kept continually flowing on to the diaphragm by means of small woollen wicks, which were supposed to be sufficient to syphon enough oil to keep the diaphragm moist; but to his knowledge this was not the case. Sufficient oil might be carried from the tables on to the top of the diaphragm, but would the diaphragm absorb it? To his mind it would not. He had proved it several times. In their works they had tried to oil the diaphragms entirely from the outside, but had failed.

Mr. J. WILSON (Falkirk) asked if the meters came in to be repaired as a result of complaints by consumers, or if there was a periodical repair of the meters. If the latter, how many years were given to a meter before it was repaired? The meters which were condemned had badge numbers put on, he presumed, by the Corporation themselves. Were these numbers used again on new meters? Could Mr. Scott tell them the approximate life of a diaphragm? and if it was the chief factor in determining the life of a meter? If not, what might be the average life of an ordinary dry meter?

Mr. J. M'GHIE (Glasgow) impressed upon all who contemplated repairing meters not to endeavour to save money on the oil used. In regard to the oiling of the diaphragm from the top, he would be rather chary of saying that it had not proved to be a good thing. They had the experience of one or two large meter makers who stated emphatically that it had been a great success. They had tried it in two different ways. They first placed in the meter a small box, into which the diaphragm dipped and absorbed the oil by capillary attraction. This method was abandoned after a time, because it was found that in the larger sizes the oil only travelled about two-thirds of the way up the diaphragm, leaving the upper part dry. They had been trying, with better success, oiling from the table on the top. Only a few years' experience of this had been obtained as yet; but they were quite pleased with the method. In one or two places where heavy pressures were being used, they had been finding that the pressure was acting on the diaphragms in the extraction of the oil from them. Where there were a number of bye-passes, it was usually found that some of them passed gas without registering. What would be the result, in unaccounted-for gas, with some of the pressures which were now coming into vogue? In the workshop they had been testing one or two rotary meters of the larger size; and they found that unless a rotary meter was passing a minimum of about 70,000 cubic feet an hour it was unreliable. If it were passing this quantity, it was very good. It was a strong point for these meters that they were suitable for use with gas-engines. They did not occupy so much floor space, which was so valuable. It was felt that the earlier defects of rotary meters were being overcome. The idea of leaving detachable cash-boxes of prepayment meters open when they were empty had, it was believed, led to a diminution of the number of damaged meters in unoccupied houses.

Mr. A. H. WHITELAW (Glasgow) thought the members must be struck with the amount of work done in the meter-repairing department of the Glasgow Corporation, when they found that 36,000 meters passed through it in a year. Every one of these meters was put through an initial test, not to find out for what reason they had been brought in, but to ascertain the state of them. They had been told that in the repair of a meter it passed through five tests. The question as to the life of a meter was one that was very often asked. They had meters coming in which had been in continual use for forty years, and which, when tested, were measuring well. He had tested a 20-light dry meter at pressures varying from 0·5 inch to 5 inches. At the former pressure, it passed 120 cubic feet of gas per hour; at 1-inch pressure, 156 cubic feet; at 2 inches, 192 cubic feet; at 3 inches, 228 cubic feet; at 4 inches, 270 cubic feet; and at 5 inches, 312 cubic feet. It would be noticed that all the way up there was a difference of 36 cubic feet per hour. It was found that the meter was 1 per cent. slow under all pressures. The greater the pressure, the quicker the gas passed through the meter. He should like to point out that the greater the pressure at which the gas went through the meter, the more it was in

favour of the consumer. He thought this was a point which was not clearly understood. With a pressure of 5 inches, the gain to the consumer might not be more than 1 per cent.; but supposing it were possible to pass gas through a dry meter at 56 inches pressure, he calculated that the consumer would benefit to the extent of about 14 or 15 per cent. Therefore he should pay more for his gas.

Mr. R. SHEPHERD, jun. (Glasgow), asked Mr. Scott's opinion as to whether back-flame was an entire loss to the supplier of gas. He would also like to know whether Mr. Scott had ever found a meter registering correctly when passing as little as 1 cubic foot per hour; also whether he considered it paid to put safety cash-boxes and patent locks upon meters, so as to prevent money being abstracted.

Mr. W. M. MASON (Glasgow) remarked that in Mr. Scott's paper the members had had laid before them what was practically the experience of a lifetime. Mr. Scott told them that of the meters which passed through their hands in the course of a year, 11,000 were found to be perfectly correct. The question had occurred to him why these meters had been brought in. They were also told that the higher the pressure the slower the meter recorded; but Mr. Whitelaw stated that for each additional inch of pressure the meter recorded 36 cubic feet more gas. On the previous day, a gentleman told him that he had been consuming gas for thirty years, and that when it was charged at 4s. per 1000 cubic feet his accounts were less than they were now. Of course, he (Mr. Mason) told him that he was using far more gas; but he declared that he was not. He said it was the high pressure at which it was being supplied. The public all thought this. It would be an interesting point if Mr. Scott could tell them whether this was the case or not.

Mr. J. WELSH (Glasgow) said his experience was that an architect never considered where a gas-meter should be put. As to the bringing-in of meters, it must be remembered that they were often brought in from houses which had been left empty.

Mr. J. WILSON (Falkirk) mentioned that he knew of cases in which rotary meters, used as discount meters, had been found to be so unreliable that they had been condemned. If they were not working at their full capacity, they did not register anything like correctly. When working at half capacity, the error was very considerable, and, of course, always to the benefit of the consumer. He did not know whether rotary gas-meters were sanctioned by Government.

Mr. A. WRIGHT (Greenock) asked if Mr. Scott found many indices acting adversely, as he came across one the previous day. When sent out, it indicated 1; next time, it was 0·8; then 1·4; then 0·9; and then 1·01.

Mr. W. GRAFTON (Glasgow) pointed out that Mr. Whitelaw had not told the meeting the rates of flow at which his tests were made. A great deal depended upon this, particularly when dealing with the heavier pressures. Taking pressures of from 54 to 60 inches, how were they to ascertain accurately the quantity of gas passed? He found that, taking an ordinary dry meter, proved officially to be correct, it would vary from $3\frac{3}{4}$ per cent. fast to 14·4 per cent. slow, according to how they used it. This would answer very closely Mr. Mason's remark with regard to the consumer complaining about his gas account. He was unfortunately not working under ordinary conditions. If they were burning 5 cubic feet an hour, they might be 14 per cent. slow; if they were burning full capacity, they might be 3 per cent. fast. He thought this cleared up the matter of the difference of pressure in a meter. The rate of flow must affect the internal resistance in a meter. With regard to heavy pressures, the pressure of the atmosphere was 15 lbs. per square inch. They were accustomed to the use of 40-10ths. This was not an increase of 75 per cent., but of only 1 per cent., because they had to add this pressure over and above that of the atmosphere. An atmosphere, under 40 inches of water, would run into something like 404 or 408 inches, which, *plus* 4 inches, would make 412 inches; so that it really made 1 per cent. Railway carriage lighting was all based upon heavy pressure; and excellent results were obtained from it.

Mr. WHITELAW thought Mr. Grafton had quoted a case which was quite abnormal. They did not expect people who had a 20-light meter to be using only 5 cubic feet per hour. He did not wish it to go abroad that 5000 was the usual number of meters they condemned in a year. Prepayment meters were displacing ordinary meters at an alarming rate; and the latter, for which there was no sale, were being thrown on their hands. One-light meters were being condemned because there was no use for them. Two-light meters were hanging heavily on their hands; and this was the reason why they were converting them into prepayment meters. A gentleman who stood very high in the profession said a few months ago that it would not pay to convert ordinary into prepayment meters. So far as they in Glasgow were concerned, they found it did pay; otherwise they would not be doing it.

The PRESIDENT tendered the best thanks of the Association to Mr. Scott for the very able manner in which he had handled his subject. He considered it was worth their while to go on with the conversion of ordinary into prepayment meters, as it was the conversion of a discredited thing into one of actual use. He thought the tests at from 0·5 inch up to 5 inches were very severe. There were few places in Glasgow where the pressure was up to 4 inches. The day pressure was 40-10ths. But they stood pretty high; and before the gas reached the lower levels he supposed the pressure would be 15-10ths to 20-10ths.

Mr. SCOTT, in replying upon the discussion, said there was no average life of a dry meter, because, as had been remarked, meters were put into all sorts of places, and some of them might only last a year, as they had had in the case of the late exhibition. There 500 meters stood out for a year without any gas passing through them after the exhibition closed; but though the gas was stopped, air got back through the pipes. The meters looked all right outside; but they were entirely gone inside. It was a mistake to allow meters to stand out for any length of time; it paid to bring them in. This was the reason for so many coming in. It was cheaper to bring in old than to purchase new meters. They kept the badges of condemned meters until they had a number of new meters on which to put them. Back-flame was an entire loss to the Corporation. A meter giving back-flame ought to be at once brought in for repair. As to running a dry meter after a wet one, if they had only 0·5 inch pressure he pinned his faith to the wet meter; and they were bound by Government to test meters at this pressure. If they were to use anything higher, they would require to do away with wet meters altogether, because they would not be able to stand the pressure. So long as a rotary meter was working at its capacity, they had fairly good registration by it; but if they took it down to half capacity, he was sure the measurement would be out. In conclusion, he thanked the members for the way in which they had received his paper.

Dow's Brightness Photometer.—At the meeting of the Physical Society at the Imperial College of Science, South Kensington, next Friday evening, Mr. J. S. Dow will show his brightness photometer, which was described and illustrated in the "JOURNAL" for the 18th ult. (p. 199).

Recent Wills.—The late Mr. Arthur Godwin Hammack, whose death was recorded in the "JOURNAL" for the 4th ult., left £6653. Mr. Thomas Whimster, formerly Gas Manager at Perth, whose death, in his 92nd year, was announced in the "JOURNAL" for the 13th of September, left estate of the value of £2665.

The Midland Junior Gas Association will meet next Saturday afternoon, when Mr. W. H. Johns, of Birmingham, will read a paper entitled "Ammonia Recovery, with Special Reference to Apparatus employed therein." The first of a series of "Coffee Meetings" will be held at the conclusion of the business.

Royal Society of Arts.—The opening meeting of the 157th session of the Society will be held to-morrow week, when an address will be delivered by Sir John Cameron Lamb, C.B., C.M.G., Vice-President and Chairman of the Council. From the programme for the session, we find that on the four Mondays before Christmas Mr. C. R. Darling will give a course of Cantor Lectures on "Industrial Pyrometry," and that on the Mondays in March next year, Professor J. A. Fleming, F.R.S., will deliver a similar course on "Applications of Electric Heating." One of the ordinary lectures after Christmas will be by Professor J. Wertheimer, B.Sc., on "Water Finders"—a subject on which, it may be remembered, he carried out some interesting investigations a few years ago.

Proceedings of the North British Association.—We have received the report of proceedings at the forty-ninth annual meeting of the North British Association of Gas Managers, held at Dunfermline on the 28th and 29th of July, under the presidency of Mr. Alexander Waddell, the Engineer and Manager to the Dunfermline Gas Commissioners. The technical matter, which was given in the "JOURNAL" at the time, is followed by lists of the officers and members, the statement of accounts, and the "Statistical Report of the Gas Supply of Scotland" in the year ended May 15, 1910, published by the Committee of the Association. A photograph of the excursion party at Kinross, on the second day of the meeting, forms the frontispiece; and there are portraits of the Presidents and the readers of the two papers submitted (Mr. J. W. Napier, of Alloa, and Mr. James Dickson, of Forfar). The book has been produced under the supervision of Mr. Lawrence Hislop, the Secretary and Treasurer of the Association.

Action on the Eyes of Dust from Tarred Roads.—This subject has lately been dealt with in the "Comptes Rendus" of the Paris Academy of Sciences by MM. True and Fleig. According to an abstract of their communication in the "Journal of the Society of Chemical Industry," it has frequently been observed that the dust from tarred roads has appeared to be more irritating to the eyes than the dust from roads which had not been tarred; and an investigation of this point was made by means of experiments on animals. It was found that dust from untarred roads had only the slightest effect when sprinkled upon the eye, and that dust from old tarred roads from which the coating had more or less disappeared gave effects little different. Dust from old tarred roads with a well-preserved surface brought about conjunctivitis and other lesions; while dust artificially produced from such roads gave still more severe effects. Artificial mixtures of powdered stone and tar gave results corresponding to the proportion of tar contained therein. The authors say this noxious effect of dust from tarred roads is due primarily to the chemical action of the constituents of the tar upon the mucous membrane of the eye; secondarily to the mechanical irritation produced by the dust; and thirdly to the germs present. It was noticed that the dust from tarred roads contained fewer germs than that from untarred ones. The authors consider that these experiments do not constitute an argument against the tarring of roads, which, if well done, they say diminishes the chance of injury to the eyes.

MANCHESTER UNIVERSITY LECTURES ON GAS.

Mr. Dugald Clerk on Explosions in Internal Combustion Engines.

THE second of the series of lectures arranged to be given at the Manchester University on "The Science of Gas Manufacture and Combustion," was delivered on Saturday afternoon by Mr. DUGALD CLERK, F.R.S., M.Inst.C.E., who took for his subject "The Phenomena of Explosions in Gas and other Internal Combustion Engines." Alderman R. Gibson, the Chairman of the Gas Committee of the Manchester Corporation, presided, and was supported by Mr. H. Kendrick, President of the Manchester District Institution of Gas Engineers, Mr. J. G. Newbigging, M.Inst.C.E., the Gas Engineer to the Corporation, Professor Harold B. Dixon, Ph.D., F.R.S., President of the Chemical Society, Mr. F. Thorp, President of the Manchester and District Junior Gas Association, and others. There was a large attendance —upwards of 130 being present.

Alderman GIBSON, in opening the proceedings, said the only certificate which he possessed to justify his taking the chair was that he happened to be Chairman of the Gas Committee of the Manchester Corporation. Those present were, as he understood, more or less experts—they were more or less interested not only in the manufacture of gas but in its scientific and mechanical distribution; and he congratulated them in attending in such large numbers to listen to the lecture which was to be delivered by Mr. Dugald Clerk. This gentleman was, he believed, one of the most competent experts in the country to-day; and there was no doubt that those present would benefit from what he would have to say to them on the subject he had chosen. So far as he (Alderman Gibson) was individually concerned, he was "the least of the apostles;" but he had no doubt they would at the conclusion of the lecture go away wiser and better men, because they could not be wiser without being better. Alderman Gibson concluded by asking Mr. Dugald Clerk to deliver his lecture.

[For the text of the lecture, see pp. 397-400].

Mr. J. G. NEWBIGGING, before formally moving a vote of thanks to Mr. Dugald Clerk for his lecture, said he should like to take the opportunity of congratulating the Manchester and District Junior Gas Association on having enlisted the sympathy and help of Professor Dixon and the University authorities in inaugurating these lectures and the classes which had been formed to enable them the better to deal with the problems they met with in the course of their every-day work. The manufacture and supply of coal gas was entirely different now from what it was twenty or thirty years ago; and though this was a subject which he could not very well go into that afternoon, he might say this—that it became more evident every day that the manufacture and distribution of coal gas must be conducted on thoroughly scientific lines. With regard to Mr. Dugald Clerk, he believed it was nearly thirty years since he read a paper on the gas-engine before the Institution of Civil Engineers; and since then he had lectured on this and kindred subjects, written books and papers continuously, and always been at the service of those interested to give them the benefit of his wide experience and knowledge. In the year 1904, Mr. Dugald Clerk delivered, before the Institution of Civil Engineers—the James Forrest Lecture—which commanded the attention of the man who was in the highest rank of his profession; and he had also written books, one of which he (Mr. Newbigging) very highly prized—that on "The Thermo-Dynamics of the Gas-Engine." This was a work to which he referred whenever he wanted to gain information with regard to the gas-engine. He proposed a hearty vote of thanks to the lecturer.

Mr. JAMES TAYLOR (Mossley), seconding the motion, remarked that the use of internal combustion engines had developed very rapidly during the past ten years; and gas engineers were looking forward to an even greater use of them in the future. They had just received from Mr. Dugald Clerk valuable information on this subject; and with an extension of the use of gas-engines and a greater demand for gas-fires, they would do much in the direction indicated by the Smoke Abatement Society.

Professor DIXON supported the motion. In the first place, he desired to congratulate the Manchester and District Junior Gas Association on having secured so large an attendance to listen to the lecture just delivered. It was a real pleasure to hear a man like Mr. Dugald Clerk, because he brought to bear on the question what one might call unique qualities, and gave his audience the benefit of a mass of experiments. He combined two qualities which were not often found in one man. He was not only able to deal with the scientific side of this difficult question, but with the business side as well. Mr. Dugald Clerk had been a student all his life, and he knew the need there was for a better University training in these subjects, so that students could the better deal with the problems with which they were faced. He (Professor Dixon) thought Mr. Dugald Clerk was a man who had always encouraged students at the University to take up research work, and had impressed upon the authorities the absolute need for extended study and work on these subjects. He was glad to know that the lecturer was not going to sever his connection with the Leeds University, having accepted a seat on the Committee of the Livesey Professorship, the holder of which (Professor Bone) was an old student of Owens College. One felt sure that with a man like Mr. Dugald Clerk upon this Committee everything would be done to urge forward the scientific side, and that no irksome restrictions would be placed upon the holder of that Chair in whatever work he cared to take up.

The resolution having been carried by acclamation,

Mr. DUGALD CLERK, in acknowledging the vote, reminded his audience of the great advances which had been made in the construction of gas-engines since 1876, when the largest then in use in Britain was a 3 H.P. Otto, made by Messrs. Crossley Bros., of Manchester. Now they had gas-engines ranging from ½-H.P. up to 2000 H.P. At a works in the neighbourhood of Manchester—those of the "National" Gas-Engine Company, in which he was interested—he had seen started that day a gas-engine of 750-H.P., which was the largest engine sent out from the works. He admitted that he was still fond of experimenting in the laboratory, and had in recent years paid a little more attention to the business side of his profession. In his early days, as an inventor and an experimentalist, he shared the usual fate of the pioneer—getting "plenty of reputation but few ha'pence."

Mr. H. KENDRICK (Stretford), in proposing a vote of thanks to Alderman Gibson for presiding, said that gentleman was the leading administrator of the largest gas undertaking in the North of England, and his reputation would bear investigation from every point of view. Alderman Gibson's conduct of the affairs of the Gas Department of the Manchester Corporation was watched with interest by everyone connected with the gas industry; and though, in his modesty, he had described himself as "the least of the apostles," this was not the title they, as gas engineers, would give to him—in fact, they would be inclined to say in Manchester that he was the leader of the apostles, and those present were exceedingly pleased to see him in the chair.

Mr. S. MEUNIER (Stockport), seconding the motion, remarked that Alderman Gibson had always taken a deep interest in the welfare of the department of which he was Chairman, and had also shown that he had the interests of the ratepayers as a whole at heart. They all remembered the fight he waged in the City Council with regard to what would be the best business policy to be adopted by the Gas Department—whether they should make huge profits to hand over in relief of rates, or whether it would not be better to reduce the price of gas, and make it more popular, particularly for heating and cooking, and thereby make the town cleaner and healthier. Alderman Gibson was opposed to the gas departments of corporations being called upon to hand over large sums in aid of the rates; and in his endeavour to bring down the price of gas to the smallest possible figure, he was assured of every assistance from Mr. Newbigging, the Engineer to the Gas Department.

The motion was carried with much applause.

Alderman GIBSON, in responding, said that gas engineers could help him much in the carrying out of his policy with regard to gas undertakings. He thought it was a monstrous thing, a gross injustice, unfair, and dishonest, to take money out of the pockets of the poor gas consumers, and put it into those of the rich and the large ratepayers who did not consume gas at all. Why this was done passed his comprehension. When he heard people complaining as to the quality of gas—he supposed they would always have these complaints—he often thought how much better it would be if they tried to educate the people to understand that it was the poor gas consumer who ought to be considered, especially the smaller shopkeeper who had to light his gas early in the afternoon and keep it going until late at night in order to eke out a living. He was satisfied that a cheapening of gas would be to the benefit of the community; and he would not rest satisfied until he had gas-fires in every office in Manchester and so improved the atmosphere in the city.

Cowpe (Bacup) Water-Works Award.—At the Bacup Town Council meeting on Friday week, Alderman J. Craven-Hoyle, the Chairman of the Finance Committee, said, with reference to their final arbitration on the subject of the Cowpe Water-Works, that the amount in dispute between the Corporation and the Contractor was £10,200, and the sum disallowed by the Arbitrator was £8054. The total amount the Corporation would have to pay when they met the award was £122,096. With regard to the original contract, it was rather hard to say how it compared; but there was extra work costing £1666. Then there had been a serious unforeseen fault in the strata, which swallowed up some thousands of pounds, and made the expenditure on the works much heavier than the Corporation thought it would have been. There would be no costs paid to Mr. Diggle for the arbitration, except out-of-pocket expenses, of which the Corporation's share was £36—each side having to pay half.

Hereford Water Supply.—On behalf of the Local Government Board, Mr. A. A. G. Malet has held a public inquiry into an application by the Hereford Town Council for sanction to borrow £7000 for the construction of new filter-beds at the water-works. Mr. Holt, the Town Clerk, stated that the rateable value of the city was £131,817, the assessable value £127,770, and the total outstanding debts £158,207. The rates were 5s. 7d. in the pound. The capital expenditure on the works was £50,760, of which sum only £10,350 was now owing. It was proposed that two additional filter-beds should be provided, with an area of 20,000 square feet each, thus trebling the present filtering-area, and giving a capacity of 1,128,000 gallons in sixteen hours, during the time any one bed was being cleaned. Under the present system, the city was deprived of 50 per cent. filtering capacity during cleaning operations. It was pointed out that the Council would be able to carry out the scheme without imposing any burden on the ratepayers, as there was ample surplus revenue to pay the whole of the cost.

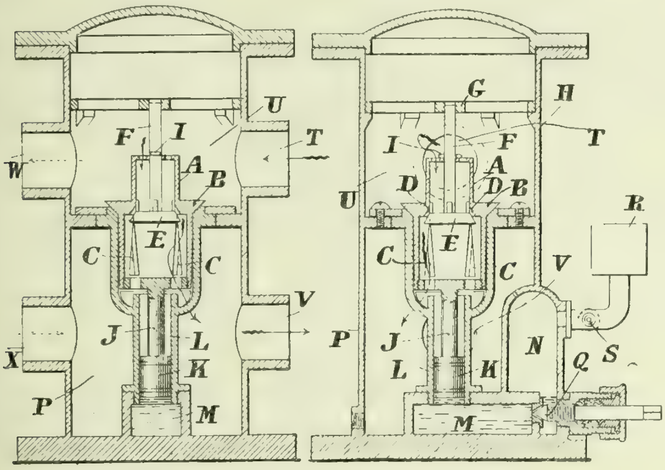
REGISTER OF PATENTS.

Gas-Compressors.

Brown, T. W., of Newington Butts, S.E., and Tilley, F. C., of Kingsland Road, N.E.

No. 22,308; Sept. 30, 1909.

This invention relates to compressors in which a pump or blower draws in gas and passes it to the burners in a state of pressure; a valve connecting the inlet and outlet so that, should the pressure become excessive, it will open the valve and relieve the pressure at the burners—some of the high-pressure gas passing back again to the blower and continuing to do so until the pressure on the outlet side is reduced and the valve thereby closed. The invention essentially consists in the particular way in which the bye-pass valve is arranged inside the relief valve.



Brown and Tilley's Gas Compressors.

The illustration shows sections (at right angles to each other) of the gas-compressing plant.

The relief valve A (of cylindrical form) is provided with a bead or ring B at some part of its length, below which is formed in the wall of the valve holes or slots C (graduated or not). Within the valve and above the holes is a seating D for a valve E, which is so positioned that it has a tendency to drop away from the seating, but is held to the relief valve, so as to prevent it entirely falling away from it, by a rod F passing through a bar G fitted inside the casing H and provided with a pin I, which lies on the valve A when the valve E is open.

The relief valve A (controlled by weights or springs) is provided at its base with a rod J, piston K, or cup leather positioned in a cylinder L, the bottom of which is provided with a chamber M connected with another chamber N outside the chamber P by a regulating valve Q—the chamber N being in connection with a supply-tank R provided with a shut-off valve S.

At ordinary pressure from the mains the relief valve A is on its seating, and the valve E inside the relief valve A is open. Gas then flows through it from the main T into the chamber U and past the valves A and E to the burners by the exit V of the chamber P, as shown by the arrows in full line. On starting the pump or blower (connected with the chamber openings W X), the gas in the chamber U is drawn through the exit W and forced into the entrance X of the chamber P (as the dotted arrows), and a pressure is created in the chamber P. This pressure acts upon, and closes, the valve E inside the relief valve A, stopping the flow of gas through these valves; and when the pressure becomes excessive, the relief valve A is lifted from its seating and some of the gas under excess of pressure passes through the slots C in the wall of the valve and passes to the inflowing gas in the chamber U, to be again acted upon by the pump or blower.

During this rise of the relief valve, the piston K (or the cup leather on it) has been lifted in the cylinder L and sucked air or other fluid or liquid through the pipe M from the chamber N into the cylinder L. But by reason of the regulating screw Q on the pipe only allowing a small quantity of liquid to pass, a drag has been put upon the valve A and piston K; and so the valve A is kept steady. When the pressure of gas at the burners has been sufficiently relieved, the valve A drops and steadily closes more or less, as the liquid in the bottom of the cylinder can only flow back into the vessel in a gradual manner, because of the regulation of the orifice of the pipe by the screw. When the pump or blower stops, the valve E, inside the relief valve A, will drop; and the gas then passes to the burners under normal pressure.

Revivifying Sulphuretted Oxide from Gas-Works.

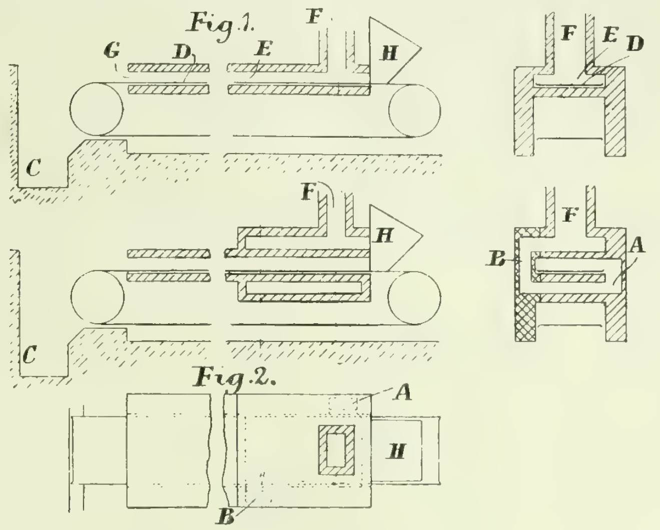
Wyld, W., of Leeds, and Green, H. E., of Yardley.

No. 22,514; Oct. 4, 1909.

This is a method to just sufficiently heat the oxide to cause ignition of the sulphur and to bring it into contact with a cooler atmosphere directly the sulphur has been consumed, as the patentees say they find then that the residual iron compound is capable of absorbing sulphuretted hydrogen and may be used for this purpose in the purification of coal gas and for other like purposes.

Fig. 1 is a section and end elevation of the most simple type of furnace for carrying out the invention. Fig. 2 is a modified form of furnace.

The inventors preferably use a travelling band or series of trays D (fig. 1) passing through a heated flue or chamber E, connected in the ordinary way with a Glover tower or its equivalent by the flue or stack F. On this band the spent oxide is evenly distributed (from a hopper H) to a suitable depth by mechanical means; the speed of the band being regulated so as to concentrate as much of the heat as possible to one small zone of the furnace—near the flue F—air being induced in the opposite direction to that of the movement of the band so as to facilitate the control of the heat. The oxide passes forward and discharges from the band into the chamber C, separated from the main flue E by any desirable means.



Wyld and Green's Oxide Revivifier.

To more easily confine the heat to one constant zone of the furnace, the flue E, before entering F, is conducted for a suitable distance under and/or over the band D by side flues A B (figs. 3, 4, and 5).

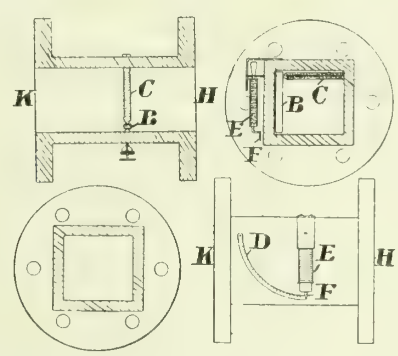
By this method there is obtained a residual iron compound leaving the furnace at G, "which is capable of absorbing sulphuretted hydrogen, and is suitable for the before-mentioned purposes."

Gas-Meter.

Tiddeman, P. J. S., of Stoke-on-Trent.

No. 23,376; Oct. 13, 1909.

This invention relates to an improved device for indicating the amount of gas or steam flowing along a pipe (say) from H to K in the illustration.



Tiddeman's Indicator of Gas Passing Through Mains.

As shown, the body of the meter consists of a piece of pipe, made of some non-magnetic metal, for insertion into the pipe-line. In it is a hanging gate B, hung from a bearing comprising the point of a screw C and a projection on the side of the pipe. This gate is not necessarily of the same size as the section of the inside of the pipe, and is shown as a strip of soft iron. In any case, the gate will contain a piece of soft iron so that it is magnetically inductive. The gas or steam flowing along the pipe causes the gate to swing over a quadrant corresponding to the scale D; and the position will be proportional to the amount passing. On the outside of the pipe is a balanced swinging electro-magnet E, hung in such a way that it and the iron of the gate move in parallel lines; and in consequence of the magnetic attraction between the electro-magnet and the iron on the gate, the electro magnet always sets itself to indicate the position of the gate. The pointer F indicates how much gas is passing; but the electro-magnet can also be caused to work a pen, which, drawing a line on a revolving drum, will give a permanent record of the amount passing.

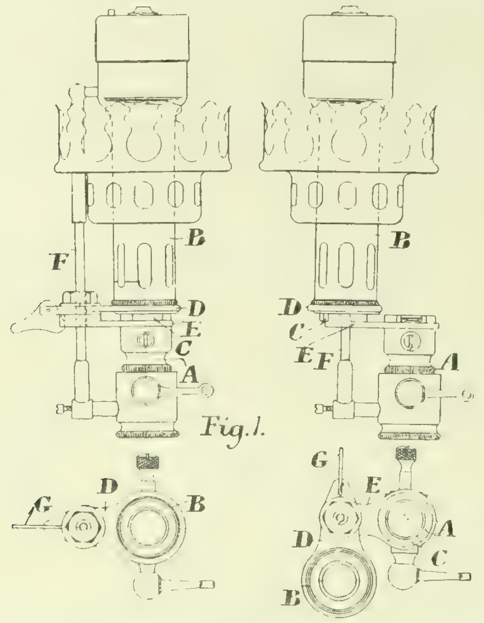
Incandescent Gas-Burners.

Cooke, J. J., of Peckham, S.E.

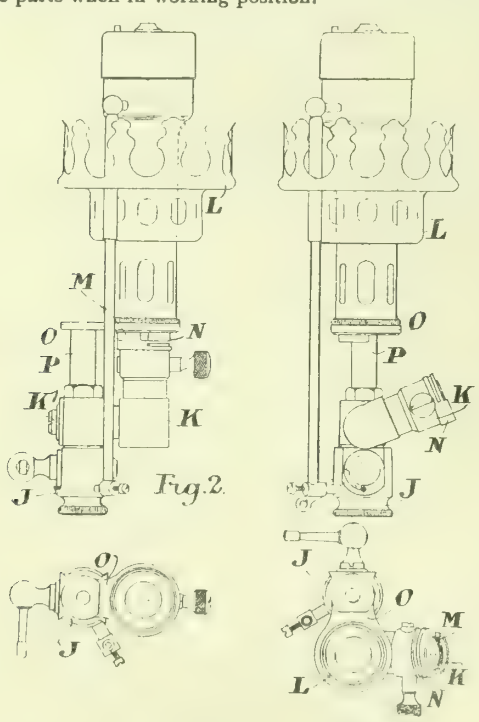
No. 23,633; Oct. 15, 1909.

This invention relates to incandescent gas-burners constructed in such a way that the gas-nozzle, the mixing-tube, and the parts usually carried thereby, may be moved out of line, so that the nozzle and interior of the burner-tube are accessible for inspection and cleaning. This may be effected either by turning the burner-tube on a vertical axis into a position parallel with the vertical axis of the nozzle, or by

rocking the nozzle on a horizontal axis from a vertical position into a position inclined with regard to the burner-tube, which remains vertical.



In fig. 1, A is the stationary part of the fitting containing the gas-nozzle, and B is the movable part comprising the bunsen tube. D and E are a pair of plates—the former fixed to the part B, the latter to the part A. These plates have threaded through their ends the bye-pass tube F, which receives lateral support from the plate E and forms a pivot pin for the plate D and the parts supported thereby. The tube F is completed by a sleeve carried by the upper part of the burner and capable of turning on the tube. It will thus be seen that the plates and the burner carried thereby can be swung round as shown. C is a stop which enables the parts to be properly centred, and G is a catch to hold the parts when in working position.



Cooke's Incandescent Gas-Burners.

In fig. 2, the upper part L of the burner is supported by a bracket O carried by a standard P fitted to the gas-supply fitting J. K is a movable part containing the gas-nozzle. It is fitted to rock on a centre projecting from the standard P, which is hollow and forms a pipe for the passage of the gas to the nozzle. M is a stop on the part O; and N is a ring on the part K for securing the parts together when in position. It will be seen that the part K can be tipped out of line with the rest of the burner, so as to expose the nozzle as in the other arrangement. Access is thus provided to the nozzle and the interior of the burner without dismounting the mantle or removing the chimney.

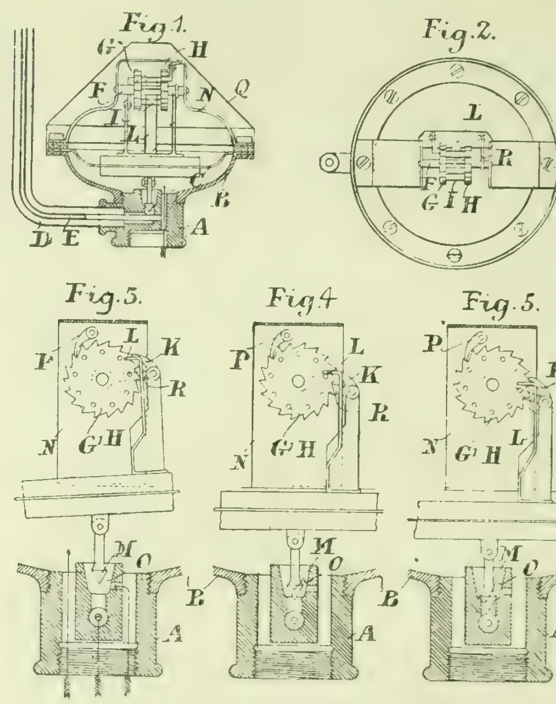
Operating Gas-Valves from a Distance.

Schnorrenberg, L., of Cologne.

No. 26,217; Nov. 12, 1909.

This gas-igniter, operated from a distance by pressure impulses, is provided with a diaphragm, which carries, on the one hand, a conical valve disc and, on the other hand, is provided with ratchet mechanism which, when the pressure wave diminishes, holds the diaphragm with the valve disc in the open position. Gas-igniters of this type are more or less alike, says the patentee—the principal difference between them consisting almost solely in the form of the ratchet mechanism of the valve. "All suffer from the drawback, however, that the arrangement of the individual parts is too complicated, and the friction between the same is so great that, in general, they cannot be used satisfactorily in practice."

Fig. 1 is a vertical section through the gas-igniter arranged according to the present invention. Fig. 2, a top plan view, partly in section. Figs. 3, 4, and 5 show the ratchet mechanism and the valves on an enlarged scale in various positions.



Schnorrenberg's Gas-Lamp Igniter.

A is the socket through which gas flows into the casing B, under the diaphragm C, into the burner pipe D, and through the small tube E to the igniting flame. F is an angle journaled in the holder N, on which axle ratchet-wheels G H are mounted. Both wheels have an equal and even number of teeth; and for the arrangement of evening and night lamps must be also divisible by three. The wheels are connected with one another by rods, the number of which is equal to half the number of teeth of one wheel. The pawl K is pivotally attached to a member carried by the diaphragm C, and rises with the diaphragm when a pressure impulse occurs in the piping—thus feeding the ratchet-wheel G one tooth. In order that the pivots of the ratchet-wheel and detent always remain at the same distance from one another when the diaphragm rises and falls, the pivot of the pawl is revolubly connected with the axle F by an arm or link R. L is a hook or catch (likewise mounted on the diaphragm) arranged between the wheels G H, and adapted to rise freely simultaneously with the pawl K when a pressure impulse occurs in the piping. The operative part of the hook is arranged transversely of the rods or pins I; and after the impulse has ceased, the hook is either suspended on one of the small rods I under it—thereby preventing the diaphragm falling, and securing that the valve M located under it is kept open—or, in the event of the small rod being lacking, the diaphragm falls further, whereby the valve M closes. As the diaphragm is placed slantwise during a pressure impulse, the valve M is suspended to swing from the diaphragm, and projects, in addition, into a funnel-shaped casing or box O, so that it is guided with certainty on to its seat in the casing. P is a detent engaging in the ratchet-wheel G and preventing the pawl and ratchet mechanism moving backwards when the pressure impulse ceases. Q is a hood for protecting the ratchet mechanism.

If the pawl K has arrived at its highest position (owing to an impulse in the piping), and the ratchet mechanism is consequently in the position shown in fig. 3, after the impulse has ceased the diaphragm C, with the pawl, hook L, and the valve M, suspended freely under the latter, will fall back, but only so far until the hook remains suspended on the first rod I located under it. The dimensions of the individual parts are so selected that in this position the valve M remains open, as in fig. 4; and the lamps can burn. When another pressure impulse occurs in the piping, the ratchet mechanism will be fed forward one tooth by the pawl K. On the impulse ceasing, and the diaphragm E, together with the pawl K and hook L, falling back (since a rod I is lacking, on which the hook could be caught), the diaphragm will descend further, and the valve M, suspended freely under the latter, will return to its seat, as in fig. 5. When the subsequent impulse occurs, the valve will be opened again, as described, and so on; so that whenever an impulse occurs the valve is alternately opened and closed.

Incandescent Gas-Light.

Süssmann, H., of Berlin.

No. 29,650; Dec. 17, 1909.

This is a "patent of addition" to patent No. 27,869 of 1909, in which an upright burner for incandescent light has between the burner-tube and the nozzle-tube an insulating sleeve, while the chimney gallery is in direct metallic connection with the inset-tube carrying the burner-head. According to the present invention, the metallic connection of the chimney gallery with the inset-tube is avoided by arranging a bad conductor of heat between the inset-tube and the chimney gallery, or by fitting the latter on the nozzle-pipe. By the new arrangement, the effect of the burner is said to be improved

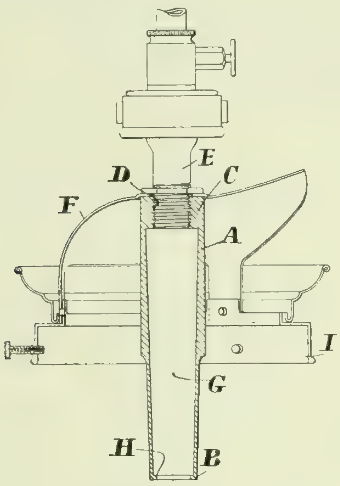
"inasmuch as the heat which is conducted downwards through the burner-tube from the flame is prevented from passing to the chimney gallery, and thus being lost by radiation." Trials are said to have shown that with the new arrangement the gallery remains cold, "which is a sign that the heat cannot be lost by radiation. Therefore, the quantity of heat which is transferred to the chimney gallery by radiation from the flame and conduction from the chimney is entirely used up for the preliminary warming of the secondary air."

Inverted Incandescent Gas-Lamps.

Bland, C. W., of Little Trinity Lane, E.C.

No. 5151; March 1, 1910.

This invention relates to an uncurved mixing tube and burner for an inverted incandescent gas-lamp constructed of one piece of some material that "will not scale or otherwise become deteriorated due to the great heat to which burners and their mixing-chambers are subjected or to moistures of atmosphere after cooling, whereby the mantle is not injured by falling particles of the mixing-tube."



Bland's Inverted Gas-Burner.

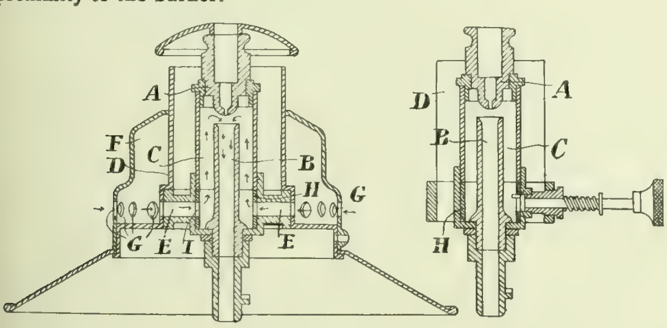
As shown, the mixing-chamber A and the burner B are made of steatite, fire-clay, or other fire-proof earthy material; the upper portion C being provided with a screw-thread D for attachment to the mixing-chamber E, which is here situate above and outside the heat-shield or dome F. The inside part G of the mixing-tube is tapered, with its narrow end next the burner B, which is provided with an internal flange H; while the outside portion is made of two diameters—the end of the larger part carrying the screw-thread D, the other or smaller end forming the burner. The patentee prefers that the mantle be supported from a separate ring or frame (not shown) held to the lamp-ring I.

Inverted Incandescent Gas-Lamps.

Wolf, O., Bambury, N. F., and Bernardy, E., of Bradford.

No. 526; Jan 8, 1910.

The object of this invention is to provide an arrangement whereby the air, before it reaches the mixing-tube of the burner, is heated to such a degree as to ensure its specific weight being as near as possible that of the inflowing gas. This object is attained by making provision for subjecting the air to a preliminary process of superheating on its way to the air inlets and superheating chamber by means of an enclosed chamber arranged around the lower part of the chimney and in close proximity to the burner.



Wolf, Bambury, and Bernardy's Regulated Inverted Burner.

A is the gas-nipple, B the mixing-tube, C the superheating chamber, and D the chimney. The superheating chamber (carried by the nipple) is provided at its lower end with an annular bracket, whereby the chimney and shade are supported.

The air passes through passages E, arranged radially across the lower part of the chimney, into the superheating chamber C; while the products of combustion from the burner, as they rise through the chimney, play round the air-passages and superheating chamber, so as to superheat the air on its way to the mixing-tube B, where it meets the gas entering through the nipple. The mixture then passes down the mixing-tube to the burner mouth as shown by the arrows.

By arranging the air-passages in close proximity to the burner mouth, they are subjected to the fullest amount of heat rising from the latter; the air passing into the superheating chamber being distributed evenly all round the mixing-tube, and thus obviating the bad effects of one-sided currents noticeable in bunsens where the air inlets are arranged about on a level with the end of the gas-nipple.

Provision is made in the lamp of means which will ensure the air being heated to such a degree that its specific weight will be as near as possible the same as that of the inflowing gas. These means consist of an enclosed chamber F arranged exteriorly around the lower part of the chimney, and in close proximity to the burner mouth. The entrance of air into this enclosed chamber is provided for by means of a series of perforations G, and the air passes out of the chamber through the passages E. The enclosed chamber is heated from the lower portion of the lamp by the heat which rises from the globe, and also from the chimney; and as the air passes through this chamber, it receives a preliminary heating, so that it does not enter the passages E in a cold state—thus greatly assisting a better burning of the mixture of gas and air.

The means employed for regulating the admission of air to the superheating chamber comprises a cylindrical slide H arranged below, and as a continuation of, the chamber C. The slide is perforated at I and actuated by means of a spindle carrying an eccentric pin at its inner end, which engages a vertical slot in the slide, so that as the spindle is rotated an oscillatory movement is imparted to the slide, which, in moving over the inner ends of the air passages E, opens and closes communication between the passages and the superheating chamber C.

Indicating the Escape of Gas from Pipes or Conduits.

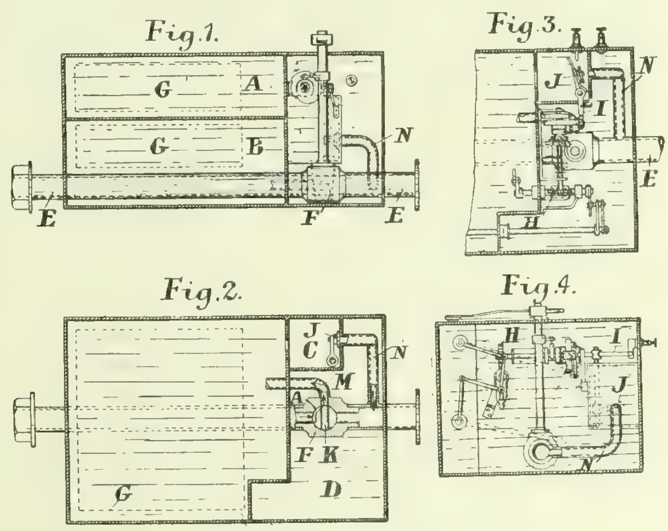
Fischer, P. G., of Stuttgart, Germany.

No. 12,515; May 23, 1910.

This apparatus "renders unnecessary the closing of the main cock of a gas-pipe or conduit, and yet prevents any escape of gas which would be dangerous to life."

This result is attained in two ways by one and the same means—viz., a rotary lever or a rack acted upon by a disc or a wheel rotated by gas-meter mechanism or some gas-current motion-device in such a manner that in the first place an audible or a visual signal is given and, after the passage of a predetermined quantity of gas through the pipe containing the motion-device, a valve is closed in the pipe, which previously permitted an uninterrupted flow of the gas.

During the regular consumption of the gas, the apparatus is switched-out. For this reason, it is arranged in a bye-pass to the main gas-pipe—a bye-pass closed during the regular consumption of gas, when the gas flows directly through the main pipe. After the normal or regular consumption has ended, the main pipe is closed or the flow of gas interrupted, but is completed again through the bye-pass, into which the safety and signalling apparatus is built, in such a manner that gas can flow in the pipe, until the bye-pass has also been interrupted by the apparatus by the closing of a valve.



Fischer's Gas Escape Indicator.

Figs. 1 and 2 are a side elevation and plan of the parts whereby the apparatus is connected to the gas-pipe. Fig. 3 is a plan of the parts whereby the signalling and automatic closure of the pipe are effected. Fig. 4 is an end elevation of fig. 3.

The apparatus is enclosed in a casing divided into a number of chambers, of which two, A and B, contain a "motion-device" driven by the current of gas. A chamber C serves as a gas-collector; and in the fourth, D, is mounted the mechanism for operating the signal and for closing the shut-off valve.

To the casing is connected a pipe E, which is preferably built-into it; and in it is inserted a valve or cock F, whereby, according to its position, the gas is either conducted directly through the pipe E or through the motion-device G. This device may consist, for example, of that used in gas-meters, and comprising two bellowslike bodies which are alternately traversed by the gas, so that the current flows uninterruptedly through the bye-pass. The motion produced by the alternate inflation and collapse of the diaphragms controlled by two slide-valves (not shown) is transmitted by levers to the actuating gear, and is converted into rotary motion by two levers and links and an adjustable crank. On the crank-shaft is mounted a worm, which engages in a worm-wheel H. On to the shaft of the worm-wheel is slid a cam-disc, which is free to turn relatively to the shaft, but cannot be moved axially. This cam-disc is acted on by a spring fixed in such a manner that it is tensioned in the turning of the disc as soon as the latter is coupled to the shaft, and after disengagement of the coupling, the disc turns back to its original position. The disc acts on a lever I which makes electrical connection with the terminal and, after the lapse of

some time, closes the shut-off valve J. In order to effect these two operations, the cam-disc has two notches of different depths, into which falls a pin that can be provided with a roller and is fixed to the lever I, which is made in the form of a double lever.

The turning of the cock F, with passages K L, takes place by means of a rod provided with an external handle or pointer, and with a slotted arm, to which is connected a fork for throwing the movable coupling-sleeve into and out of engagement.

The bye-pass through the pressure-gas motion device is formed by the pipe M, which is connected to the cock-casing F and terminates in the slide-valve-casing of the motion-device (fig. 2) and by the pipe N, which opens into the main pipe above the cock and is connected at the other side to the gas-collecting chamber C. The opening of this pipe into the collecting chamber is closed by the valve J, which is mounted on one shaft with the contact-lever I. In this manner the pressure of the gas acts to keep the valve tight when closed, and effects a complete closure of the pipe.

The method of operation is as follows: As soon as the normal consumption of gas is ended (the main cock being open), the cock F is turned, and by this means the apparatus is switched into the gas-passage. If there is no flow of gas, the apparatus remains at rest. If, however, a flow takes place—for example, through a fault in the piping or a cock being left open—the motion-device G comes into operation and turns the worm fixed on the shaft, and rotates the disc, since, by turning the cock F, the coupling has been simultaneously moved into engagement by means of the arm and actuating fork.

So long as the valve J is open, gas flows out of E through L, pipe M, motion-device G, collecting chamber C, valve J, and pipe N, back to the pipe E. When, however, the pin falls into the first notch, the shaft of the double lever I turns, and its contact spring touches the terminal, and closes the circuit of the signal. Being thus brought to notice, the damage can be repaired; otherwise the device turns further until the pin falls into the second deeper notch of the disc, and by this means the valve J is pressed on to its seat, against which it is held fluid-tight by the gas-pressure. The passage is thus shut off and the flow of gas interrupted.

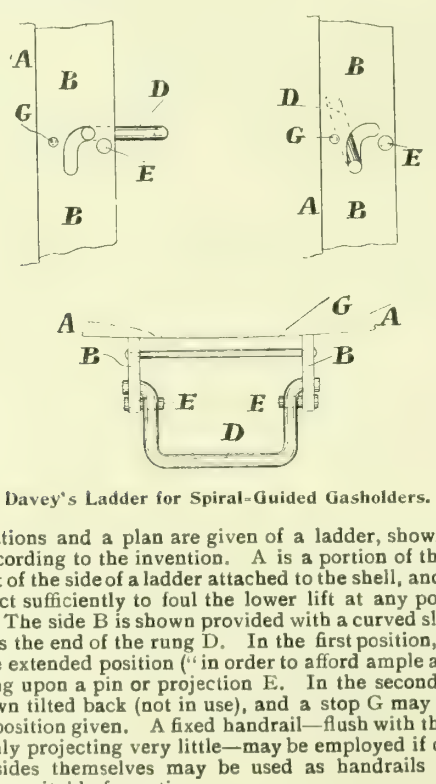
If the device is to be brought back into its original position, the cock F is turned by turning the rod so that the passage K makes direct connection in the pipe E. At the same time the coupling is thrown out of engagement by the arm; and the disc, under the action of the spring, is turned back into its original position relatively to the lever I. The cycle of operations can begin again after the rod has been turned and the device again switched in.

Ladders for Spiral-Guided Gasholders.

DAVEY, A. E., of Aberdare.

No. 3177; Feb. 7, 1910.

This invention relates to ladders, more especially for use with spiral-guided gasholders where the spaces between the telescopic lifts are limited, and the ladders have ordinarily to be fixed in close proximity to the surface of the shells.



Davey's Ladder for Spiral-Guided Gasholders.

Side elevations and a plan are given of a ladder, showing one step arranged according to the invention. A is a portion of the gasholder, and B is part of the side of a ladder attached to the shell, and which sides do not project sufficiently to foul the lower lift at any position (when one exists). The side B is shown provided with a curved slot, engaging with which is the end of the rung D. In the first position, the rung is shown in the extended position ("in order to afford ample and safe foothold") resting upon a pin or projection E. In the second sketch, the rung is shown tilted back (not in use), and a stop G may be provided for it in the position given. A fixed handrail—flush with the side of the ladder, or only projecting very little—may be employed if desired; but the ladder sides themselves may be used as handrails by being of beaded or like suitable formation.

New Joint-Stock Companies.—There were registered in Edinburgh last week the St. Andrew's Gas Company, with a capital of £16,960, in £10 shares; and the Tillicoultry Gas Company (a private concern), with a capital of £6900, in £5 shares.

The Lighting of Calcutta.—Mansfield's improved inverted incandescent gas-burner (which was described and illustrated in the "JOURNAL" for the 18th ult., p. 195) has, we learn, been considered by the Corporation of Calcutta; and Messrs. Mansfield and Sons, Limited, have received an order for 9000 as a first instalment towards the lighting of the city.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Special Courses of Lectures at Leeds University.

SIR,—May I venture, through your columns, to draw attention to the future arrangements for special lectures on the manufacture, distribution, and uses of coal gas, and on bye-product coking processes, in connection with the work of the Department of Fuel and Gas Engineering in the University of Leeds.

During the two past years, as your readers are doubtless well aware, courses have been given on (1) "The Manufacture of Coal Gas," by Dr. Harold G. Colman, and (2) "Bye-Product Coking Processes," by Mr. Ernest Bury, M.Sc. Both courses were attended by some thirty students drawn from a very considerable area of the North of England. Under the new arrangements now contemplated, the scope of these special courses will be considerably extended, and will now include a two years' systematic course in the manufacture, distribution, and uses of coal gas. The course of twenty lectures on the "Manufacture of Coal Gas," which was given by Dr. Colman during the first term (January to March) of this year, will be repeated in 1912, 1914, &c.; and, alternating with Dr. Colman's course (viz., in the years 1911, 1913, &c.), there will be a new course on "The Distribution and Uses of Coal Gas."

From the preliminary announcement which appears in your advertisement columns, it will be seen that the new course of twenty-two lectures, to be given on Wednesdays at 6 p.m. and on Thursdays at 9 a.m. during eleven consecutive weeks commencing Jan. 11 and ending March 24, 1911, will include four sections—viz. (1) Eight lectures, on the "Distribution of Coal Gas," by Mr. Walter Hole, of Leeds; (2) four lectures, on "Gaseous Combustion and the Structure of Flames," by Professor Smithells and myself; (3) six lectures, on "The Uses of Coal Gas for Heating Purposes," by Mr. John Bond, of Southport; and (4) four lectures, on "Gas Lighting and Photometry," by Mr. Jacques Abady, of London. It is hoped the important subjects comprised in this course, as well as the distinguished outside lecturers who have so kindly consented to help the University in this movement, will attract a large audience from among the young gas engineers in the North of England.

In addition to the above lectures, Mr. Bury will again give his course of eight lectures, on "Bye-Product Coking Processes," on Saturdays at 3.30 p.m., commencing Jan. 21, 1911. Mr. Bury's name is already well known to your readers as an acknowledged authority in all matters relating to coke-oven practice; and his recent association with the scheme for supplying Little Hulton with coke-oven gas for lighting purposes (which was largely due to his foresight and initiative) is a sufficient guarantee that he will treat this important branch of carbonization in a way which cannot fail to interest and stimulate gas engineers. He will in particular deal with the latest developments in regard to direct ammonia recovery methods. So far as future years are concerned, Mr. Bury's course will be repeated in 1913 and 1915, &c.; and, alternately with this, we hope to arrange, for 1912, 1914, &c., a special Saturday afternoon course on "Refractory Materials."

The ultimate success of the above arrangements, and the ability of the University to extend or supplement them by other courses, will very largely depend on the response which will be forthcoming from the industries concerned during the next year or two. The special outside lecturers whose services have been secured in connection with this scheme will be put to considerable personal inconvenience and sacrifice of time in order to fulfil their engagements; and I therefore earnestly appeal to young gas engineers throughout the North of England to make the fullest use of the opportunities which are now open to them. May I also venture to extend this appeal to those responsible for the management of gas undertakings, that they will support the efforts of the University by liberating such of the junior members of their staffs as may desire to attend these courses.

WILLIAM A. BONE,
Livesey Professor and Head of the Department
of Fuel and Gas Engineering.

Leeds University, Nov. 5, 1910.

The Midland Association Carbonization Discussion.

SIR,—I notice that a leading article in the current issue of the "JOURNAL" contains the following: "And the fact that at Guildford it has not been adopted in the new retort-house, has not been in its favour."

It is only fair to state that the fact that we have put horizontal retorts in our new retort-house here bears no more significance with reference to Mr. Love's principle than the adoption of horizontal retorts would in any other works of a similar size. When I came to Guildford, there was only one setting of Love's 45's, and that an experimental one in a bad state of repair. It was not even in use, and was never lighted up afterwards. I had, therefore, had no experience of them; so the mere fact that I recommended horizontals should not carry any special weight.

I was rather afraid that the adoption of horizontals at Guildford might adversely affect the consideration of Love's 45's elsewhere; and I am glad to take advantage of this opportunity of stating the facts.

P. C. CLEASBY.

Guildford, Nov. 2, 1910.

[It is a pleasure to have Mr. Cleasby's letter, and to give it publicity. The first two lines of his last paragraph: "I was rather afraid that the adoption of horizontals at Guildford might adversely affect the consideration of Love's 45's elsewhere," precisely explains what was in mind when, last week, in the comment on the carbonizing discussion at the Midland Association meeting, we wrote: "The fact that at Guildford it [the system] has not been adopted in the new retort-house, has

not been in its favour." Had we expressed ourselves in the converse form: "If the system had been adopted in the new retort-house at Guildford, it would have been greatly in its favour," the meaning intended to be conveyed by our words would have been the same. It is quite natural that, when a new engineer of a works is appointed, and new plant is required, he should follow lines upon which he has, through personal experience, every reliance; and this, of course, is fully recognized, and not necessarily to the detriment of systems that he has not adopted. Considering our remark from all points of view, we cannot admit that the statement is in any way misleading. We believe that there are other settings of Love's 45's at work; and, it is understood, doing well. It will be interesting to have the working particulars as soon as publication is permissible.—Ed. J.G.L.]

Mantle Renewals in High-Pressure Inverted Lamps.

Sir,—As many of your readers have probably seen the article, on "High-Pressure Maintenance," recently published in the "Electrical Times," in which the writer endeavours to prove that the cost of mantle renewals makes this method of street lighting prohibitive from a commercial point of view, I think our experience in this matter at the "White City" may be both interesting and instructive.

In the Japan-British Exhibition which has just closed, we had 355 Keith 1500-candle power lamps. Of these, 309 were in the grounds, and therefore exposed to the weather in just the same way as ordinary street-lamps. The number of new mantles required for these 309 outside lamps during the six-months' run of the Exhibition was:

In 39 of the lamps	None.
,, 92 ,, ,,	1
,, 85 ,, ,,	2
,, 80 ,, ,,	3
,, 13 ,, ,,	An average of 6.

There were altogether 580 mantles used, or an average of 1·87 per lamp; and I may say that no mantle was allowed to remain on after it showed the least sign of deterioration.

The average would have been lower if all the lamps were of the latest pattern; but some of them are three years old.

Speaking generally, the record at the Exhibition confirms our experience of the low cost of mantle renewals necessary for high-pressure lamps, and certainly goes far to defeat the attempt made in the Electrical Press to depreciate their value in this respect.

E. R. H. Wingfield, Chief Inspector.

Brentford Gas Company, Nov. 2, 1910.

Vertical-Retort Working.

Sir,—In the discussion on the President's Address at the recent meeting of the Manchester District Institution of Gas Engineers, the President (Mr. H. Kendrick) and Mr. T. Duxbury are both reported to have expressed doubt as to the economical advantages of vertical retorts. Also, at the recent meeting of the Midland Association of Gas Managers, Dr. Davidson is reported to have said that he "believed it was pretty well admitted now that vertical retorts were not very strong on the illuminating power basis;" and Mr. Harrison asked the question whether it was possible to instal vertical retorts economically on a works making under 100 million cubic feet per annum.

Will you allow me to say in reply that, even assuming the cost of working horizontals by machinery to be rather less than 7d. per ton of coal carbonized, when the plant is in full operation, it can be shown that, with the latest Dessau settings, a saving is effected equal to fully 15 per cent. per annum upon the extra capital cost, in working expenses alone. There are also to be placed to the credit of the system the further very substantial saving by the increased yield of gas, tar, and ammonia, greatly improved quality both of tar and coke, and freedom not only from naphthalene, but also from excess of sulphur compounds —to say nothing of the absolute simplicity in working, and entire independence of machinery.

On the question of cost of wear and tear, Herr Prenger, the Engineer of the Cologne Gas-Works, finds, after four years' experience, that the cost for repairs of Dessau verticals is less than one-third that of horizontals. Quite recently he, for the first time, repaired the lower parts of some of his settings, which had been in operation for over a thousand days; and he estimates that these will now last for a further eleven to twelve hundred days before renewal of the upper parts becomes necessary. The experience of other engineers confirms that of Herr Prenger, and leaves no room for doubt as to the great superiority in this respect of Dessau verticals. It may be further pointed out that the discussion between Mr. Harris (the author of the paper) and Dr. Geipert, published in the "Journal" early in the year, conclusively proves that no apprehension need be felt as to the behaviour of Dessau verticals when worked intermittently, inasmuch as settings have been repeatedly let down and relighted without the slightest injury to the brickwork or the retorts.

With regard to the alleged reduction of illuminating power, Dr. Davidson may be referred to the comparative table which forms part of Mr. Harris's paper, and which was reproduced in the "Journal" for March 8, 1910, p. 662. It will be seen from this that the Sunderland tests, so far from showing any falling off in illuminating power, actually head the list for quality of gas, although the coal used for these tests was unscreened ordinary Durham.

May I, in conclusion, inform Mr. Harrison that the Dessau system of vertical retorts is adaptable to a works of the size he names—viz., 100 million cubic feet per annum.

C. Holmes Hunt.

17, Victoria Street, S.W., Nov. 5, 1910.

The Finance Committee of the Leeds Corporation have passed a resolution approving of a quarterly collection of the gas accounts, and recommending the Water Committee to agree to the substitution of a quarterly collection of the water accounts for the half-yearly collection at present in operation.

LEGAL INTELLIGENCE.

REINSTATEMENT OF ROADS AFTER MAIN-LAYING.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, Nov. 3.

(*Before Mr. Justice* Darling *and a Special Jury.*)

King v. Barnet Gas and Water Company and Aird and Sons.

This was an action to recover damages for injury sustained by the plaintiff, occasioned by the alleged negligence of the defendants. It appeared that in January last the defendant Company were carrying out certain works in connection with the water-mains which run along Lyonsdown Road into the Station Road, and in so doing it was said they negligently filled in a trench in which the mains were laid where they crossed the Somerset Road West, so as to leave a ridge or mound some 4 to 6 inches above the level of the road, which was an obstruction to members of the public lawfully using the highway. The plaintiff's case was that she tripped over this ridge, and so occasioned the injury complained of. The defendants both denied that there was any negligence on their part; and the Gas Company further pleaded that if there had been any, Messrs. Aird were responsible for it.

Mr. Drucquer and Mr. Cartwright Sharp appeared for the plaintiff; Mr. Rawlinson, K.C., and Mr. Scarlett represented Messrs. Aird; and Mr. J. D. Crawford, the Gas Company.

Mr. Drucquer, in opening the case, submitted that the accident was entirely due to the manner in which the trench was filled up. He said that if the work had been properly and carefully done, the contractors should have left a ridge of about 3 inches, properly rammed down, and have taken care day by day to see that it had not been disturbed by passing traffic. If a person fell over a ridge only 3 inches high, he would have no cause of complaint, as the work would have been done in a workmanlike manner. But in this case, the ridge varied from 4 to 6 inches. The defendants said the plaintiff was guilty of negligence in not having noticed the condition of the road; but, as the evidence would prove that the road was badly lighted, he did not think she could be accused of negligence.

His Lordship said he did not understand why the Gas Company should have been joined as defendants, seeing that the persons responsible, if there was any responsibility, were Messrs. Aird.

Mr. Drucquer said they had joined the Gas Company as defendants because they were not aware of the exact position of the two parties.

Mrs. *J. A. King*, the plaintiff, was called, and stated that prior to the 17th of January she had seen the men opening the road, but had no particular reason to notice what they were doing.

In cross-examination, witness said she remembered the road being broken up on the 1st of January and finished on the 12th. She had occasion to go in and out every day, but not to cross the road before the day of the accident.

Dr. *A. Peringall*, who attended the plaintiff, described the nature of the injuries, and said his fee amounted to 14 guineas. His attention had been drawn to the condition of the road by being jolted when passing over it in his trap. He looked at the mound, and thought it was very rough; there being many loose stones on the top.

Mr. *W. T. Strather*, Surveyor, of Chingford, said he had had eighteen years' experience in the maintenance and management of roads. When a trench was reinstated, the highest camber that should be left was 3 inches, and the shape should be perfectly oval. The earth should be well rammed. Work was not properly carried out if there were loose stones left. It should be steam-rolled to prevent traffic displacing the top of the mound. If the height of the mound was from 4 to 6 inches, it was unsafe. He often had to complain of the way in which roads were made up. Granite and gravel should not be mixed. Granite was more binding than gravel, and would keep together very easily; whereas gravel depended upon the binding matter which filled up the interstices.

In cross-examination, witness said a good road could be made with gravel. It was his duty to look after excavations in the road; but he did not go about looking at trenches in other districts. Messrs. Aird and Sons were a good firm, and had had considerable experience in this class of work.

Re-examined: Big contractors required looking after as much as small ones. He had sometimes had to steam-roll Messrs. Aird's work, and charge the Gas Company with the cost of doing so. In this instance, the road should have been steam-rolled.

Mr. *King*, the husband of plaintiff, generally confirmed the evidence given by her.

Friday, Nov. 4.

On the resumption of the hearing this morning,

Mr. *King* said he examined the ridge, and found it was in a very rough condition. The level of the stones started at 2 inches and rose to 5 or 6 inches. The shape of the mound was anything but a nice, even curve. On the top were a lot of loose stones.

Several other witnesses were called to speak to the rough condition of the road; one being Mr. *Crompton*, the Chairman of the Highway Committee of the Barnet District Council, who said he brought the matter before the Council.

Mr. Crawford submitted that there was no case for him to answer. The Gas Company had statutory power to open the road; and there was no suggestion that the Contractors employed were not competent to do the work.

His Lordship said he would reserve the point until after the evidence had been given.

Mr. Crawford then addressed the Jury. He said it was no doubt a great inconvenience to people to have the streets disturbed. But life could not go on without gas and water; and Parliament had given the suppliers of these necessaries statutory powers to break up streets in

order that the pipes might be laid down. The defendant Company, having these statutory powers, employed competent contractors to do the work; and they reinstated the road in the best known manner. It was probable the accident was caused by the lady stumbling over a loose stone, and not by tripping over the ridge. Before the Company could be held liable, the Jury must be satisfied that they were responsible for leaving the road in a dangerous condition.

Mr. SCARLETT said his clients were a firm of the very highest standing, having had great experience in the particular kind of work in question. If the case had to be decided on sympathy instead of evidence, the verdict would, no doubt, be for the plaintiff; but it was for the Jury to say whether or not the work had been carried out in a negligent way. It was impossible to replace the road in its original state. All that could be done was to do the work in a reasonable and substantial manner. His evidence would show that in no place did the ridge exceed 3 inches in height. The work was done under the supervision of the Engineer of the defendant Company and the Surveyor of the District Council.

Mr. *Frank J. Martin*, Assistant-Engineer of the Company, said it was his duty to superintend the laying of mains, but not to inspect the work, though in passing to his home he looked at the trench, and saw nothing the matter with it. On the day of the accident he measured the ridge, and found it to be 2 inches high in one of the worst places he could see. It was only natural there should be several loose stones about, but not more than one would expect to find after a road had been relaid. The road was well lighted; there being a lamp of 80-candle power close to where the accident happened.

In cross-examination, witness admitted he had made a mistake in saying he measured the ridge on the day of the accident. It was not till the 20th, when the Council informed the Company that an accident had happened. The gravel should be put in first, and granite on the top. The District Council complained that Messrs. Aird had not done this, but had mixed the granite and gravel. He did not agree with the evidence already given that granite and gravel would not bind.

A labourer in the employ of the Company said he inspected the road after Messrs. Aird's men left, and found it in good condition. There was no ridge at all.

Mr. *Henry York*, Surveyor to the East Barnet Valley Urban District Council, said he saw the road daily after it was relaid, and found the trench had been properly made-up. It was not correct to say there was a ridge of from 4 to 6 inches. When first completed, it would not be more than 3 inches high at any part, and at the time of the accident not more than 2 inches. Had there been any obstruction, he should have reported it to the Company or to Messrs. Aird. It was impossible to keep the granite and gravel separate; and he requested the Contractors to take off the top surface and relay it with granite.

In cross-examination, witness said he had no recollection of Mr. Crompton making a complaint at the Council meeting. The road was not steam-rolled after it was relaid.

Mr. *F. E. Andrews*, Manager to Messrs. Aird, said he received notice of the accident at the end of January. He at once went to the spot, and found that it was well lighted. In the Metropolitan area, Messrs. Aird laid from 150 to 200 miles of pipe every year, and they had never had an accident similar to the present one.

Mr. *Charles Maunders*, Messrs. Aird's superintendent for pipe laying in the North of London, said the depth of the trench was about 3 ft. 2 in. The subsoil was clay, upon which was a thin coating of gravel and granite. The ground was well rammed when the trench was filled in. Special care was exercised; and the road was attended to daily after the work was done. The ridge was about 2 inches high in the centre.

George Jackson, foreman ganger in the employ of Messrs. Aird, said special care was taken in laying the main in question, having regard to the slope. After the pipe was down, the clay was put back and rammed with an iron rammer, then the gravel, and on the top the granite. A man was sent over the trench with a broom for several weeks after the work was completed. It would not be right to pass a steam-roller over the trench for fear of damaging the pipe. The ground should be allowed to consolidate.

Mr. *J. C. Radford*, Surveyor to the Wandsworth Borough Council, said the work had been done in a thoroughly proper manner. In his opinion, it would have been very unwise to allow a steam-roller to be passed over the road, considering the size of the pipe and the shallowness of the trench.

Mr. *P. J. Bright*, Manager to an estate agent at New Barnet, said he remembered the road being opened; and after it was reinstated he noticed nothing wrong with it, though he drove over it daily in a motor.

Dr. *Norton* thought the plaintiff's injury was quite consistent with her having slipped on a loose stone. Had she tripped over a ridge, she would have fallen forward and fractured her thigh, not her left ankle.

Counsel having addressed the Jury,

Justice DARLING summed up. He said in order that the plaintiff might recover, she must satisfy the Jury that one or both of the defendants were guilty of negligence in doing the work in question. The defendant Company had a right to open the road to perform a statutory duty; and if the Contractors employed properly made-up the road, they could not be held responsible for the accident.

The Jury, after deliberating in private for three-quarters of an hour, returned into Court and said there was no prospect of their agreeing. Under these circumstances, his Lordship discharged them.

POISONED BY CARBON MONOXIDE.

Claim against the Corporation of Rochdale.

At the Rochdale County Court on Friday, before his Honour Judge Bradbury, an action was heard in which compensation was sought from the Rochdale Corporation by the daughter of Thomas Harris, who lost his life by the inhalation of carbon monoxide gas while working in a culvert which the Corporation were constructing in Newgate, Rochdale. It was stated for the applicant that Harris and two other Corporation employees descended the culvert, and three-quarters-of-an-hour later were found "gassed." Harris died the same evening, and William Clegg succumbed on the following day. The third man, named Collins, was not yet able to resume work. The blood of Harris was analyzed; and it was found to contain a sufficient quantity of carbon monoxide to account for death. It was urged by Counsel for the Corporation that the injury did not arise out of the men's employment; and that it was due to something outside the scope of their employment. John C. Shaw, foreman in charge of the work at the culvert, said that when Harris came out of the culvert he "looked like a man who had been in a very bad fog." Witness at once examined the culvert, and found in it a yellow vapour. He believed there was a gas-engine in the vicinity which discharged gases into the culvert. After hearing the medical evidence, Judge Bradbury said the only point raised for the defence was that the accident did not arise out of the employment. He failed to see how such a defence could be established. Here was a case of a sound man going into a culvert and coming back practically dead. He ruled that the accident did arise out of the employment, and awarded the plaintiff £300 and costs.

AFFAIRS OF E. O. PRESTON.

In the "JOURNAL" for the 25th ult. (p. 275), it was stated that the previous Friday's "Gazette" contained an announcement that a receiving order had been made under the Bankruptcy Acts in the case of Edward Oxenford Preston, described as a financier carrying on business at Tokenhouse Buildings, E.C. The circumstances under which Mr. Preston's name has frequently been mentioned in the "JOURNAL" will be fresh in the recollection of readers.

The first meeting of creditors took place at the London Bankruptcy Court last Wednesday, when Mr. E. S. Grey, the Official Receiver, reported that the debtor had stated, when before the Examiner, that he had carried on business under the name of E. O. Preston and Co. for twenty-seven years, at Tokenhouse Buildings. Latterly he had been principally engaged in financing and floating water-works, gas, and other companies, and had undertaken contracts up to £50,000. He had carried through important ventures, and in the past had made large profits; but, owing to the unsettled state of affairs, it had become increasingly difficult to do this, and in many cases he had made considerable losses. He was now indirectly interested in a contract with the South Lincolnshire Water Company, of Spalding, to carry water to Sutton, a distance of 21 miles; also in a contract with the Bungay, Eye, and Halston Water Company, of Bungay, to bore for water. His unsecured liabilities amounted to about £27,000, and were principally in respect of money due to sub-contractors for materials supplied, for loans, and for guarantees. From time to time he invested about £26,500 in land and property at Cookham, where he resided, and had since mortgaged the properties. His other assets were debentures in water-works and gas companies, now held as security for loans, and debenture moneys payable under contracts. The most direct cause of his failure was loss arising from his loans of about £16,000 to various gas and water companies without security. He advanced the money to protect the interests of clients; and some of the companies had gone into liquidation. He had also been interested in the promotion of several electric theatres, and made substantial profits therefrom.

Mr. R. Barnes attended the meeting on behalf of the debtor, and, in the absence of any offer, Mr. Owen Walker, C.A., of St. Stephen's Chambers, Telegraph Street, was elected Trustee to administer the estate in bankruptcy, assisted by a Committee of Inspection.

A Deal in Incandescent Mantles.

At a sitting of the Salford County Court last Wednesday, before his Honour Judge Stanger, K.C., a case was heard in which the Perfect Mantle Company, Limited, of London, sought to recover from Harry Taylor, incandescent gas-mantle merchant, of Salford, a sum of £66 for goods supplied. There was a counter-claim for £17 10s., said to be loss of profit on a certain transaction, owing to the plaintiff Company having supplied him with mantles which proved to be unsatisfactory. When the case was called, the defendant Taylor admitted the liability for £66, and judgment was entered for the plaintiffs for this amount. Mr. Jessel Rycroft, who appeared for Taylor, said, with regard to the counter-claim, that the mantles supplied to the Corporation for street-lamps by his client were found to be unsatisfactory; and, as a consequence, the Corporation cancelled an order for 100 gross of mantles given to him. In the witness-box, Taylor said a Corporation official told him in the presence of a representative of the Perfect Mantle Company that the lights gave out less brilliancy after three days' use, and were unsatisfactory in other ways. He wrote the Company on the subject, and received a reply saying that the complaint had been forwarded to the works. Dr. Atkinson, for the Company, submitted there was no evidence that Taylor had obtained any orders from the Corporation except two for 25 gross. William Clarke, foreman in the Lighting Department of the Salford Corporation, said that last year they handed Taylor an order for 25 gross of mantles; but they did not give satisfaction. A second supply was sent, and these also proved to be unsatisfactory—being easily damaged by the vibration resulting from street traffic, and also by the weather. In October of last year, the department communicated with Taylor to the effect that he would receive no further orders from the Corporation. The Manager of the Perfect Mantle Company gave evidence showing that there was a distinct understanding between the Company and Taylor that if any of the mantles were not satisfactory, he was to return them. His Honour said there was no evidence that Taylor had received an order from the Corporation for 100 gross of mantles; and he gave judgment for the Company with costs.

Messrs. Falk, Stadelmann, and Co., Limited, have appointed Mr. G. Falk as Manager of their Glasgow branch, in succession to the late Mr. A. C. Taylor. Mr. Falk has been connected with the house for the past ten years, and so has an intimate knowledge, technical and administrative, of the various departments of the business.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the Association was held last Tuesday, at the Cannon Street Hotel, E.C.—Mr. J. Horsley Palmer in the chair.

The Secretary (Mr. R. W. Wilson) read the notice convening the meeting, and the following report of the Directors.

The Directors have pleasure in reporting on the results of the Association's operations during the half year ended June 30, 1910.

The profit of the half year was £269,149. This, together with the sum of £9698, brought forward from the account of the previous half year, makes a total of £278,847 available for appropriation, as compared with £271,044 for the corresponding half year of 1909. Inasmuch as the profit for the first half year of 1909 included the profit earned by the Frankfort Station in the first quarter of that year, before it became incorporated with the reconstituted Frankfort Gas Company, the results of the past half year were really better than these figures would indicate.

The total output of gas in the various towns supplied directly by the Association shows an increase for the half year at the rate of 4·46 per cent.; and the number of consumers, an increase at the rate of 9·89 per cent.

The total number of meters in use at the close of the half year under review was 508,845, of which 130,986 were prepayment meters. At the end of June, 1909, the total number of meters placed was 472,085, which included 115,838 prepayment meters.

The total length of mains laid up to June 30 last was 2296 miles; representing an increase of 67 miles since Dec. 31, 1909.

The gross cost of coal was 10½d. a ton less than in the corresponding half year of 1909; but this advantage was more than counterbalanced by the fall in the value of coke. The average value derived from tar was much the same as in the corresponding half year; but the returns obtained from ammoniacal liquor and its products showed some improvement. The net cost of coal increased by 1·94d. per ton.

The new retort-house at Aix-la-Chapelle, containing four benches of vertical retort settings, was completed, and put in action with satisfactory results.

At Berlin, the 5½ million cubic feet gasholder on the Schöneberg works was completed.

Progress was made with the erection of a new house for vertical retorts on the Holzmarktstrasse works, and with the enlargement of the apparatus house on the Mariendorf works.

At Brussels, satisfactory progress was made with the construction of the electricity station at Droogenbosch; and a contract was concluded for the exclusive supply of gas and electricity in the commune of Woluwe St. Etienne—a suburb lying north-east of Brussels—until the year 1948.

At Flushing, the new retort-benches were completed, and a contract was concluded with the suburban commune of Koudekerke, securing to the Association the monopoly of the supply of gas until 1960.

In view of the fact that the Association's contract with the Municipality of Vienna for the supply of gas to the suburbs on the west bank of the Danube expires on Dec. 31, 1911, when the business will be taken over by the Municipality, it was deemed desirable that an arrangement should be come to by which the Municipality should also take over, at the same time, by purchase, the gas supply of several smaller and less important suburbs on the eastern bank of the river, with which the Association also has contracts of varying duration. The Directors have the pleasure to report that this has been accomplished to the satisfaction of both parties.

The gas contract with Houplines, a suburb of Armentières, supplied by the Cie. Continentale du Gaz, was prolonged from 1920 to 1950.

In conclusion, the Directors desire to draw the attention of the proprietors to the accounts for the half year ended June 30 last, and to the balance-sheet. These have been duly audited; and from them the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association for the half year, and the portion thereof applicable to the purposes of dividend, which they recommend now to be declared—viz., a dividend of 4½ per cent. for the half year ended June 30, 1910, payable, less income-tax, on and after Tuesday, the 8th inst.

Scheme for Division of Profits of Half Year ended 30th June, 1910.

Balance brought forward from last half year	£9,698	1	10
Profit resulting from the workings at the stations, and dividends on investments, less interest on debenture stock, and the charges on account of depreciation and income-tax	269,149	12	2
	£278,847	14	0
Dividend of 4½ per cent. for the half year	£222,300	0	0
Credit to pension reserve	40,000	0	0
Balance carried forward to next half year	16,547	14	0
	£278,847	14	0

DIFFICULTY OF COMPARISON, BUT GOOD PROGRESS.

The Chairman moved—"That the report of the Directors upon the affairs of the Association, which has been read, be received and adopted, and entered upon the minutes." In doing so, he said: When I come to the November meeting to speak to you upon the affairs of the Association, I generally find myself in a somewhat difficult position, because a six-monthly interval since the last meeting is in no way adequate for a proper survey and comparison of our working; and to-day it has been rendered somewhat more difficult because of the changes that have necessarily been brought about in the Association's returns and statistics by the separation of the Frankfort branch (to which I fully alluded in my speech in May last), and also by the new system we have adopted of taking up meters. These changes entirely preclude any direct comparison of one year with the other; and not only with regard to the details of revenue received, and the amount of gas sold, but also in respect of the profit shown by the balance-sheet covering the period under review. You probably have noticed in one of the first paragraphs of the report that the Directors say: "The results of the half year were really better than these figures would indicate." I should like to give you an example of what these words mean. The accounts of the Frankfort Gas Company (in which you know we are now largely interested) are made up annually from April 1 to March 31, and they are only submitted once a year; and, for the past year, they were submitted to the proprietors in August, when a dividend of 10 per cent. was declared. The result on the Association's finances is that neither during the second half of 1909, nor during the half year which we are now considering, did we receive any interest on our investment in the Frankfort Gas Company. Therefore, the whole of that dividend (which represents a sum of £37,000) will have to be included in the current half-year's accounts. Now, although I have said that exact comparisons are most difficult, still we are able to report to you the splendid progress this old Company continues to make. We can point to a very large addition to the number of meters fixed, to the many miles of additional mains laid, and also to the considerable addition to the total volume of gas sent out. So that you see progress is being made steadily in almost every direction. We have an increase of nearly 20,000 meters placed in the half year, and the past half year was not what can be called a favourable one for gas, because the winter months were abnormally mild. Still it shows that our people and staff have plenty of energy for pushing our business; and it also indicates that the public appreciate the value of gas both for lighting and heating. Of course, when we speak of this large increase in consumption in the warm winter months, we have to look on the opposite side of the question; the warm winter months having a distinctly prejudicial effect on the sale of our principal bye-product—coke. Prices fell; stocks increased. And the result was that the value of coke diminished largely. But as the report states, owing to our purchasing coal judiciously, the extra cost was only about 2d. per ton more than in the first half of 1909. I am glad to say that, since the close of the half year, a demand for coke has set in at some of our stations; and we are selling the stocks at a better price than has been lately ruling.

THE RELATION OF PERCENTAGE INCREASES TO VOLUME.

A few days ago I was reading again the comment that appeared in the "Journal of Gas Lighting" on my speech to the proprietors in May last. The writer of the leading article asked me if I could not give some information as to what an increase of 5 per cent. in the Association's gas business—an increase which we have been in the position to report to you nearly every half year now for some time past—represented in volume on the consumption of ten and twenty years ago, as compared with that of to-day, making allowance for the stations that have been severed from the main body. Taking the first period, 5 per cent. represented in volume 198 million cubic feet for the half year; for the second period, it represented 244 million cubic feet in a half year; and now in the third period—that was, the second half of 1909, the period covered by the remarks of the writer in the "Journal"—without Amsterdam, the inner district of Vienna, Haarlem, the French stations, and Frankfort (which have been separated from the Association, and whose total make represents 2,681,000,000 cubic feet per half year), the 5 per cent. increase represents no less than 279 million cubic feet. Personally, I do not think that to talk about millions of cubic feet is of any interest, except to the expert in gas matters; but a much simpler example of marking the progress of the Association's work is to state that, during the first half of 1910, notwithstanding the limbs which have been cut off from the Association, we carbonized no less than 483,500 tons of coal, or over 100,000 tons more per half year (notwithstanding the fact that the carbonizing returns show that we are extracting above 900 cubic feet of gas more from each ton of coal) than we did twenty years ago.

THE SITUATION IN VIENNA.

In the report of the Directors, there is a brief reference to an arrangement with Vienna, regarding which I should like to give you a few explanatory words. The Association has two distinct and separate businesses in Vienna. The larger one is on the right bank of the Danube, and there 100,000 tons of coal are carbonized yearly; while the other is in the commune of Floridsdorf on the opposite, or left, bank of the Danube, where only 10,000 tons of coal are carbonized annually. The conditions to be observed on the cessation of the concession for the larger business are fixed by the contract we entered into with Vienna, and which expires in 1911; while the arrangements referred to in the report are chiefly concerned with the smaller business from the Floridsdorf works. From these works the Association not only light Floridsdorf, but a number of communes in the vicinity. These communes were incorporated not long ago in the City of Vienna, which contested the validity of the contracts that we had made with them. The Board thought the Association had a very strong case. But we also considered it politic to come to some arrangement with the authorities; and the negotiations have come to a successful issue. The Association will give up their business from Jan. 1, 1912; and the city will buy, on expert valuation, the whole of the plant and materials outside the works—that is, the mains, services, meters, public lamps, &c. In addition, the considerable sum of £29,000 odd is to be paid as compensation for loss of profits. The general position on Jan. 1, 1912, therefore, will be that the Association cease all active operations in Vienna, but remain in possession of the valuable sites occupied by the works and offices. A pleasing feature of the negotiations is the friendly way in which they were conducted by the authorities. And a proof of the readiness of the authorities to assist and meet the Association is furnished by the fact of their having agreed to supply us with gas in bulk from the municipal gas-works, in the event of the output from the Association's own works proving insufficient to meet the demand during the remaining term of the contract in our own area of supply. Of course, by this arrangement with the Corporation, the Association will realize a portion of their assets; but the proprietors must not lose sight of the fact that such realization cannot compensate the Association for the loss of profits which are at present derived from our business in Vienna.

"LESS INCOME-TAX."

I come now to the last paragraph in the report, which refers to the dividend, and which probably is the paragraph which interests the proprietors more than any other. I daresay you will expect me to say a few words upon the change which has been made in the system of

paying the dividend. Two questions may be asked me. One is why the Directors have increased the dividend; the other is why we have chosen to deduct the income-tax. We have proposed the increase because we have fairly earned it, and because we have, after mature reflection, thought we shall be able to maintain it. That is the principle this old Company (which has been in existence for over 85 years) has adopted from the very commencement. The Directors have never suggested an increase of dividend which they did not think they could maintain in the future; and I sincerely trust we shall be able to maintain it, unless some very extraordinary upheaval on the Continent (such as a war) occurs. It is for that reason—because of our belief—that we have suggested an increase in the dividend. Now I come to the more knotty question perhaps, which has been agitating the minds of some of our shareholders, as to the deduction of the income-tax. Still in this we are only falling into line with all the great commercial and industrial companies of the present day. In my own case, some of these companies have paid me my dividends free of income-tax; but now they write and tell me that in future I shall have my dividends with income-tax deducted. When income-tax was only 2d., 4d., or 6d., it did not much matter about dividends being paid free of income-tax; but now we have come to 1s. 2d. I think that really everybody ought to realize, through his dividend warrants, the great incidence of taxation which has been imposed upon this nation. I also think that the true capital value of our stock is never quite realized on the Stock Exchange. They merely say it is 4 or 4½ per cent. for the half year; and they do not pay sufficient consideration as to whether it is paid free of income-tax or less income-tax. This is the opinion that has been expressed to me by several leading members of the Stock Exchange. And there is another thing. The public, or perhaps I ought to say some fortunate members of the public, have to make a return of their income to the Chancellor of the Exchequer, so that they may pay a super-tax; and this change will simplify their returns in a very material degree. In consequence of the large number of letters we receive annually at the office on the question of income-tax, the Secretary has begged me to take this opportunity of reminding the proprietors that annexed to each dividend-warrant there will be a certificate to the effect that income-tax has been deducted and specifying the exact amount that has been deducted; and he hopes that I will urge all those proprietors who are entitled to reclamation or rebate, to make the necessary claim to the Inland Revenue for the return of the amount due to them. Proprietors must bear in mind to preserve their income-tax certificate, as it will be required by the Inland Revenue Authorities when claim is made. I must express my regret that our foreign proprietors have had the privilege of reclamation of income-tax taken away from them by the Finance Act of 1910. It inflicts a hardship on those who do not enjoy the advantages of British citizenship while having to contribute to the nation's funds. I can only hope that at some future date we shall see this injustice remedied.

THE BALANCE-SHEET—DEPRECIATED CONSOLS.

I want for a moment to turn to the balance-sheet. The proprietors will notice that it has been set out in greater detail than hitherto; and it contains one important feature to which I should like to allude. Proprietors who have made it their business to study the balance-sheets for some years past will remember that the existence of the reserve fund investment of £400,000 Consols was formerly mentioned in the following footnote to the balance-sheet: "In addition to the above, the Association possess £400,000 Consols as a reserve fund." But it was not incorporated in the balance-sheet figures. In 1906, you will remember the depreciated value of this reserve was mentioned; and it was not then thought necessary to take action in the matter. The reserve fund investment was allowed to remain in our books at its original cost. Since then the price of Consols has gone from bad to worse, until we now have the nation's premier security standing at a price of about 79½. In these circumstances, the Board have decided that it would be unwise to delay any longer making some provision to meet this depreciation. They have therefore first taken the sum of £2664 6s. 2d. to bring up the reserve fund to £400,000 on the left-hand side of the account; and they have also taken from the profit of the half year a sum of £17,335 13s. 10d. for writing-down the £400,000 Consols which stood at £397,335 13s. 10d. to the book value of £380,000. In order to make good this reduction, we have transferred to the reserve fund investment £24,000 Consols of the book value of £20,000, and forming part of £80,000 Consols hitherto included in the Association's general investments. The fund is now therefore represented by £424,000 Consols at £400,000. At this figure the price averages £94 6s. 10d.; and the Board propose to continue the process of writing-down the investment half year by half year until it stands at a price more in accord with its market value. This treatment of the reserve fund investment is set out fully in the balance-sheet.

CAPITAL EXPENDITURE AND PROGRESS.

The only other item in the balance-sheet which calls for comment is that of works and mains. If you compare the balance of £4,729,158 with the balance on the corresponding date of £4,375,511, it will be seen that, during the past twelve months, the total expenditure upon works and mains has amounted to £353,647. This is only another evidence of the progress the Company is making. This is necessary expenditure. Every gas company having works in different countries and towns, where great building is going on, is obliged to spend huge sums of money on extensions which for the moment do not return their proper rate of interest towards the revenue, but which are absolutely necessary for the future well-being of the Company.

VISIT OF THE SENIOR AUDITOR TO THE PRINCIPAL STATIONS.

This is all I am going to say to you to-day with regard to the accounts and the business of the Association for the half year under review. But it is usual for the Chairman to mention anything of importance that may have happened since June 30. A matter of interest which I should like to mention is an entirely new departure, or perhaps I should call it an innovation. It was the visit of your Senior Auditor to several of the most important of the Association's stations. Mr. Gurney Fox, with the zeal which always characterizes his actions for the benefit of the proprietors in auditing the accounts and looking after their interests, approached the Directors to know if he might visit the most important of the stations, and go closely into the system of accounts and the system of inspection that we employ on the Continent. The Directors were most happy to give him every facility in this service, because there is nothing to conceal in our business; and we believe that our system of accounts and inspection is as perfect as that of any big industrial establishment to be found on the Continent. I am glad to see Mr. Gurney Fox present to-day; and perhaps, after the routine business has been disposed of, he will kindly say a few words as to what he found on the Continent with regard to the accounts of the Association.

DIRECTORS' VISITS TO THE STATIONS.

Lastly, I have to allude to the Directors' visits to the Continent, which always take place during the autumn. Sir Charles Jessel has visited several of our most important stations. Mr. Lucas has also been abroad on your behalf. Colonel Le Roy-Lewis has been to various towns. Mr. Wilkinson has visited a great many of the stations; and I have taken my share in visiting a number of the smaller French stations. I am glad to be able to report that everything is in excellent order; and our works are fully equipped to meet the demands which we hope will be made upon us for a plentiful supply of gas during the coming winter.

Mr. Arthur Lucas seconded the motion.

Sir John Runtz congratulated the Board upon the continued progress of the Association. He saw that in the corresponding half year they made £242,396 profit; while in the past half year they made £269,149—being an increase of £26,753. This was extremely satisfactory. The Chairman had referred to the question of investments and to the large loss on Consols. It was a considerable item; but they had to face the loss. Lower down in the balance-sheet would be found the heading, "English, Colonial, and Indian securities," the market value of which on June 30 was £413,238; while they cost £401,344, or an appreciation of £12,000. He ventured to think that if the Directors had acted a little more vigorously a year or two ago, and placed some of the reserve fund in Colonial stocks, they would not have had this large loss in Consols. No one could blame the Directors for investing in Consols, and no one could have foreseen the deplorable price at which they stood to-day. They all hoped that the price of Consols, for the nation's sake and credit, would soon be altered. Fortunately the Association could face this loss; and it did not affect them very seriously. He proceeded to speak against the deduction of income-tax from the dividends, and expressed the opinion that shares or stock with dividends paid free of income-tax stood in a more favourable, or more popular, position than those with the income-tax deducted. Personally, he would rather have a dividend of 4¼ per cent. net than 4½ per cent., less income-tax. He hoped (it was too late to be altered this year), the Directors would reconsider the matter; and return to the old condition of paying the dividend free of income-tax.

The motion was unanimously carried.

Proposed by the Chairman, and seconded by Sir E. Chandos Leigh, a dividend of 4½ per cent. on the £4,940,000 of stock, less income-tax, was declared.

The Chairman moved a vote of thanks to the staff and agents of the Association. The agents, he remarked, exercised very responsible duties on the Continent; and they were their trusted local representatives. They had the pleasure of seeing present Mr. Delbrück, the well-known banker of Berlin, who succeeded his father some years ago, and on whose shoulders had fallen most worthily the mantle of his illustrious sire. He (the Chairman) could assure the proprietors that Mr. Delbrück was devoted to the interests of the Association, and did his very utmost to advance the interests of the Association in Germany.

Colonel H. Le Roy-Lewis seconded the motion; and it was heartily agreed to.

Mr. J. Gurney Fox, at the invitation of the Chairman, referred to his visits to some of the more important stations. He was grateful to the Directors for allowing this innovation; and he was also exceedingly indebted to the managers and engineers at the various stations. Thanks to their kindness and courtesy, he was able not only to see closely into the accounts and the inner workings, but they took the greatest trouble in showing him over the various works. He was also fortunate in being accompanied by one of the inspectors of the Association, who made everything so simple and clear to him. They examined very carefully at the different stations—Antwerp, Berlin, Hanover, Brussels, and Aix-le-Chapelle—into the systems of accounts, and went into the carbonizing accounts, wages-sheets, meter takings, stock, and, in fact, into everything that would be of assistance. He could as the result say that a more thorough system of accounts, and a more thorough system of checking, he could not possibly conceive. What he saw at the works impressed him with the feeling that everything was up to date in connection with their plant, and that the work was being economically done. Further he saw that everything possible was being done for the welfare of their men, who appeared to be thoroughly happy and contented, and earnest in their work. He was glad to find, too, that they had one day's rest a week. From all he saw, he felt confident that progress and dividend would be maintained, and that the proprietors might congratulate themselves upon the position of the Association.

Mr. Delbrück thanked the Chairman very much for the complimentary remarks made in regard to himself (the speaker), and also the proprietors for the kind reception they had given to the remarks.

An acknowledgment of the services of the Chairman and Directors terminated the proceedings.

Paignton Water-Works Extension.—It is proposed by the Paignton Urban District Council to apply to Parliament in the ensuing session for powers to duplicate the water-main from the reservoir on Dartmoor. The works are of quite recent construction; but the need of additional means of supplying the water has already been felt. Plans of the intended works have been made by the Water Engineer to the Council (Mr. J. C. Hawkins) and forwarded to Mr. Baldwin Latham, who will be the Consulting Engineer for the work.

COLONIAL GAS ASSOCIATION, LIMITED.

A Coal Strike, but a Good Financial Position.

The Annual General Meeting of the Association was held last Tuesday at the London Offices, Suffolk House, Laurence Pountney Hill, E.C.—Mr. SAMUEL SPENCER in the chair.

The SECRETARY (Mr. A. J. Kingdon) read the notice convening the meeting; and the report and accounts were taken as read.

The CHAIRMAN, in moving their adoption, said it was with much regret that they had to announce the death of their London colleague, Mr. A. Godwin Hammack, which took place on Sept. 19. On the directorate Mr. Hammack succeeded his father, the first Chairman, in 1894. Shortly after the last annual meeting, he was taken ill; and, as mentioned, passed away a few weeks ago. The Board, at their last meeting, sent a letter of sympathy and condolence to his family; and he was confident the shareholders would confirm what was done, as they all regretted his loss. Mr. Hammack was a most agreeable colleague, and attentive at all times to the duties of his office. As stated in the report, the Board did not think it necessary at present to fill the vacancy. It was now his pleasure to move that the report and balance-sheet be adopted; and, in doing so, it was most gratifying to be able to say that, notwithstanding the disastrous five months' coal strike in Australia, which cost the Association some hundreds of pounds, they were able to pay the same rate of dividend as last year, and to increase the carry-forward from £1068 to £1251, besides writing off for depreciation the sum of £997. At the last meeting, he was too optimistic in thinking that at this one the Directors would be able to increase the dividend; but had it not been for the lamentable strike referred to, there was no doubt it could have been done. As the great Disraeli once said, "It's the unexpected that always happens." However, it was a most thankful result of the year's working that they had come through it with such a favourable return, particularly as, during the last four or five months of the strike, they had to pay three, four, and five times as much for coal as the contract price. However, by so doing, they were able to keep up the supply of gas, and did not increase the price to the consumers. The prosperity of Australia, it was gratifying to report, was still increasing, and everything pointed to its continuance. Their Managing-Director (Mr. Swinburne) was sanguine that the current year's working would be of the most satisfactory character. It was the hope of himself (the Chairman) and of his colleagues that, at this meeting, they would see the shares at par or a premium; and he felt convinced this would soon be the case. The shares were very firmly held, as it would be noticed that only some fourteen transfers were passed during the year. In the notice calling the meeting, it would have been observed that there was a proposal to make some addition to the Directors' fees. This, it would be remembered, was the wish of the shareholders present last year. But as notice of it had not been given, it was thought better to defer it to this meeting. It was now 22 years since the Association started; and the fees were then fixed at £30 for each Director, and had remained at the same figure up to now, with the addition, according to the Articles of Association, of £100 for every 1 per cent. dividend paid beyond 4 per cent. Last year it was stated that the Municipality of Geraldton had given notice of their wish to purchase the works at the end of the concession in March last. The Managing-Director went to Geraldton, and came to an agreement with the Municipality for the sale. After going fully into the matter, the price of £12,000 was accepted; and the works were taken over by the Municipality on March 1 this year, with the understanding that the Association were to continue the working up to the time the payment was made, which was fixed for November—the Municipality paying the Association interest as it became due, and for the stocks of coal and other things that they agreed to take over, with an allowance for interest and management. Under the terms of the agreement, there was an arbitration clause; but it was not necessary to bring this into operation, as the sum arrived at was agreeable to both. The Directors were expecting to hear daily that the amount had been paid; and, when received, the Board would take into consideration how it was to be disposed of to the best advantage of the Company. The result would appear in next year's balance-sheet. It would be noticed that the expenditure of capital during the year amounted to £1886; and this was spent in connection with new mains, meters, &c. The debenture re-issue was about £2000 less; and this it would not be necessary to issue now, as, with the amount coming from the Geraldton works sale, the loan from the bank would be paid off. The stocks were about the same as in the previous year. The receipts from gas, including only eight months' working from Geraldton, showed an increase of £700, and for residuals £400. This result, with the reduced price for gas at several of the stations, enabled the Board to say that the trading of the past year was very satisfactory. The 11 per cent. increased sale of gas, they thought, would be accepted as an excellent result. The number of consumers obtained during the year had been 270. The prospects for the current year might be regarded as favourable; and he considered, supported by the Managing-Director's opinion, they might look forward with every confidence. In conclusion, the Directors thought, under all the circumstances mentioned, it was best to continue the same dividend (5½ per cent., free of income-tax), and to increase the carry-forward by £200. He felt confident the shareholders would consider the past year's working had been fairly good, and that the decision of the Board would meet with their approval.

Mr. CHARLES HUNT seconded the motion; and it was carried.

On the motion of the CHAIRMAN, seconded by Mr. WILLIAM C. PARKINSON, a dividend was declared for the half year at the rate of 7 per cent. per annum, free of income-tax, making, with the interim payment, 5½ per cent. for the year.

The CHAIRMAN said their two local Directors (Mr. Henry Andrews and Mr. George Swinburne, Managing-Director), retired on this occasion; and he had pleasure in moving their re-election.

Mr. FREDERICK R. SMITH seconded the motion, remarking that they were fortunate in having Mr. Swinburne as Managing-Director, and Mr. Andrews as a local Director.

The motion was unanimously agreed to.

Proposed by Mr. SAMUEL WHILE, and seconded by Mr. SAMUEL CUTLER, the Auditors (Messrs. Wood, Drew, and Co.) were then re-appointed.

Mr. JOHN COATES (Consulting Engineer in England to the Victorian Government) said that due notice having been given, possibly, as founder of the Company, it was fit he should move a resolution which he felt sure would be received by the shareholders unanimously. It was that the remuneration of the Directors should be a sum equal to £60 per annum, multiplied by the number of Directors for the time being, in addition to the provision made by Article 73 of the Articles of Association, and that the fees be paid free of income-tax. The shareholders who were present last year would remember that he then said that the Board was perhaps the most underpaid one in the City of London. He did not think this was the besetting sin of Boards generally. But in the present case it seemed to him that, for a long time past, they had been much underpaid. During all the years of depression in Australia, after the land boom, the Company suffered adversely with all the rest of the industrial companies there; and he could only assure the shareholders that this ship was steered safely, with marked ability and great care and economy, through very troublous waters. Now they seemed to be on the eve of better times; and the day had come when a change should be made in the Directors' fees. Most of those present (perhaps all) had seen that an able delegation, composed of the Hon. Hugh Mackenzie, Minister of Lands, and Dr. Elwood Mead, Chief of the Irrigation Department, from Victoria—where the Association had most of their works—was here recently; and he was looking forward with intense interest to the result of this delegation, because it would mean a closer settlement in the districts where their business was, and particularly at Shepparton and Wangaratta. It probably meant that where there were now ten families there would be a hundred, with perhaps 100 to 150 acres to each; the facilities the Victorian Government were giving just now being simply directed to getting the land occupied. This would represent increased wealth and population to the districts where they had little consumption. He looked forward to an era of prosperity for Victoria. On its eve they could not do better than pass the motion unanimously, and in this way thank the Directors for all they had done in times past. He felt sure they might expect they would do as well in the future as they had done in the past.

Mr. FREDERIC G. PAINTER, in seconding, said it was quite right for them to have gone on with the low fees while the Company were not paying what might be regarded as a fair dividend on such an investment; but now the shareholders were getting a 5½ per cent. dividend, £30 a year was not an adequate remuneration for Directors managing the concern—especially a concern doing business so far away. He would suggest that after the words "£60 per annum," they should insert "from day to day," so that, if a Director retired from the Board from any cause, there would be no possibility whatever of any question arising.

The suggested insertion was agreed to; and the resolution was unanimously carried.

The CHAIRMAN said the Directors were extremely obliged for this mark of the confidence of the shareholders. When the land boom came to an end in Australia, the 7 per cent. dividend that had been paid fell to 6 per cent., and then the 6 to 4 per cent., and next year to 3 per cent. These were troublous times; and they made the Board feel very anxious. But he was perfectly certain they were going to get into their old position. They had a sum equal to one-and-a-half year's dividend in hand, and this could be appropriated for any purpose for which it was required. He was reading that morning that there had been an increase of something like 3 millions of exports from Australia, and 2 millions from New Zealand. This showed that this part of the world was becoming marvellously prosperous; and in this prosperity their Company would share. Proceeding, he said that owing to the coal strike they had had an anxious time during the early part of the year. The strike continued for some five months; and their Managing-Director had had a difficult task to keep the stations going. The Association had twelve works; and eight to ten of them were affected by the strike. He might say that, if their friend Mr. Hunt had not helped them considerably, their loss would have been very much more. Melbourne being close to their works, they were able to get from there supplies of coal which had been sent from England. It had all ended very well, however; and they might congratulate themselves that they had had such a satisfactory year. He wanted the shareholders to send out a special vote of thanks on this occasion to the Managing-Director and his colleagues, and to the various station managers, for their services during the year.

Mr. PAINTER seconded the proposition, which was heartily carried.

Moved by Mr. PAINTER, and seconded by Mr. WHILE, a cordial vote of thanks was passed to the Chairman and Directors.

An acknowledgment by the Chairman concluded the proceedings.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held at the Offices, Ogle Road, Southampton, last Wednesday—Captain A. J. CORSE-SCOTT, J.P., presiding.

The CHAIRMAN said it gave him great pleasure to move the adoption of the report and accounts for the past half year. The stockholders would see that there was a sufficient sum standing to the credit of the profit and loss account to meet all charges, allow for payment of the maximum dividend on the ordinary stock, and leave a balance of £2426 to be carried forward. The sale of gas was still very satisfactory. Applications for supplies were being received every week. The demand for cooking-stoves during the past summer was exceedingly gratifying to the Directors; and they hoped that during the winter a large number of consumers who had not hitherto used gas-fires would avail themselves of the great variety that were to be obtained on hire at very low rentals. As the Directors expected, the decision of the Corporation to transfer the lighting of the street-lamps from the Gas Company to the Electricity Committee had resulted in an increased cost to the ratepayers. Notwithstanding that only about 500 lamps were transferred

at March 31—the greater portion of these lamps being taken over nearly at the end of the period mentioned—they would see, on referring to the published accounts of the town, that the total cost for public lighting for 1909-10 was £684 more than that of the previous year. In order to deal more effectively with the increasing work, new buildings were being erected to take the place of the old workshops, which were now totally inadequate for the requirements. Mr. Charles Crowther Smith, who for 39 years was Secretary of the Company, and since 1904 occupied a seat on the Board, passed away in June. By his death, the Directors lost a valuable colleague. During the long period he was connected with the Company, he rendered yeoman service; and it was to a large extent owing to the valuable service and sound judgment he brought to bear on the many matters concerning the welfare of the Company that it occupied the sound position it did at the present time. He would be greatly missed, not only by those connected with the Company but also by the town at large. The Directors had, after careful consideration, offered the seat to Mr. Joseph Cash, who had for some years acted as the Company's Consulting Engineer; and he had agreed to accept it on Jan. 1 next, after he had handed in his resignation of the office he now held. In securing Mr. Cash's services on the Board, the Directors felt sure they had obtained a gentleman who would be able to render excellent help to the Company. Mr. J. B. Paddon, who for many years held the position of Consulting Engineer, and who designed the greater portion of the Company's works, and also the offices they were meeting in, passed away recently. The Directors recommended, for the confirmation of the stockholders, an increase in the salary of the Secretary. In order to enable consumers to better understand the proper use of gas-cookers, the Directors had arranged for a series of cooking demonstrations to be given. The first lecture proved most successful. After Christmas, it was proposed to start a school of cookery.

The report was adopted, the payment of the maximum dividends was agreed to, and the salary of the Secretary (Mr. J. R. H. Jacobs) was increased from £400 to £500 per annum.

THE INCOME-TAX COMMISSIONERS AND DEPRECIATION ALLOWANCE.

The appeal of the Brixham Gas Company for allowance in respect of depreciation was heard on the 1st inst., before the District Commissioners at Paignton. The Company was represented by Mr. W. A. Schultz, Chartered Accountant, of No. 50, Cannon Street, E.C.

In this case, depreciation had been allowed for some years; and the assessment for 1909-10 had been made as before. But, subsequently to the issue of the circular by the Inland Revenue to surveyors, the latter had raised an additional assessment in the amount of the depreciation already allowed.

After hearing the arguments, the Commissioners decided to allow depreciation in accordance with the Customs and Inland Revenue Act, 1878, and the Finance Act, 1907; and the amount was fixed at 3 per cent. on the value of the plant and machinery.

MANCHESTER CORPORATION GAS UNDERTAKING.

A Criticism and a Reply.

Readers of the "JOURNAL" are aware that Mr. S. Norbury Williams exercises vigilant supervision over municipal affairs in Manchester; and in the "Manchester City News" for the 29th ult. he had a long article dealing with what he called the three important problems of the amalgamation of the city with Salford, the rectification of the ward boundaries, and the lighting quality of the gas, about which he, in company with many other citizens, was surprised to find so little had been said or written during the municipal contests. The views of the writer on the two first-named subjects are of no special interest to our readers; but his remarks on the last call for notice.

Criticism by Mr. S. Norbury Williams.

For long years the subject of the lighting quality of our gas has baffled us. I have myself endeavoured to elicit the information both by correspondence and at a recent public inquiry. But it was impossible to extract from the leading witness a clear statement as to the present candle power of Manchester gas; and the inquiry left us just as wise as we were before. I have inquired from members of the Gas Committee itself as to how our gas of to-day compared with that of ten or twenty years ago, and they have been unable to tell me. They were as much in the dark as I was myself. We have had cryptic, mysterious public statements made, that "the gas to-day is as good as ever it was." Then we have scanned the official figures, showing us the illuminating power in candles thus:

Year.	Candles.	Year.	Candles.	Year.	Candles.
1890	19·74	1903	18·25	1907	17·67
1893	19·11	1904	17·80	1908	17·53
1897	19·16	1905	17·04	1909	17·72
1900	19·40	*1906	15·30	1910	17·63

Every user of gas in Manchester must have noticed the great difference in the lighting power of our gas as compared with what it was years ago. My own belief is that the eyesight of thousands has been either damaged or utterly ruined by the reduced light of our gas. This is chiefly the case among our poorer consumers, who cannot afford incandescent mantles. I have received complaints from hundreds of them; and I am glad to notice that our friend Canon Nunn has called attention once more to the subject. The excuse of modern gas makers is that the calorific (or heating) properties of gas are now as important as their lighting properties, owing to the advent of gas-cookers, gas-engines, and so on. But our Manchester figures show the proportion of gas sold—

Ordinary consumers	76 per cent.
Automatic meter consumers	10 ,,
Gas-engines	7 ,,
Public lamps	7 ,,

Some years ago, the Gas Committee adopted a new standard by which to test our candle power. To indicate this in the official figures given above there is an asterisk before the date of 1906. To put it bluntly, it

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 385.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,863	Stk.	Oct 14	5	Alliance & Dublin Ord.	88 90	+1	5 11 1
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95–98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6⅜–6⅝*	..	5 5 8
40,000	5		7	Do. New, £4 paid	4⅞–5⅛*	..	5 [illegible] 3
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½–29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼–16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¼–15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246–249	..	5 0 5
330,000	,,		9½	Do. New	184–186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
220,000	Stk	Aug. 31	11	Brighton & Hove Orig.	215–218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	157–160	..	5 0 0
460,000	20	Sept. 29	10⅝	British	44–45	..	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c.	117–119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88–90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107–109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85–87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97–99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½–5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½–111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk.	105–108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do.	101–103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79–81	..	3 14 1
800 000	Stk.	June 10	4†	Continental Union, Ltd.	80–100	6	4 0 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122–124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104–105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103–105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¼–24¼	¼	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾–18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	104½–105½	..	4 8 5
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87–89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103–105	..	3 16 2
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80–82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92–94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	17–17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145–148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112–114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98–100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental	183–190	+1	4 14 9
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120–122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	220–222	..	4 10 1
718,100	,,	,,	7	Do. B	163–165	+1	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅝–4⅞	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99–101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99–101	..	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd.	12½–13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102–103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90–91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½–14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138–140	..	5 14 4
60,000	5	Sept 15	8	Ottoman, Ltd.	6–6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A.	131–133	..	5 3 0
60,000	50	,,	13	Do. B.	124–126	..	5 3 2
100,000	50	,,	12	Do. C.	117–119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102–104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼–7½*	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5 3/16–5 7/16	..	4 11 11
488,900	100	June 1	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97–99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd.	15¼–15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼–11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51–52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229–231	..	4 6 7
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾–11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80–82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121–123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141–143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112–114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9–9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98–100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112–114	..	4 7 0
255,6 6	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c.	139–141	..	4 15 9
85,765	,,	June 29	3	Do. 3 p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

looks as though they were now measuring our milk in a three-gill can instead of a two-quart one, as was previously the case. At any rate, we have now at last got at the fact which we have suspected for years, and that fact is that to-day our gas is 4 candles poorer than it was twenty years ago—that is, its illuminating or candle power is worse to that extent. Although many of us have long suspected this, I confess that the admission which has now been officially made almost staggers one. Four candle power worse than twenty years ago! The citizens ought to know this, and to make their arrangements accordingly. It affects most those who cannot afford to buy mantles. The poor suffer, as they always have to do. I may say that the price charged to consumers within the city twenty years ago (1890) was 2s. 6d. per 1000 cubic feet; the price is still 2s. 3d., in spite of the very serious fall in candle power. So we have not been doing such great wonders in the gas line, after all!

Those who were present at the last inquiry in the Town Hall on gas matters will remember what great efforts were made to elicit the plain facts as to the lighting power of our gas to-day, as compared with that power in years past. Questions were put in various forms, in order to bring out clearly the relative value of the former and the present method of calculating the candle power; but all to no purpose. The people who heard this questioning will be instructed and pleased when they now hear that Mr. J. G. Newbigging, the Chief Engineer of our Manchester Corporation Gas-Works, when giving evidence before a House of Commons Committee on the 7th of July last, admitted that there is no prescribed quality or price of gas in our city. "Since 1889," said he, "the illuminating power of the gas has been gradually reduced by about 4 candles." It was not because of want of "pluck" that the reduction was gradual, or even to prevent the consumer finding the thing out. So said the Engineer. Well, we are glad to know the real fact at last; and I can only hope that our citizens (the poor especially) are pleased and satisfied now that they know of a truth that the gas they are burning in 1910 is 4 candles worse than it was in 1890.

Reply by Mr. J. G. Newbigging.

The following reply by Mr. J. G. Newbigging appeared in the "Manchester City News" last Saturday.

Mr. Alderman Gibson [the Chairman of the Gas Committee] intended replying to the article of Mr. Norbury Williams in your last issue; but inasmuch as reference has been made to me and to technical questions, he has been good enough to consent to my replying in his place.

The facts of the case are not quite as stated by Mr. Norbury Williams. At the Local Government Board inquiry held on May 3, 1907, with reference to the application of the Gas Committee for a loan of £300,000, the reason for the change of test-burner and consequent lowering of the candle power of the gas was fully explained; but it appears necessary to traverse the ground once more.

For many years, down to 1906, the Gas Committee had voluntarily penalized themselves by continuing to test their gas with a flat-flame burner—a statutory test unknown in the gas industry with any gas of a prescribed illuminating power lower than 20 candles, and a most exacting test owing to the cooling and over-oxidizing effects of an unrestricted supply of air to the burner, which prevents the full value of the gas being recorded on the photometer. This test had been continued by the Gas Committee in spite of the fact that the undertaking is under no obligation in any of its Acts of Parliament to have any illuminating power test whatever.

The Chairman of the Gas Committee (Alderman Gibson) was, however, so anxious that the gas consumers should have the best possible gas supply suitable for the consuming appliances then available, that he continued the test so long. On my pointing out to him the changes that had taken place in the methods of consuming gas, and that the Manchester gas undertaking stood in an invidious position as regards the illuminating power test with every other undertaking in the kingdom, he decided to advise the Committee to adopt the latest test-burner—the "Metropolitan" argand burner No. 2—which is accepted by Parliament and the Board of Trade, and is, in fact, now almost compulsorily imposed upon gas undertakings seeking additional parliamentary powers.

Alderman Gibson showed his solicitude for the gas consumers by instructing me that the illuminating power of the gas should not be less than 17 candles, notwithstanding that 14 candles is now almost universally prescribed for all gas undertakings; and this power will be continued in Manchester until the next progressive step is made in the gas industry—viz., the general distribution of gas at high pressure at a price of 1s. to 1s. 6d. per 1000 cubic feet, which, in my judgment, is looming in the not distant future.

Leaving aside all questions of test-burners, and putting it into the simplest language, it is quite true that the gas supplied in Manchester at the present time will only give a light of 2 to 3 candles per cubic foot of gas used, against 3 to 4 candles per cubic foot in the case of the gas supplied ten to twenty years ago, when consumed in a flat-flame burner; but in practical use the difference between the two gases is not so great, owing to the flat-flame burners of to-day being constructed on more scientific principles than they were twenty years ago.

But why should we waste time in discussing the flat-flame burner, when, with the incandescent burner, for the same cost, including outlay on burners and mantles, four or five times the light can be obtained as compared with the flat-flame burner? With the existing pressure at which the gas is distributed, 20 candles of light per cubic foot can be obtained; and in the case of gas supplied at high pressure, a light of 60 candles per cubic foot of gas consumed is secured, as is demonstrated in the new installation of lighting round the site of the old Infirmary buildings in Piccadilly.

The obvious conclusion is, therefore, that, in their own interests, all gas consumers, even the poorest, should adopt incandescent gas-burners; and, as a matter of fact, the class of consumers referred to have seen the wisdom of this course, and have to a great extent abandoned flat-flame burners for the cheaper and better incandescent light.

Though the gas in Manchester is regulated to 17 candles, our main guide is its calorific value, which we maintain at 600 B.Th.U. per cubic foot. The proportion of gas sold in Manchester is as follows :—

Ordinary consumers	76 per cent.
Automatic meter consumers	10 ,,
Gas-engines	7 ,,
Public lamps	7 ,,

These figures are quoted by Mr. Williams ; but he does not state that at least 80 per cent. of the total gas used is dependent on calorific or heating power for its usefulness, and not on the illuminating power, as it is consumed in a bunsen form of burner for incandescent lighting, heating, cooking, motive power, and industrial purposes. There is no direct relationship between the calorific and illuminating powers of a gas ; recent improved methods of carbonizing coal showing that gas of a comparatively low illuminating power can be produced having a high calorific value. There is thus only about 20 per cent. of the gas consumed in which illuminating power is of value ; and this percentage is rapidly being reduced owing to the high cost of flat-flame lighting, however rich the gas may be. You cannot in fact dissociate consuming appliances from quality of gas when making a comparison with the gas supplied to-day and twenty years ago.

Mr. Norbury Williams points out that the price of gas in 1890 was 2s. 6d. per 1000 cubic feet, and the price of gas to-day is still 2s. 3d. ; and he asks, in so many words, where has the saving gone by the reduction in the illuminating power? During the past twenty years, enormous burdens have been placed upon the department, and heavy concessions made to the gas consumers. The following particulars, taken from a statement prepared by Mr. F. P. Smith, the Accountant to the department, show the additional annual burdens borne by the gas undertaking in 1910, as compared with 1890 :—

Concessions.—Loss of Income :	
1.—Reduction in price of gas	£57,600
2.—Abolition of meter-rents	18,700
3.—Abolition of stove-rents	17,000
Total	£93,300
Additional Burdens.—Increased Expenditure :	
1.—Cost of eight-hour day for workmen, increase in pay, and workmen's compensation	£22,000
2.—Average provision for future renewals of plant (actual renewals only were charged in 1890)	15,000
3.—*Pro ratâ* increase of statutory sinking fund for redemption of loan capital consequent on large increase of "short life" plant	20,000
4.—Statutory obligation to meet out of revenue wages of Corporation workmen employed on capital account	6,500
Additional burden per annum in 1910 over 1890	£156,800

Then, again, in the year 1907, when the price of coal increased by 2s. 6d. per ton over the previous year, the price of gas was not temporarily raised—as was the case with some neighbouring gas undertakings—to the extent of 3d. per 1000 cubic feet, which in Manchester is equal to £66,000 per annum. As a matter of fact, with all these burdens thrown upon the Gas Department in recent years, it would be quite impossible to supply gas at the present price if great economies had not been effected in manufacturing costs, and the several works kept thoroughly up to date. In addition to this, the financial position of the Manchester gas undertaking has been placed on a sound footing, unsurpassed by that of any other corporation gas undertaking in the kingdom.

If Mr. Norbury Williams is anxious to safeguard the interests of the poorer citizens, let him support the Chairman in his endeavour to bring the price of gas down to an average of 2s. per 1000 cubic feet, which could at once be effected by relieving the Gas Department of the necessity to contribute £50,000 per annum in relief of the rates. This contribution of £50,000 per annum presses more heavily on the working class than on any other, and is, of course, a system of indirect taxation. The reduction of the price to 2s. per 1000 cubic feet would encourage the more general use of gas for purposes other than lighting ; and in a short time the increased consumption which would inevitably follow this reduction would enable the Gas Committee to still further reduce the price. It is by taking up the subject of "cheap gas" that Mr. Norbury Williams would earn the gratitude of the citizens, rather than by discussing the economics of gas manufacture and supply, with which subject he is evidently not well acquainted.

I hope what I have said will influence Mr. Norbury Williams and other critics to help rather than hamper Alderman Gibson, the Chairman of the Gas Committee, who unselfishly devotes his time to the administration of a great undertaking with such signal success.

REDHILL AND REIGATE PUBLIC LIGHTING.

Dispute between the Reigate Corporation and the Redhill Gas Company.

The Reigate Town Council were engaged till midnight on Monday of last week debating a resolution which materially affected the Gas Company and their right to impose conditions on the Corporation where the question of renewing the contract for street lighting is concerned. The discussion, which came up in the form of a recommendation from the last Council meeting, was based on certain offers to pay the Reigate and Redhill Gas Companies £3 per lamp per annum for lighting public lamps, on the understanding that the number of lamps which might be converted to electricity should not exceed 10 per cent. of the number supplied to the 17th of August last, but that the Corporation should have the power to do so on payment of 10s. per lamp per annum during the three years' contract for every lamp so converted

The Reigate Company accepted this offer; but the other Company declined to entertain it. They, however, consented to receive a deputation from the Council to discuss the matter. The deputation were unable to arrive at a satisfactory conclusion with the Company; and the Highways Committee recommended that it was advisable to put in force the statutory provisions of the Gas-Works Clauses Act, 1871, so as to secure a supply of gas for public lighting; and that on disagreement as to terms and prices, the Council should go to arbitration.

Mr. Ongley explained what took place at the meeting of the Directors of the Company and the deputation. He said the whole question was threshed out, and, with the exception of himself, the Committee agreed with the recommendation. It was most important to arrive at a decision at once, as the contract to light the public lamps expired on the 9th inst., and the Company could, if they so desired, plunge the public thoroughfares in darkness. They had accepted the Reigate Company's offer. The Redhill Company made a similar offer with regard to the charge to be made for lighting, but stated that if more than 10 per cent. of the lamps were converted to electricity, a sum of £3 should be paid for each lamp. It seemed to him this offer was a reasonable one. He did not believe the Corporation could grapple with the work themselves in time; and he strongly urged the Council not to adopt the recommendation of the Committee, but to accept the Redhill Company's offer.

Alderman Barnes expressed regret that things had come to a deadlock. Too much hostility had, he said, been shown against the Redhill Company because it was a gas company. They must remember that in the old days the Company had been essential to them, and had been always willing to pay attention to their requirements. They did not want to discard old friends; and personally he thought the Company's offer a very reasonable one, and one that ought to have been accepted. He laid stress upon the danger of precipitate action, and said before discarding the Gas Company they should ascertain what the Electric Lighting Company could do for them. The ratepayers deserved their first consideration. He should like to move the acceptance of the Redhill Company's terms, believing the Council would otherwise find themselves in "a confounded mess."

At this point, an opinion was expressed that the Mayor (Alderman Gregory) being a shareholder in the Redhill Gas Company, ought not to occupy the chair. Whereupon he vacated it, and it was taken by Alderman Barnes, who, in a long speech, urged the acceptance of the Company terms.

Other councillors having dealt with the question,

Mr. Ince said he had not heard any reasons advanced why the Committee's recommendation should be rejected. He denied that hostility had been shown towards the Gas Company by the Committee. They had tried to reason out the matter in a businesslike way. The Corporation had not, as a matter of fact, taken advantage of the powers of conversion which they might have done, and had converted fewer lamps to electricity than they were entitled to; but the moment they decided to vitalize their rights, the Gas Company said they should not do so. The Reigate Company had shown a very laudable desire to be friendly with the Corporation, but with the Redhill Company it was otherwise.

After a further two hours' debate, the Committee's recommendation was carried by a large majority; the Mayor and five other councillors, being shareholders in the Redhill Company, refraining from voting.

EDINBURGH AND LEITH GAS COMMISSIONERS.

The Edinburgh and Leith Gas Commissioners had before them, at their meeting on Monday last week, the following matters in addition to the report of Mr. W. R. Herring on the subject of the supply of cheap gas for trade purposes in the city and burgh noticed elsewhere.

Disclosure of Prices.

Lord Provost Brown (who presided) called attention to a part of the minutes of the Works Committee in which it was stated that "the Committee authorized the purchase of 250 tons of 'Lux' purifying material (at the price stated to the Committee) to be mixed with oxide of iron for gas-purifying purposes, the result of the experiments to be reported to the Commissioners;" and he asked if there was any reason why the price should not be stated. He thought this was a matter the Commissioners should very seriously consider. A great many observations were being made about their being obliged to put into their minutes the prices at which they bought things; and he would like the Commissioners to take the matter up, and, if possible, give a reason for their not doing this. He had it from various electors that too much was being kept back. There might be good reasons for this—he was not passing an opinion upon the matter; but he thought that if there were, they should be given in public.

Judge Bryson (the Convener of the Committee) said there was a good reason. The material in question was a new one which they were testing; and they could not get it from the manufacturers unless they kept the price close.

The Lord Provost said this might be a good reason; but he thought it had better be considered.

Traducing the Commissioners.

Provost Smith, of Leith, said a question had been put to a town councillor at one of the ward meetings in Leith as to whether it was the fact that members of the Edinburgh and Leith Corporations got work done by the Water Trust and Gas Commissioners at cost price or less; and that workmen's time was not charged for. The questioner assured his hearers it was a fact which he could prove. This was a serious statement, reflecting on members of the Commission; and he thought it right to ask their officials whether or not it was correct.

Mr. Herring stated that, so far as the Gas Commissioners were concerned, and also the members of the Edinburgh and Leith Corporations, they were treated in every way similar to any other of the gas

consumers who came to them and asked them to do work for them. No favour whatever was shown to them.

Provost SMITH considered it only right, then, that the Law Agent of the Commissioners should be instructed to communicate with the gentleman referred to, and ask him to prove his statement or withdraw it.

This was agreed to.

ALLOWANCE TO DEPENDANTS.

The Finance and Law Committee reported that, in terms of a report by the Clerk (Mr. J. M'G. Jack) as to the powers of the Commissioners, they recommended that they could not grant a donation or allowance to Mrs. T. B. Henderson, the widow of a runner, or her children. In Mr. Jack's report, it was stated that several years ago the Commissioners granted special donations to the Edinburgh Royal Infirmary and the Leith Hospital, as an acknowledgment of the benefits conferred on their disabled employees by these institutions. The Commissioners' action, however, was challenged in Court, and it was held that the Commissioners were not entitled to grant the contributions, as these did not form expenses of managing and maintaining the undertaking; and the Royal Infirmary and the Leith Hospital repaid the donations. Section 8 of the Commissioners' Order of 1902 enlarged their powers. It authorized them to grant allowances "to aged and disabled employees, and to the dependants of any employees who may be serving with any of His Majesty's Forces in time of war or emergency." Section 30 of the Order of 1908 repealed the above section, but provided that "the Commissioners may, if they think fit, notwithstanding such repeal, continue thereafter, for such period as they may determine, to pay any such allowances under the said section so repealed which have been previously granted." The Superannuation Scheme under the Order of 1908 sanctioned superannuation allowances only to employees retiring after lengthened service, or on account of permanent infirmity of mind or body. On several occasions, the Commissioners have declined to grant allowances to widows and families of deceased employees, on the ground that there was no power to do this. But occasionally they had granted allowances, though they knew, when doing so, that they were exceeding their strict powers. These payments, however, were never challenged. The latest allowance they granted was on Nov. 30, 1908, of 7s. 6d. a week to the widow of the foreman at the Leith works. Objection was taken to this on the ground that making such a grant was *ultra vires*. Prior to the 1908 Order, the Commissioners' accounts were subject to objection at the instance only of a Commissioner of the Corporations of Edinburgh and Leith, or of any creditor holding a security on the undertaking. Since this Order, however, every ratepayer in Edinburgh or Leith, as well as every gas consumer, can also object. The recommendation was adopted.

Messrs. John Wright and Co. have received instructions to supply a suite of cooking apparatus for use in the Peers' Kitchen, at the Houses of Parliament, and a similar suite, including an instantaneous water-heater, for the Royal Scottish Academy's New Galleries, Edinburgh.

GAS FOR HEATING AND COOKING IN BELFAST.

Increased Consumption.

At a recent meeting of the Gas Committee of the Belfast County Borough Council, the Gas Engineer and Manager (Mr. J. D. Smith) reported that the number of heating and cooking appliances sent out by the Gas Department between Oct. 1, 1909, and Sept. 30, 1910, with the estimated consumption of gas in each case, was as follows: Cookers (1186), 43,289,000 cubic feet; fires (1285), 16,345,200 cubic feet; wash-boilers (32), 66,560 cubic feet; hot-plates and grillers (154), 554,000 cubic feet; circulating boilers (8), 49,920 cubic feet; laundry irons (121), 50,336 cubic feet; auto cookers (128), 1,868,000 cubic feet; auto boiling-rings (2060), 7,519,000 cubic feet; free boiling-rings (5534), 20,199,100 cubic feet—total, 89,942,316 cubic feet.

The report here referred to came before the Council in the minutes presented by the Gas Committee at the quarterly meeting last Tuesday. In the absence of the Chairman (Mr. J. A. Doran), owing to ill-health, Mr. Squire moved the adoption of the minutes. In doing so, he remarked that some 90 million cubic feet of gas had been consumed by the cookers and other appliances sold during the past twelve months. There were something like 870 million cubic feet of gas burnt by the cookers over the whole city, which was more than one-third of the total production of gas. This bore out what they had tried to impress upon the Council—viz., that it was not to the gas burnt for lighting that they looked for the great increase that would take place in connection with the necessities of the gas-works, but to the gas used by cookers.

PROPOSED SUPPLY OF CHEAP GAS FOR TRADE PURPOSES IN EDINBURGH.

Report by Mr. W. R. Herring.

At the Meeting of the Edinburgh and Leith Gas Commissioners on Monday last week—Lord Provost BROWN in the chair—the Works Committee submitted a report by Mr. W. R. Herring, the Engineer, as to the supply of cheap gas for trade purposes, which they had adopted. In the course of the report, Mr. Herring stated as follows.

The Commissioners having resolved to charge a special rate for gas used for trade purposes, other than for lighting, heating, and cooking, where such gas is used in approximately equal weekly quantities throughout the year, and principally during daylight hours, I have pleasure in intimating to you the following conditions under which this supply will be granted.

The supply must be by separate meter and fittings—the user either supplying his own meter under the usual conditions as to test, &c., or paying for the hire and fixing of such meter from the Commissioners,

and such alteration as may be required in the necessary piping to connect up the meter from the main supply. The user must provide a separate set of piping, exposed or otherwise, to the satisfaction of the Commissioners, leading from the meter to the apparatus in which the gas is to be used. The user must supply to the Commissioners a schedule of the apparatus proposed to be supplied with gas under the special rates; and such apparatus will have affixed thereto a seal bearing the Commissioners' mark. No additional apparatus is to be installed without first intimating to the Commissioners that such is the intention of the user; and this must be duly stamped before being put into use. Any infringement of these conditions will warrant the Commissioners in charging the current account at the lighting rate without notice to the consumer. The special rate will be applicable to such apparatus as the following:—

Gas-engines.	Blowpipes.	Laundry-irons.
Branding machines.	Brazing machines.	Enamelling-stoves.
Linotype machines.	Heating-irons.	Mufflers.
Laundry machines.	Soldering apparatus.	Drying-stoves.
Kilns.	Tailors' irons.	Gas-hammers.
Coffee roasters.	Upholsterers' irons.	Gas-blasts.

Also to such others as may be added to the list from time to time by the Commissioners. The rates to be charged for gas supplied under these conditions have been fixed at 2s. 3d. per 1000 cubic feet for the ensuing twelve months, for gas used within the boundary of the city of Edinburgh and burgh of Leith, and 2s. 9d. per 1000 cubic feet for gas used beyond such boundaries, both subject to the usual scale of discounts.

Applications for supply under these conditions will be dealt with in the order in which they are received, when an inspector will be sent to advise as to how the fittings are to be arranged; and after the fitting work has been executed, the inspector will again examine, and if found satisfactory, approve, of such, and attach the Commissioners' seal, after which the supply will be turned on. The Commissioners reserve all their rights under the Gas-Works Clauses Acts, the Sale of Gas Acts, &c., as to the terms and conditions of supply, so far as they are applicable to these special circumstances.

Attached is a schedule of the hire rates for meters, which also include the cost of the supply cock and connecting up when the new meter is fixed near the source of supply, but not otherwise. [The rates range from 3s. per annum for a 2-light up to 70s. for a 250-light meter.]

Judge Bryson (the Convener of the Committee) expressed a desire to take the subject back for further consideration; and this was agreed to.

The Directors of the Continental Union Gas Company, Limited, have decided to recommend, at the forthcoming general meeting, dividends for the half year of 2 per cent. on the ordinary stock, free of income-tax, and 3½ per cent. on the preference stock, less income-tax; making 4 per cent. on the former and 7 per cent. on the latter for the year.

HASTINGS CORPORATION AND THE GAS-BURNER BILLS.

Complaint as to the Expense of Opposition.

The Corporation of Hastings were among the opponents of the Gas Companies (Standard Burner) Bills; and when the accounts for the opposition were presented at the meeting of the Town Council last Friday, the Town Clerk (Mr. B. F. Meadows) mentioned that he had received information that the Houses of Lords and Commons fees would be £11 11s. 6d. less than the amount stated in the accounts. Mr. E. C. Smith asked why another item of £215, which would also have to be paid, was not included in the accounts. Alderman Chesterfield said he had never seen a bill which he liked less than the one before them. Hastings had entered into the opposition to the Gas Bills with other towns in order to avoid many of the expenses which they had before them. This would be a warning to be more careful how they took part in joint opposition in future. They were informed that if they opposed jointly their costs would be much smaller than if they did so individually; but when they were scooped in, they had been let in for Parliamentary Agents' expenses which they did not expect to have to pay. If they had known things would be as they are, he ventured to say that Hastings would have opposed the Bills individually, and left the other places to go their own way. The Town Clerk had said that when he saw the accounts he was staggered by them. He (Alderman Chesterfield) was sure he had not the remotest idea that a twentieth part of the cost mentioned in the accounts was being incurred against the Corporation. Dr. Gray (the Chairman of the Hastings and St. Leonards Gas Company) said he could prove positively that Hastings was left alone at the last in opposition to the Bills. Before the House of Commons, only three towns appeared by Counsel—Hastings, Liverpool, and Torquay. Liverpool's case was taken separately; the opposition of Torquay was suspended; and this left Hastings alone. Dr. Gray read extracts from the shorthand notes to show that Counsel spoke on behalf of Hastings, and that the Town Clerk alone gave evidence against the Bill. Mr. Cox asked if it was not a fact that Hastings was merely taken as typical of all the other towns. The Town Clerk agreed that this was so. The accounts were then passed for payment, in due course, without any further discussion.

It may be of interest to give the constituent items in the accounts, as submitted by the Public Lighting Committee. They are as follows: Advertising, £1 5s. 10d.; Town Clerk's journeys to London and sundry disbursements, £9 5s. 5d.; Parliamentary Agents' charges, £101 4s. 4d.; Parliamentary Agents' disbursements—viz., printing petitions to the Houses of Lords and Commons, and copies, £11 6s.; Houses of Lords and Commons fees, £26; copies of printed proceedings before Committees of both Houses, and documents, £33 11s. 1d.; postages, telegrams, and incidental expenses, £2 9s. 7d.—total, £185 2s. 3d. These expenses are apart from the proportion of those incurred in connection with the joint opposition to the Bills.

GAS EXHIBITION AT CARLISLE.

In opening an exhibition of gas appliances at Carlisle, on Monday of last week, the Mayor remarked that it was only the duty of every citizen to do all he possibly could to assist the Gas Committee in continuing to improve the success which had at all times attended the city gas-works. Gas was first manufactured in Carlisle by a private Company; but the works in 1850 were purchased by the Corporation, at a cost of £18,000. The price paid was a good one; but he thought it was the wisest speculation that the Carlisle Corporation ever made. They had now had the works for sixty years; and the progress which had attended them had been simply marvellous, and the value of the undertaking had increased from £18,000 to £147,489. The sum standing against the works at the present time was £26,959. They saw, therefore, how favourably the gas-works stood from a strictly commercial point of view. All this had been accomplished in face of the fact that Carlisle charged a very low price for gas—only 2s. 3d. per 1000 cubic feet. This spoke volumes for the management of the concern. By the economical working of the gas undertaking, the citizens were paying less in rates than they otherwise would have had to do. During the last eight years, the average profit handed over to the City Treasurer was £5574; and this meant a rate of 4d. to 5d. in the pound. This was a splendid exhibition. Placed before them were the latest innovations in the gas engineering world; and they would derive much interest from examining them and getting their objects explained. He hoped no change would take place as to the manner of the disposal of the profits on the works in the future, and that they would continue to be handed over to the City Treasurer to keep down the rates of the city. No doubt the Committee, under the able management of Mr. J. P. Buck (the Chairman) would do their best to keep the works a profitable and popular concern; and they looked forward to the result of this exhibition being a further increase in the demand for gas for fires and the other appliances which were to be seen around them.

The exhibition, as stated by the Mayor, proved a highly interesting one; and a quantity of the most modern apparatus by the leading makers was included. The lighting was on the Keith high-pressure system. All the details were arranged and carried out by the Engineer, Mr. Harold E. Bloor.

Maltby Water Supply.—At the meeting of the Rotherham Rural District Council on Monday last week, a motion that the Sheffield water scheme, so far as Maltby is concerned, be deferred for a period of five years, to enable the Council to duly consider any other local scheme which in the meantime may be brought forward, and that the Clerks to the Council be instructed to withdraw application for the sanction of the Local Government Board to the Sheffield scheme, was negatived by ten votes to five.

METROPOLITAN WATER BOARD.

Humphrey Pump for Chingford—Afforestation Question.

At the Meeting of the Metropolitan Water Board last Friday, the Works and Stores Committee presented a report as to the provision of pumping machinery for the Chingford reservoir. They had received a report from the Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.) to the effect that it was necessary to provide for a total pumping capacity of not less than 180 million gallons in 24 hours, made up of one unit of 20 million and four units of 40 million gallons each. He had studied the various methods of raising large volumes of water to moderate heights, and in which only a comparatively low lift was required—viz., gas and oil engines, electricity, triple-expansion engines, and the Humphrey pump; and, having regard to his advice, the Committee recommended the installation of the pump just named by the Pump and Power Company, Limited. The cost of the installation of five pumps, inclusive of a Dowson gas-producer plant and all accessories, would be £19,388. The recommendation was discussed at some length; but it was eventually adopted.

Mr. Easton asked the Chairman of the Works and Stores Committee whether he could give any information as to what his Committee were doing with regard to the proposal to plant 100,000 trees upon the Board's waste land for afforestation. Mr. Hearson, in reply, said he believed a resolution had been passed that trees should be planted on certain conditions on some parts of the Board's land. It was not, however, desirable to plant everywhere; and it was in the hands of the Chief Engineer to bring up a report as to whether or not it would be desirable to plant the trees.

NOTTINGHAMSHIRE WATER FOR DERBYSHIRE.

Local Government Board Sanction a Scheme.

Some time ago, the Rural District Council of Clown, near Chesterfield, applied to the Local Government Board for power to borrow £41,500 for a joint scheme of water supply for the whole of their district; the source of the proposed supply being in Nottinghamshire. Owing to the fact that the recent report of the Select Committee on the Water Supplies (Protection) Bill was invoked by the opposition, the inquiry into the matter held by Mr. A. W. Brightmore, M.Inst.C.E., on behalf of the Board, assumed more than usual importance; and the result has been awaited with interest.

The Council have entered into an agreement with the Wigan Coa and Iron Company, Limited, to purchase in bulk by meter a supply of water, derived from the new red sandstone of Nottinghamshire, which

was met with by the Company in sinking their shaft at Manton, near Worksop. The water is pumped to the surface by machinery fixed at the base of the sandstone in a well adjacent to the colliery shafts; and by the provision of a further set of machinery at the surface, the Company will deliver the water into a reservoir, from which it will gravitate to the eastern boundary of the Council's district, where it will be pumped again to a service reservoir and water-tower for distribution to the consumers—the total lift being 850 feet.

At the inquiry, it was urged, on behalf of the Nottinghamshire County Council, by Dr. Handford, the County Medical Officer of Health, that the question of the preservation of the water resources of the Nottinghamshire sandstone for use in the county had assumed the greatest importance, and that in considering the subject they had to look forward to a longer period than thirty years. Evidence was given of the remarkable recent increased population in the mining districts of Nottinghamshire; and it was stated to be now known that the present agricultural area would ultimately be covered by collieries, with their necessarily enlarged demands for water, while the supply derivable from the sandstone was a fixed and limited quantity. A copy of the report on the Water Supplies (Protection) Bill was put in, especially with reference to the appropriation of water for the benefit of other places, without regard to the needs of the locality from which it was taken, and to the proposed central authority for taking the necessary measures to husband the supplies and advise on their allocation. It was further urged that the particular question had been considered by Parliament in connection with the Worksop Water Bill, and that the Nottinghamshire County Council had obtained a clause prohibiting the sale of water beyond the boundary of the county without their consent.

On behalf of the Rural District Council, a large body of evidence was given as to the pollution and inadequacy of all the existing supplies, and as to the urgent need for an abundant supply of pure water for the colliery population, which was increasing with great rapidity. Evidence was given by the Council's Consulting Engineers (Messrs. G. & F. W. Hodson, of Loughborough) that no adequate source existed within their area; that, though a part of the district was entitled to demand water from the Derwent Valley Water Board, the cost would be prohibitive, and that the only available source was the Nottinghamshire sandstone; that Parliament had decided in the Worksop Bill that, so long as water was available from Manton, no further well ought to be sunk in the neighbourhood; that the county boundary, being an artificial one, was not such as was contemplated in the report; and that the needs of the district urgently requiring a supply ought to be considered before those of a problematical population.

The decision of the Local Government Board has now been made known; and their sanction to the loan has been granted.

Among the recent elections of members of the British Chamber of Commerce in Paris we notice there is included the name of Simon-Carvès, Limited, of Manchester.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

At the meeting of the Scottish Junior Gas Association—Western District—in Glasgow to-night, Mr. G. Scott, of the Meter Repairing Department of the Glasgow Corporation, gave a plain and a detailed account of the procedure followed in the repair of meters. This is a work which the Corporation do for themselves, as is also the case in Paisley, and, to a greater or less extent, in one or two other towns. Mr. Scott's description of the work will not appeal to a wide circle of readers; but there doubtless are many gas managers in small works who like to do a little tinkering themselves at apparatus under their charge, and to them the paper will be of assistance. There was a spirited discussion, which was confined to the ordinary members—not to any degree upon the repair of meters, but rather upon the use of meters generally, and the latest developments in the world of meters—in which a number of interesting things were said.

The monthly meeting of the Edinburgh and Leith Gas Commissioners on Monday was noteworthy for two items of business, neither of which was technical, but both of which were of importance. In the one instance, Lord Provost Brown stated, somewhat abruptly, his view that something was being held back in the non-communication to the public of the prices at which commodities are bought. The subject was sent to the Works Committee for inquiry. The inquiry can only result in one of two ways. Either the Commissioners may resolve to give the price of every article that is contracted for, which would be absurd and unbusinesslike, or they may go on as they have been doing, and withhold that which, in their opinion, should be withheld, which would be the common-sense way of doing business. The other matter referred to was the remark, looked upon as slanderous, made by an elector in Leith regarding the privileges of town councillors. The subject has gone into the hands of the Law Agent to the Commissioners. It is right of the Commissioners to be chary of their honour. At election times much has to be endured; but this instance is looked upon as more offensive than the ordinary badinage which is often indulged in, in respect of the positive nature of the assertion and of the relationship of the speaker to a gentleman who is a member of the Leith Town Council.

The municipal elections which have been concluded this week have not been of much interest; neither have they produced much change in the outward appearance of public life. In Glasgow, I note that Bailie Paxton, taking the place of Mr. M. W. Montgomery, has been appointed Convener of the Gas Committee, and Bailie Kirkland takes Bailie Paxton's place as Sub-Convener. In Arbroath, Bailie Smith has been re-elected Convener of the Gas Committee—a position which he has held since 1906. In Falkirk, Bailie Bogle, who has been Gas Convener since 1906, has been elected Provost of the burgh, and Councillor Muirhead has received the appointment of Convener of the Gas Committee. The most important public question involved in any

of the municipalities of Scotland has been that of the water supply to the city of Aberdeen. A few months ago, the Corporation promoted a Bill in Parliament for the taking of water from the River Avon. The Bill was rejected, and since then there has been continued agitation locally as to the desirability of making further effort to seek a new water supply in the Avon, or to augment the existing supply from the River Dee. There were contested elections on Tuesday in five of the eleven city wards; and the result was that, in every instance, the advocates of the Dee extension proposals were returned by large majorities. Lord Provost Wilson heads the Avon party, which now counts 13 in the Town Council, as against 21 for the Dee party.

Last night, the first of a course of lectures under the auspices of the Smoke Abatement League was delivered in the Technical College, Glasgow, by Professor Glaister, of Glasgow University. The Professor dealt with the subject of "The City Atmosphere and the City Health." Last night, also, there was a meeting of the Company of Honourable Alchymists, in the botanical lecture-room of the Glasgow University, at which Principal Sir Donald M'Alister presided, and a lecture on "Air Pollution" was given by Professor J. B. Cohen, of the University of Leeds. Professor Cohen said the smoke problem divided itself into three distinct parts—the cause, the effect, and the remedy. The cause was easily explained. It was mainly a chemical question on which he did not propose to enter. The suggested remedies were manifold. They were partly chemical—such as the substitution for coal of combustible gas, coke, anthracite, or coalite—and partly mechanical, as illustrated by the use of mechanical stokers, forced draught, and other appliances. There was no doubt that the use of gas for heating was gradually gaining ground among the more enterprising manufacturing firms; but nothing but outside pressure, steadily and firmly applied, would induce the great bulk of coal users to make a change.

On the occasion of the turning on of the gas to a new gasholder at Buckie on the 31st ult., ex-Provost Webster, Vice-Chairman of the Buckie Gas Company, Limited, who performed the ceremony, said that during the past year the gas-works had been practically reconstructed. The retort-house had been rebuilt, and a setting of retorts of the most up-to-date style put in. It was found that their storage capacity was too small, and a new gasholder, of 54,000 cubic feet capacity, had been built. Forty-one years ago, the first holder was erected, and it met the requirements of the Company for 17 years. Then a second holder was installed; but it was now too small. The price of gas was then 12s. 6d. per 1000 cubic feet; but they had been reducing it until it now stood at a little over 5s. per 1000 cubic feet. He considered that it would be some time before another reduction would take place, as a large capital outlay had been incurred during the year. Alterations had been made on the condensers, the purifiers had been almost renewed, and an exhauster had been installed, which would mean better results. The successful termination of the various contracts was due to a large extent to the capabilities of Mr. S. Milne, of Aberdeen, the Engineer. The Contractors for the new holder were Messrs. Clayton, Son, and Co., Limited, of Leeds.

In the Sanquhar Town Council last week, a letter from Messrs. Firth Blakeley and Co. was read, in which it was asked that they be relieved from the liability of counterbalancing a telescoped gasholder. The Town Clerk explained that the firm had undertaken to put the gasholder in proper order, and a sum of £53 of the contract price was still kept up until the work should be completed; but they now wanted to be relieved of their contract altogether. If the Council would do this, they were prepared to put in a new engine and exhauster, to assist in counterbalancing the pressure, for a sum of £60 and the old exhauster. He held that this new plant was worth £110, and that the value of the old exhauster was £10; and thus the Council were getting £40 off the first contract. The Council resolved to consult Mr. W. Fairweather, of Kilmarnock, upon the matter.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 5.

Sulphate of Ammonia.

Although the tone has been quieter during the past week, there has not been much actual decline in values; but in some instances purchases have been made at 1s. 3d. per ton less money. Buying for covering old contracts has to a certain extent been suspended meantime; but the new orders which have come on the market have been sufficient to absorb all parcels offered. The quotations at the close are £12 18s. 9d. to £13 per ton f.o.b. Hull, £13 to £13 1s. 3d. per ton f.o.b. Liverpool, and £13 1s. 3d. to £13 2s. 6d. per ton f.o.b. Leith. No further sales by manufacturers have been recorded for future delivery; but it is stated that second-hand sellers are offering for shipment January-June, 1911, at 2s. 6d. to 5s. per ton below prompt prices.

Nitrate of Soda.

The spot values of this article are still unchanged at 9s. 4½d. per cwt. for ordinary and 9s. 7½d. for refined quality, the market continuing quietly steady thereat.

LONDON, *Nov.* 7.

Tar Products.

The markets for tar products have remained fairly steady throughout the past week. Pitch continues in about the same position, though reports from the Continent state that this article is being offered there for delivery between now and April 1 next at considerably under the equivalent of the market price here. In creosote, the market is not very active, but there does not appear to have been any further weakening in prices. In benzol, 90 per cent., the market remains in about the same position; but no substantial transactions are reported to maintain the recent improvement. Fifty's show a little dull; but the price keeps fairly firm. Crude carbolic continues in about the same position. Solvent naphtha is quiet; heavy naphtha is fairly steady; and in some quarters slightly better prices have been obtained.

The average values during the week were: Tar, 17s. 3d. to 20s. 9d. *ex*

works. Pitch, London, 34s. to 34s. 6d.; east coast, 33s. 6d. to 34s.; west coast, 37s. to 38s. 6d. Clyde ports, 32s. 6d. to 33s. Manchester, 33s. 6d. to 34s. Liverpool. Benzol, 90 per cent., casks included, London, 7½d. to 7¾d.; North, 7½d. to 7¾d.; 50-90 per cent., casks included, London, 7¾d. to 8d.; North, 7½d. to 7¾d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4d.; North, 3⅜d. to 3¼d.; solvent naphtha, casks included, London, 11½d. to 1s. 0½d.; North, 11d. to 1s.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 10½d. to 11d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2⅛d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market remains steady, though the volume of new business has not been quite so large. Actual Beckton can be purchased at £12 10s.; outside London makes, at £12 8s. 9d.; and Hull, at £13 1s. 3d. to £13 2s. 6d. In Liverpool, the quotation is £13 2s. 6d. to £13 3s. 9d.; and in Leith, £13 3s. 9d. to £13 5s.

Owing to a clerical error, the price of Beckton sulphate in last week's report was given as £12 2s. 6d. instead of £12 12s. 6d.

TAR PRODUCTS.

Representative manufacturers give the following as fair current values for the week ending Nov. 5.

Article.	Basis.	Lond'n.	North-East Coast.	East Coast, Yorks.	West Coast. Liverpool.	West Coast. Manchester.	Glasgow.
Tar, crude	ton	21s.	19s.-21s.	20s.-22s.	19s.-21s.	19s.-21s.	—
Pitch	,,	36s.-37s.	33s.	33s.-33s. 6d	36s.	35s.-36s.	37s.
Benzol, 90%	gal.	8¼d.	7d.	8d.	7¼d.-8d	7¾d.-8d.	7¼d.
Benzol, 50/90%	,,	9d	8d.	9d.	8d.-8¼d.	8d.-8¼d.	—
Toluol, 90%	,,	—	9d.	10d.	10d.	10d.	—
Crude naphtha, 30%	,,	—	3½d.	3½d.	3¼d.	3¼d.	—
Light oil, 50%	,,	—	3d.	3½d.-3¼d.	3d.	3d.	—
Solvent naphtha, 90/160	,,	—	10½d.	10½d.	1s. 1d.	1s. 1d.	1s.
Heavy naphtha, 90/190	,,	—	11d.	11d.	1s.	1s.	1s.
Creosote in bulk	,,	2¼d.	2¼d.	2d.	2½d.	2⅛d.-2¼d	2d.
Heavy oils	,,	3d.-3¼d.	2½d.	2¼d.	3d.	3d.	—
Carbolic acid, 60's	,,	1s. 0½d.	11½d.-11¾d.	1s. 0½d.	1s. 0½d.	1s. 0½d.	1s. 1d.
Naphthalene, crude drained salts	ton	—	37s. 6d.	40s.-42s. 6d.	50s.	50s.	—
Do., pressed	,,	—	50s.	63s.	60s.	60s.	—
Do., whizzed	,,	80s.	—	—	75s.	75s.	65s.
Anthracene	unit	2d.	1½d.	1½d.	1¼d.	1¼d.	—

Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade has been irregular, and prices have stiffened through the effect of the uncertainty as to working in South Wales. In the local steam coal trade, best Northumbrians are from 9s. 9d. to 10s. per ton f.o.b.; but the values move rather rapidly. Second-class steams are from 8s. 6d. to 8s. 9d. per ton, and steam smalls are about 5s. 6d. to 6s. 6d. There is a steady output at most of the collieries, and it is well taken up generally. In the gas coal trade, the demand steadily improves; while the deliveries on the long contracts are now very heavy, and take up much of the production of the best-known collieries. Durham gas coals vary in price according to quality. The usual classes are from 8s. 9d. to 9s. 7½d. per ton f.o.b.; while for "Wear" specials, 10s. 4½d. is quoted. One or two contracts have been placed, but not for very large quantities. There are also offers for coal for some of the Italian ports, but at prices which are not acceptable to the sellers. The lack of ready steamers is impeding the gas coal trade. It has forced up the rate of freights, and thus makes the coal dearer at the ports of delivery. It has also hindered the shipments on contract; and there is as yet not much prospect of early full supplies. In coke, the demand is fair; and the fuller production of gas coke seems to be well taken up. Good gas coke is firm at about 14s. per ton f.o.b.

Scotch Coal Trade.

Trade has deteriorated. There has been no improvement in the home demand, and the foreign inquiry has gone back somewhat. There is much indecision, on account of trade troubles, in consequence of which the market is meantime greatly weakened. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 310,350 tons—a decrease of 25,074 tons upon the previous week, but an increase of 13,170 tons upon the corresponding week last year. For the year to date, the total shipments have been 13,432,446 tons—an increase upon the corresponding period of 710,244 tons.

Encouragement of Cooking by Gas.—With the view of encouraging the use of gas-stoves for culinary purposes in the household, the Cardiff Gas Company offered medals and certificates to scholars in the elementary schools of the borough for the best assays on the "Use of a Gas-Cooker." About 300 girls entered for the competition; and six silver and a like number of bronze medals have been awarded.

Gas Lighting in Japan.—The report of the British Consul on Kobe (Japan) furnishes the information that a new gas company has been formed for the purpose of supplying gas to the city of Sakai. The capital of the Company is 600,000 yen (£61,250), of which the Osaka Gas Company (65 per cent. of the capital of which is American) is to hold 51 per cent.—thus securing a preponderating interest. The gas is to be supplied by means of a main laid from the Osaka works. The Osaka Gas Company is the only one left in the city in which foreign and Japanese interests are jointly concerned; and the undertaking continues to be prosperous. The net profit for the second half of 1909 was upwards of £25,000. A dividend of 9 per cent. was declared.

Trial of Improved Gas Lighting in Fulham.—The Lighting Committee of the Fulham Borough Council report that in June last authority was given to the Gaslight and Coke Company to substitute inverted for upright incandescent burners in six of the public lamps at Parson's Green, to demonstrate their contention that improved efficiency and economy would be obtained by the alteration; and it was proposed, subject to the experiment proving satisfactory, to lay a scheme before the Council for the conversion of the whole of the remaining gas-lamps in the borough upon reasonable terms. Having inspected the new burners, the Lighting Committee are of opinion that there is not sufficient improvement in the lighting to justify the expense of altering all the remaining lamps in a similar manner; and they have instructed the Town Clerk to inform the Gas Company to this effect.

Weston-Super-Mare Water Supply.—A Committee meeting of the Weston-super-Mare Urban District Council was held last Tuesday for the purpose of receiving a report presented by the Water Supply Committee in reference to a proposed application for powers to provide additional water storage accommodation. The Committee recommended that application should be made to the Local Government Board for a Provisional Order amending the local Improvement Act of 1887 so as to provide for the construction of a reservoir at the north-east corner of the water-works estate, on a site abutting the existing structure in the Bristol Road, or adjoining the present reservoir. An open meeting of the Council was subsequently held, at which it was explained that the local water supply was absolutely unlimited, and that the extra storage accommodation would be provided merely in view of the rapidly-increasing population. The recommendation of the Committee was confirmed unanimously.

Leigh (Lancs.) Gas-Works and the Rates.—The Leigh (Lancs.) Town Council have applied to the Local Government Board for sanction to borrow £7700 for gas purposes; the money being required for mains, services, and meters. At an inquiry held recently by Mr. H. R. Hooper, it was elicited that the Gas Department had no reserve fund, and that, in addition to the amounts given in aid of the rates out of profits, gas had been supplied free for street lighting to the estimated value of £22,000 before it was charged in the rates to the Highways Department. Since the undertaking was purchased by the Local Authority in 1874, loans had been sanctioned to the total of £175,000; and the capital expenditure up to March last was £168,780. The Inspector, at the close of the inquiry, said he thought it would be well if the Gas Department set about building up a reserve fund, and not give the profits on the undertaking for a reduction in the rates as formerly.

Abstraction of "Excess" Water from the Thames.—At the meeting of the Thames Conservancy on Monday last week, the subject of the drawing of "excess" water from the Thames by the Metropolitan Water Board was under discussion. The Clerk to the Board (Mr. A. B. Pilling) wrote that he had had under consideration the accounts rendered by the Conservancy in respect of the abstraction of "excess" water from the Thames during the half year ended June 30. He regretted that he could not advise the Board to entertain the claim; and he suggested that the accounts should remain in abeyance, without prejudice to the rights of either party, pending the settlement of the questions now at issue between the Board and the Conservancy. The Secretary to the Conservancy (Mr. F. W. Geary) replied on the 24th ult. that he could not advise his Board to allow the payments due for excess water to remain in abeyance as suggested, and requested that the Clerk would be so good as to forward a cheque for the amount due (£622) without further delay. The matter was discussed in private; the Chairman (Lord Desborough) making a statement with regard to the present position of the negotiations between the Conservators and the Board; and consideration was given to the question of promoting a Bill in Parliament in the ensuing session to deal with the matter.

End of the Torquay Water-Works Farming Experiment.—It was decided by the Torquay Town Council yesterday week to discontinue the farming operations which have been carried on by the Water Committee on a portion of the watershed on Dartmoor. Some years ago, the Corporation purchased the whole of the land constituting the watershed with the idea of ensuring the water against any possible risk of contamination from the farms which then existed. In order to make use of the land, and in the hope of recovering part of the heavy outlay, the Committee decided to carry on farming under conditions which would entail no danger of the water becoming impure. Their operations have been subjected to considerable criticism from time to time; and at last week's meeting of the Council, Mr. Taylor, the Chairman of the Committee, had to admit that, from the financial point of view, they have not been a success. He said that in 1900 they had an indebtedness of £724, and it had increased this year to £2875, against which, however, they had stock of the value of £2870. In his opinion, the indifferent results were principally due to want of capital, and the consequent limitation of the quantity of stock. Mr. Glanfield and Mr. Pike severely criticized the operations of the Committee, and contended that thousands of pounds had been lost through the municipal farming operations during the last ten years. Alderman Winter said the important question was that of the maintenance of the purity of the water. The watershed was purchased with this object, and the farming had been a subsidiary thing. What was to be done in future to keep the land in a pure and sweet condition? Mr. Taylor promised that the Water Committee would bring up a scheme for dealing with the land; and with this understanding, it was decided that the farming operations should be brought to an end as soon as might be found convenient for the disposal of the stock.

Gas Supersedes Oil in Dutch Guiana.—According to the annual consular report on Surinam (Dutch Guiana), during the past year the old oil-lamps by which in the past the town of Paramaribo had been lighted gave place to gas-lamps. The new lighting, though a great improvement on the former state of things, is not altogether satisfactory. The Gas Company are the only importers of coal for sale; the stock being kept up to 4000 tons of Welsh steam coal.

Retford Gas and Water Supply.—The gross profit of the Retford Corporation in connection with their gas undertaking for the past financial year was £2113, compared with £2287 for the preceding twelve months; while the net profit is £697 against £942. The water-rates amounted to £2993, compared with £2936. This is considered satisfactory, having regard to the slackness in the building and other trades and the large number of empty houses. The amount standing to the credit of the profit and loss account is £753.

Salford Corporation and Slot-Meter Consumers.—The *agenda* for the monthly meeting of the Salford Town Council includes two notices of motion in the names of Messrs. Bescoby and Johnson, whose object it is to secure a rescinding of the resolution of the Council passed in June last which reduced the quantity of gas supplied for a penny to consumers using automatic meters from 30 to 27 cubic feet. Mr. Johnson also asks that the reduction in charges to large consumers agreed to at the June meeting of the Council be rescinded likewise.

Ventilation of Street Boxes.—The Town Clerk of Woolwich has issued a circular-letter to the other Metropolitan Borough Councils, stating that the Woolwich Council are of opinion that, having regard to the fact that explosions have taken place owing to the escape of gas into street boxes constructed by the Post Office, telephone and electric lighting companies, and other similar authorities, these boxes should be ventilated, so as to prevent the possibility of such explosions. In order to ensure a uniform system of ventilation, the Woolwich Council have addressed a communication to the London County Council, asking them to consider the advisability of framing regulations so as to secure ventilation. It is intended that the regulations should apply to the whole County of London, and be enforced by the various local authorities, who are asked to support the action taken in the matter.

Damage to a Gas-Meter by a Precocious Girl.—At the Tottenham Children's Court last Tuesday, a girl named Marie Carroll (14), residing with her parents at 26, Dunbar Road, Wood Green, was charged with damaging a prepayment gas-meter, the property of the Tottenham and Edmonton Gas Company, in her house, and stealing 6s. 4d. from it. According to the evidence, the girl told an extraordinary story about being attacked by burglars, and having her hands tied while they broke open and emptied the money-box of the meter. This turned out to be an entire fabrication, the result of the girl having seen such an incident depicted at a cinematograph theatre. When asked by a detective to give particulars of the burglars, she admitted that she had broken open the meter, and spent some of the money. The prisoner's father said she was a very good girl, and was a great help to her mother. The Bench bound her over with her father in a sum of 40s. each to be of good behaviour for six months. The Chairman remarked that they had been in doubt as to whether they ought not to inflict a fine, and charge it to the father, for having allowed the child's innocent mind to be influenced by these pictures.

In view of the fact that gas managers will soon be thinking about the extra demands for gas which will be made upon them at the time of the Coronation next year, their attention may be directed to the latest catalogue (No. 157) of Messrs. D. Hulett and Co., Limited, of High Holborn, W.C., a special feature of which is a collection of devices suitable for that occasion. They occupy eight pages, and include various transparencies, printed in colours, suitable for gas. The rest of the catalogue, which extends to about 140 large pages, consists of upright and inverted burners, lamps, brackets, pendants, lamp-columns, mantles and globes, gas stoves and radiators, &c.

APPLICATIONS FOR LETTERS PATENT.

24,622.—Barker, W. H., jun., "Conveyors for coal." Oct. 24.

24,684.—Fleischer, E., "Gas-producers." Oct. 24.

24,698.—Archer, D. J., "Gas-heaters for irons." Oct. 24.

24,754.—Cross, F. L., "Regulator for gas." Oct. 25.

24,793.—Woodworth, L., "Gas-engines." Oct. 25.

24,794.—Woodworth, L., "Internal combustion engines." Oct. 25.

24,863.—Marks, E. C. R., "Valves and taps." A communication from J. A. Barbour. Oct. 26.

24,903.—Davis, H. N., and Twigg, W. R., "Gas-fires." Oct. 26.

24,904.—Davis, H. N., and Twigg, W. R., "Fuel for gas-fires." Oct. 26.

24,948.—Grieve, G. K., and Peebles, W. C., "Gas-governor." Oct. 27.

24,973.—Ehrich and Graetz, "Incandescent lamps." Oct. 27.

25,001.—Hume, G. W., "Pipe-joints." Oct. 27.

25,009.—Schroeder, F. W., Penny, W. J., and Gibson, E. J., "Delivery or supply pipes." Oct. 27.

25,049.—Thorp, T., F., & H. T., "Apparatus for the combustion of a mixture of gas and air in enclosed spaces." Oct. 28.

25,066.—Pace, P. C., "Manufacture of air gas." Oct. 28.

25,085.—Kenyon, T., "Testing water-pipes." Oct. 28.

25,093.—Berry, J., Glover, W. T., and Meters Ltd., "Gas-meters." Oct. 28.

25,103.—Morrison, E. J., "Controlling valves or the like at predetermined times." Oct. 28.

25,128.—Corbett, J. J., "Gas-regulator." Oct. 29.

25,141.—Bennis, E., "Discharging coal from waggons." Oct. 29.

25,172.—Glover, A. W., and George Glover and Co., Ltd., "Coin-controlled mechanism for governing the supply of gas." Oct. 29.

25,177.—Fowler, R., and Meters Ltd., "Gas-meters." Oct. 29.

25,178.—Richey, W. F. A., and Stobart, H. J. S., "Light concentrating appliances for use with gas-fittings." Oct. 29.

During a short, sharp thunderstorm which occurred at Newcastle-under-Lyme last Tuesday evening, the Waterloo Chemical Works of Messrs. C. Massey and Son were struck by lightning. One effect was to fuse an electric wire in the office and burst a gas-pipe in the wall immediately behind it, setting the place on fire. By means of a patent fire extinguisher the flames were quickly put out; and with the gas turned off and the dynamo stopped, any danger there might have been was soon over.

During a storm which swept over the Manchester district on Monday night of last week, a marquee erected at the corner of Ashfield Road and Tatton Road, Sale, containing a collection of gas stoves and gas appliances, was blown down and damage caused to the stock to the extent of about £100. The exhibits in the marquee had been got together under the direction of the Stretford Gas Company to demonstrate the usefulness of gas for lighting, cooking, and heating; the firms represented at the exhibition including Messrs. Fletcher, Russell, and Co., Messrs. John Wright and Co., the Parkinson Stove Company, Messrs. Wilsons and Mathiesons, Messrs. Makenson, Bowen, and Co., and the Davis Gas-Stove Company. Measures were at once taken to repair the damage. The marquee was re-erected, and the exhibition continued over Saturday. The Stretford Gas Company had a stall at the exhibition.

The Foster Engineering Company, Limited, of Morden Road, Wimbledon, S.W., send a copy of their most recent list of the Foster gas-governors. They are making two types, either of which can be used for all pressures up to 27 inches. Pressure charts have been taken by an independent authority on two governors—the Foster Standard Duplex and one of another make; and we are informed that, whereas the line given by the Foster was perfectly straight, the charts taken on the other one showed the pressure varying between wide limits.

Mr. M. D. Propert, the District Auditor for the Local Government Board, in his report on the accounts of the Pontypridd Urban District Council for the year ended March 31, 1909, states that considerable expansion is shown in the volume of the financial transactions of the Council as compared with the preceding accounts. The results on the year's trading in the gas-works, tramways, and electricity works disclosed a deficit in each case; and it was necessary for him to press that these accumulating deficits should be met and dealt with by the Council in accordance with statutory provisions. The financial results were laid before the Council promptly and very clearly by their Accountant (Mr. L. R. Williams) year by year; and it was essential that the demands which were placed before the Council in the estimate half yearly should be provided for, if it was desired to establish the trading concerns on a commercial basis. The alternatives were fairly obvious.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

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TENDERS FOR

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TAMWORTH GAS COMPANY. Tenders by Nov. 12.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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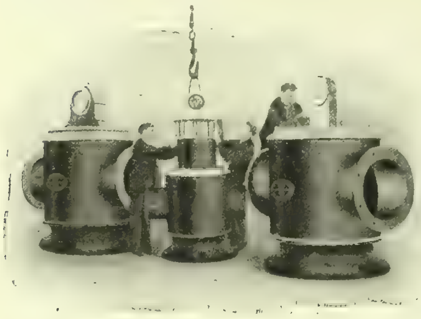
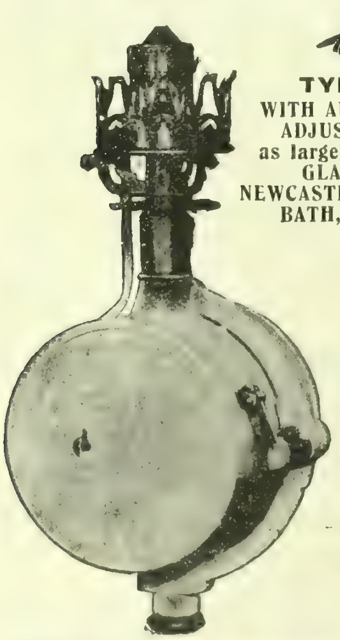
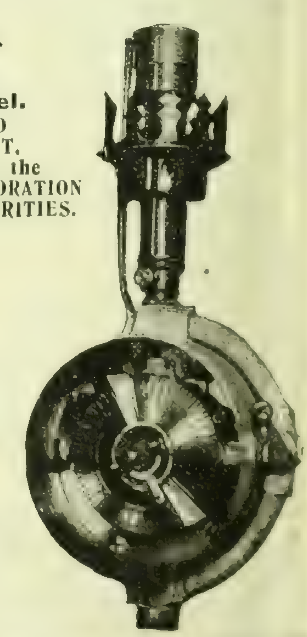




HORSTMANN AUTO-ADJUSTMENT GAS CONTROLLER.



HORSTMANN HAND ADJUSTMENT GAS CONTROLLER.

Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Nov. 8, 1910.

THE JOURNAL OF GAS LIGHTING WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXII. No. 2479.] LONDON, NOVEMBER 15, 1910. [62ND YEAR. PRICE 6d.

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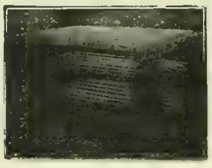
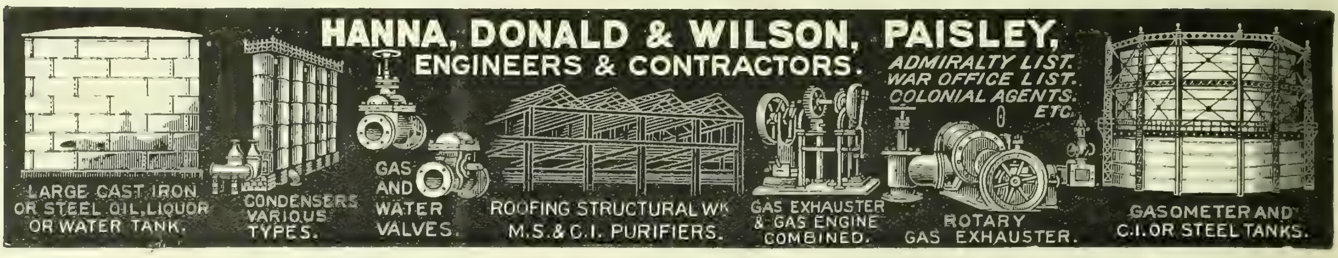

"RACK" GRIDS.


WATER TUBE CONDENSERS.



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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2479.—TUESDAY, NOVEMBER 15, 1910.

EDITORIAL NOTES—GAS, &c.

Efficiency of the Inverted Burner.

Fixed or Adjustable Gas and Air Supplies.

THERE was a truce to controversial commercial questions affecting lighting, when, at the meeting of the Illuminating Engineering Society, last Tuesday, Mr. F. W. Goodenough, the Controller of Gas Sales of the Gaslight and Coke Company, read a paper, prepared in the most general terms (evading all polemical trading subjects, and refusing even nominal distinction to the newest of modern types of high and low pressure lamps), on the brilliant advances that have been made in gas lighting. For once, and for the first time in the short history of the meetings of the Society, the voice of the electrician was still; and he gave full scope to all that could be said within the limits set by the author of the paper, without even a note of praise or a note of dissent or criticism. There is one thing that must be said in respect of the embargo placed upon himself and his subject by Mr. Goodenough (though the restraint must have been irksome to a nature that commercially has been largely moulded by the acute forces that are brought to bear upon him in his official position), that, as the responsible executive officer of a Company engaged—particularly at this time—in severe competition, in installing in immense numbers the newer forms of gas-lamps in the streets, and in raising to a height to which it has never been raised before, in the 100 square miles or so constituting the area of the Company, illuminating efficiency in the streets, it would have been against the interests of those he serves to have carried his subject beyond the purely technical aspects, or to have touched upon points that are the subjects of both settled and open contract. Upon this self-imposed and necessary restraint under his peculiar circumstances, Mr. Goodenough has our sympathy; but nevertheless it was a good tale that he had to tell. It was a tale that put under complete seal those whilom pessimists and prophets who pronounced the approaching ostracism of gas as a lighting agent; it was a tale that disclosed, by contrast with the order of things that existed at the dawn of electric lighting, flights in efficiency that have astonished even those of the most optimistic tendency among the technicians of the gas industry; it was a tale that told of a new era in lighting having set in for the gas industry, with attendant possibilities too great for prognostication in any shape or form. With relatively so little of the thermal energy of the gas expended in obtaining the lighting efficiency of the present time, there is in the waste a reserve to which the aid of science may be evoked to show the path to profitable utilization. Let those among our competitors who will not acknowledge stubborn facts go their way; their acknowledgment is something with which we can dispense in the position in which we find ourselves, but acknowledgment will come in due time by the sheer force of circumstances.

In the paper and in the discussion, there was complete concord in placing the inverted gas-burner at the head and front in efficiency of gas lighting to-day, both with high and low pressures. The reasons for pre-eminence are being sought; and various theories are presented in the paper and discussion. The most obvious causes are those that were naturally grasped first; and these were duly submitted. Observation of the flame, in a well-constructed burner, shows that it is a concentrated one, having a high flame temperature; and observation, too, shows that it is impossible for the gas and air mixture to escape being heated prior to reaching the point of combustion. It is also obvious, from a mere consideration of the construction of the burner and from observation, that whereas with the upright burner useful lighting rays were dissipated above the horizontal, now they have been largely transferred to below the horizontal, and are being brought to bear in the most serviceable of all directions. But the most interesting theory, and one which has not so far as we are aware been suggested before, for the greater efficiency of the inverted burner, was introduced by Mr. Carpenter; and he seems pretty confident of his ground in this matter. To put it briefly here (his fuller remarks on the point will be found in our report of the discussion), it is this: With the upright burner, the particles of the flame that are most active in promoting the incandescence of the mantle are carried with considerable velocity upwards, and are not allowed time to effectively perform their work; whereas with the inverted burner there is, being downward, a retardation of flow, and, by the time the active particles reach the bottom of the suspended mantle, they come to (so to speak) a pause, before taking an upward course to escape in the spent products. In this way they are given longer time to do their work. It is a pretty theory, which, at any rate, is acceptable on common-sense considerations, subject, of course, to scientific ratification. It may be suggested the point is one that would serve as a practical subject for investigation by the Gas Engineering and Fuel Department of Leeds University.

Here we are confined to one or two prominent matters that transpired at the meeting. Technically, in the discussion, Mr. Carpenter's contribution was the most important. The theory advanced by him, as already alluded to, was one point; but as important, if not more important in the practical sense, is the (as it were) challenge that he has now thrown down in favour of non-adjusting burners as opposed to those with either or both gas and air adjustments, available for use at any time. But let there be no mistake about Mr. Carpenter's plan, which he has put into large use in South London, and is going to offer to the private consumers in the district (the necessary burner having now been developed) this winter. The burners, while non-adjustable after they have left the hands of the suppliers, are adjusted, in regard to the area of the air apertures and the passing capacity of the gas nipple, to the conditions under which they are to be used before being supplied to street-lamp or to private consumer. Mr. Carpenter does not make such a proposal as this, and put it into such extensive practice as he has done, without being very sure of his grounds. But there will be many who will be sceptical as to whether his proposal will have any general application outside his own area, and as to whether the disadvantages will not greatly outweigh the advantages. A straight coal gas is supplied in South London; but that is not the usual condition in other supply districts. Composition varies; and, even with straight coal gas, it must vary during the periods of transition in carbonizing practice from comparatively low makes per ton to the higher makes. Pressures also vary; but not so much as formerly during the lighting hours. There again, as Mr. Goodenough and Mr. A. E. Broadberry both pointed out, the tendency of pressure is upwards, and this introduces a variation of condition that is gradually growing. However, whatever changes in gas supply there may be, fortuitous or premeditated, the burner with fixed conditions removes from the consumer all power of making any readjustment. And in cold blood, Mr. Carpenter holds that this is the best thing that can happen. It follows that the standardizing of the burner demands the standardizing of the gas supply within limits; otherwise there will be much trouble. And in this way the gas supplier imposes on himself delimitations that will bring him difficulty. But perhaps we are considering the question without any sufficient knowledge as to the new burner's capabilities; and it would be interesting to know whether there are points in the quality of the gas and in the pressure between which the burner will give a fairly constant duty, as tested photometrically, in the South Metropolitan Gas

Company's district and in a district where the burner has been adjusted for a mixed gas. Seeing, too, the amount of attention such a burner must necessarily receive for adjusting it to a certain set of conditions, it would be interesting to know how stands its cost in comparison with an ordinary burner having adjustable air and gas supplies.

To the present we cannot see (though open to conviction) that any good case has been made out for the burner with unalterable gas and air supply. Given a burner with adjustment devices, when these are set to impart the maximum illuminating power, what advantage over this will a fixed conditioned burner possess? We fail at the moment to see any, unless a blessed state of perfection in the matter of uniformity and constancy rules throughout a gas-supply area. What disadvantages are there to the consumer? The power of adjustment is removed, together with the ability to effect an easy clearance of the gas-nipple when required without dismantling the burner. Mr. Goodenough made this latter point in replying to the discussion. We know of inverted burners in more than one house of the South Metropolitan Gas Company's area that are all the better for having a needle regulator attached. The burners are adjusted for both gas and air supply to a nicety to get the maximum efficiency. There comes a time, however—the straight coal gas of the South Metropolitan Company notwithstanding—when a vast improvement in the illuminating efficiency of the burners is secured by the clearance of the nipples; the restoration being effected by simply turning the regulating needle up and down two or three times. Consumers who have accustomed themselves to this rapid means of restoration of illuminating duty, will want to know what advantage they are to gain as compensation by adopting burners that remove this labour-saving power from their hands. All gas consumers are not unintelligent; and all gas consumers do not want to be put under—shall we say, obliged to be put under?—the Company's maintenance system. The inverted mantle and the needle regulator have greatly reduced the cost of maintenance and labour to the private consumer. Mr. Carpenter spoke of the dust in the air of London. In this connection it would be interesting to know something as to the relative costs of labour, or the number of street-lamps that a man can in a given time put into fit working condition with, respectively, fixed conditioned burners and burners with gas and air adjustments.

These are merely points that occur on a first consideration of the matter. But now that Mr. Carpenter has given prominence to his advocacy of fixed gas and air supplies to burners, the matter is bound to obtain a wider discussion than it received last Tuesday. Let it be remembered, however, that Mr. Carpenter's experiments extend over the past eighteen months, and that he has at his back a large experience of the burner in South London. But no one would regret more than he if these facts deterred anyone from stating his views. Argument and experience combined form the best path along which to get to the bottom of a matter of this kind.

Livesey Advisory Committee and Gas-Fire Research.

The hope was expressed in the "Journal" for Nov. 1 that the departure of Mr. E. W. Smith, the Chemist to the Gas-Heating Research Committee, from Leeds to Birmingham would not mean any suspension of the work of the Committee; but almost before the printing of the page in which that hope appeared had been completed, information was to hand that the Council of the Institution and the Gas-Heating Research Committee had determined that, at any rate for the present, the work should be discontinued. As the information was not official, and there was no particular urgency in making the announcement, it was deferred until after the conference arranged with gas-fire manufacturers for last Wednesday at the Leeds University. It has been thought opportune to suspend the work for the present under existing conditions; and it must be quite evident to all who give the matter serious consideration that it is not an easy thing to get anyone to readily pick it up, and conduct it from the point at which Mr. Smith (who has shown splendid aptitude for it) has relinquished it. But this does not, nor does the dissolution of the Gas-Heating Research Committee, necessarily imply that gas-heating research is to be permanently abandoned at the Leeds University. Whether or not Mr. Smith had continued at Leeds, there is little question that the research on its recent lines would have been, and not at a very distant date, brought to a termination. But that research bearing upon gas heating should for ever be banished from the Leeds University would, it is obvious, be entirely opposed to the purposes and objects of the Gas Engineering and Fuel Department; and it becomes now, as Professor Smithells (without pledging himself to any particular action at this juncture) pointed out on Wednesday, entirely a matter between the Livesey Advisory Committee and the University Authorities. Upon that Committee, the Gas Institution and the Society of British Gas Industries have a good representation; so that we fail to see that there is any good cause for agitation in regard to the matter of the suspension. The interests of the gas industry are in good hands; and there may be full reliance that, in their deliberations over the work of the Gas Engineering and Fuel Department, the Livesey Advisory Committee will not lose sight of practical problems that still require solution in relation to the gas-fire.

To the point to which Mr. Smith has carried his work, there will be some further report at next year's meeting of the Institution in Glasgow. An interim statement on various details, however, was made by him last Wednesday; and in it several hints are to be picked up by gas-fire makers. It was also clear that he has been examining the various introductions of the manufacturers this season, having the common purpose of increasing efficiency, in order to see how far the object has been realized. But the main point for present consideration is as to whether there is at the moment further work that can be usefully prosecuted at the University in connection with gas heating. We cannot help feeling, after what was said at the meeting on Wednesday, that there is. Mr. Smith thinks that gas-fire research has only just commenced; but it is also his opinion that further work requires greater facilities than can be obtained at the University. That is a point that the Livesey Advisory Committee must soon take into consideration. But that the matters for investigation in connection with this large subject have not been exhausted, within the capacity of the University, by what Mr. Smith has done, is easily gathered from the speeches at the conference; and, in the indications these afforded, the conference was not barren of good, and we are not without hope that it will have influence on future work. To give illustration. It was the view of Professor Cohen that a great deal of work has still to be done; one of the most important problems for solution being as to the relation between temperature and radiation. Mr. Smith himself pointed out that the thickness, composition, porosity, and form of fuel is a subject for special experiment. There are practical difficulties in this regard; but surely in collaboration with the manufacturers of such fuel, the difficulties would not be insurmountable. There is also the subject of surface combustion in relation to the "fuel" and fire-brick. Mr. H. M. Thornton suggested the point that gas-fire makers desire to see some standard of test of gas-fires adopted by gas-supply authorities generally, so that the makers may know under what standard conditions their apparatus would be tested—thus affording them some guidance in their work. This view was endorsed by Mr. A. P. Main. The variation of the shape of flame by using the gas supplied in different towns is a question suggested by Mr. J. H. Brearley as worthy of investigation for future direction in burner design; and he also pointed to the meagre knowledge that exists as to the heat conductivity of "fuels."

These are only illustrations of suggestion; but we submit that they, without going further, show that there is useful work in connection with gas heating which it is within the power of the department at Leeds to take in hand, independent of what is being done by the gas-fire makers. The latter are themselves more and more introducing into their work scientific assistance; but in each case, naturally, they work on their own lines and to their own ends. For this they are to be applauded, as it all means initiative—successful or attempted—in the cause of progress. But if we take the results of individual work of the firms to date as embodied in their productions, and place them side by side for inspection, it is seen that there is anything but uniformity of view. Mr. Smith by his work independent of the makers, having their various productions at his command, has done something to adjust the differences. On all grounds, we hope the Livesey Advisory Committee will take counsel with the Leeds University authorities, so as to see what can be done to further the important and helpful work that, as seen above, has not yet reached a point that justifies it being laid aside until again some practical question arises for the penetrating searchings of science.

Extension of Sulphate Manufacture to Small Works.

Small works in isolated position (though, as a rule, well situated for the local disposal of sulphate of ammonia) have hitherto been in a disadvantageous position for making a profit, compared with large works, from the ammonia they produce, simply on account of the small magnitude of their operations, and the cost of the conveyance of ammoniacal liquor to places where it could be worked up economically; and, as a matter of fact, the ammonia to them has been nothing but a source of nuisance and cost. But it need be so no longer, as simple ways and means have been found to give them the profit and relief that must be desired. The Managers of small works look from the distance on many things which seem only applicable to the larger undertakings with admiration not unmixed with envy; and sulphate of ammonia manufacture is one of these things. It will therefore be, we doubt not, that they will hail with some satisfaction the advent within their own province of a sulphate plant which has been already put into practical operation, and at gas-works between the two widely separated points in annual gas production of 5 million cubic feet and (say) 26 millions—respectively at Wareham and Dunstable. It was the pleasure of Mr. Philip G. G. Moon, of Bournemouth, to present the information concerning the plants at a meeting of the Southern District Association last Thursday; and he must be complimented upon his (so far as recollection serves) maiden effort in this direction, and on having for his subject a matter that represents distinct progress for the smaller undertakings of the gas industry.

The basis of this process is the absorption of ammonia from the gas by dilute sulphuric acid—a process that is not new, as shown by Dr. Harold G. Colman in the discussion, but one which has been surrounded by many practical difficulties in application in connection with town-gas manufacture. As a matter of fact, the fundamental part of the process is so old that Mr. A. E. Broadberry was able to refer to the use of sulphuric acid for this very purpose (and to quote substantiating evidence from "King's Treatise") by Mr. Alexander Croll, at the Tottenham Gas-Works in the forties. Mr. Croll appears to have attained some amount of success; but the sulphate produced was of a bad colour. The disclosure as to antiquity is good and interesting so far as it goes. But the fact remains that the process as applied by Mr. Croll was discontinued, and that the product was not all it should have been in regard to colour. The Tottenham Gas-Works were but small in those days, and so are the gas-works for which the new plant of to-day is primarily intended. But where Mr. Croll was unsuccessful, the Chemical Engineering Company have been successful; and the resultant product of the process is of good colour. From what Mr. Broadberry remarked, it may be conjectured that it was tar that affected the purity of the sulphate in Mr. Croll's time. But in the plant as now brought before us this is overcome by the provision of means of filtration; and with the weak solution of sulphuric acid that is employed in it, we imagine there would be very little deposition of tar. The first point is that the new and simple plant Mr. Moon introduces to us successfully yields a vendible product, and converts a source of trouble into one of profit.

It would be unfair to contrast with too much severity the economic aspects in relation to the working results of this plant with those of the long-established plants on the ordinary lines of operating method. But it may be held that distinct progress is recorded when plant of the kind is productive of advantages where the old process was incapable of being used, and when the differences between the results and effects of such a plant and the more economical results and efficiencies of the larger and ordinary plants have been reduced to the narrow compass that are revealed by Mr. Moon in his paper. The plant has a low initial capital cost; it is so simple that it can be operated, after brief instruction, by a novice; the amount of attention required is small (in fact, at Dunstable it has not occasioned any increase in the works' staff); and there is an all-round benefit from its adoption, which (on the testimony of Mr. Harold Woodall and Mr. Moon) can be summed up in the two small words "it pays." There are no complete figures yet available as to working expenses; but from the little plant at Wareham, with a selling price of £11 per ton for sulphate, a net profit of £7 per ton is anticipated. The quantity of effluent—this is an important consideration—is also small in comparison with the ordinary method of working. The most vulnerable point for criticism is that of plant depreciation. But here again there is sufficient information to give every confidence. It is common knowledge that many difficulties have been encountered in designing a practical process for ammonia recovery in which sulphuric acid is employed; but there is an amount of experience which gives good warrant for saying that the use of a weak sulphuric acid solution will not have any alarming effect upon the lead elements of the plant.

Several trifling adverse suggestions (it would be strange were it not so) might be made in regard to the process. There is, for instance, the effect on the illuminating power of the gas. But here we are dealing with an acid that is kept below a strength of 4° to 5° Twaddel. There is the question of the effect upon purification of the complete removal of the ammonia from the gas. There again, however, Mr. Moon and Dr. Colman give satisfactory answers. In the small Wareham plant only the free ammonia is dealt with, and there is a loss in the virgin liquor of no less than the equivalent of 1·1 lbs. of free ammonia and 4 lbs. of fixed ammonia. But with such limited operations, the greater economy lies in this waste. In the Dunstable plant the range of operations makes the fixed ammonia worth recovery. But whatever point can be raised that is apparently derogatory to the new plant and process as compared with the old situated in works of comparatively extensive, or fairly extensive capacity, there are presented by the newly introduced process ample compensations for the proprietors of works of small to medium gas outputs. There is one question that was not asked in the discussion, which suggests itself at the moment. It is: Is there any contamination of the sulphate by sulphur through the action of sulphuretted hydrogen on the acid?

The process is so succinctly described and explained by Mr. Moon that it would be waste of time to here attempt to reduce the description to greater brevity. But the introduction it has received will enlist almost immediate consideration from those responsible for the most economical working, with freedom from nuisance, of small gas undertakings; and sulphate of ammonia manufacture will no doubt be shortly conducted in places where hitherto there has been little hope of it being carried on.

Higher District Pressures.

Latter-day developments in gas supply in respect of the volume, diversity of demand, and extension of the hours of heaviest load have had quite a revolutionary effect on district pressures; and there is nothing in the whole of the technical requirement and responsibility of the time in connection with a gas undertaking that calls for greater attention and acumen than this. This applies to gas undertakings both large and small. Need any gas man be told that the design and arrangement of much gas plant, designed and erected in a day in which there could not be prediction as to the upheavals in gas supply and methods of utilization of the future, are, without large conversion or supervenient aid, insufficient for the needs of the time. Under existing circumstances (without auxiliary help), pressure at the consumers' meters is defined and limited by the conditions of the canalization; and the highest available constant pressure from the works is that which can be thrown by the lightest uncupped holder. The existing conditions are those which have to be dealt with; but the existing conditions are of such variety that it is difficult to prescribe any single plan that would be best for universal application to give what is requisite to-day—a higher pressure, and with the *plus* and the *minus* from the standard of uniformity reduced to the narrowest possible limits. The ideal standard is a uniform pressure throughout a district, with a permanent degree at the point of delivery to consumers. Beyond that gas suppliers cannot expect to go, though they may bring influence to bear in respect of internal fittings to ensure the minimum of fluctuation at the point of use.

This fairly expresses the general view of Mr. Thomas Price and the principal speakers in the discussion on his paper on "District Pressures," read at the Southern Association meeting last Thursday. It was a subject that lent itself to the expression of views and experiences roving over much ground. How to deal with the weak spots in a district by boosting (a system that is becoming the vogue with remarkable rapidity from large works down to those fairly low in the scale of magnitude) may be taken as figuring at one end of the discussion with the governing of consumers' incandescent burners at the other. But the main feature of the whole paper and discussion was the recognition of the need of higher and constant pressures, both in the interests

of consumers and the maintenance of a good reputation by the gas undertaking. And the view of the author is, and he is supported by Mr. Charles Carpenter and others in this, that the ideal system for obtaining what is required would be to keep a pressure throughout the district of supply in excess of the maximum pressure demanded for any purpose and in any place, and then govern down to requirement at every service. This would mean (save for variation caused by inadequate internal fittings) a constant pressure at any given point in a house.

It goes without saying that to realize such a condition of things means expense. But there is little doubt that this is what we are coming to. For such a purpose a reliable consumers' service governor would be required; and, in Mr. Price's opinion, its application would pay. Mr. Carpenter has found a governor that answers the purpose, and one in which accuracy and safety are the main factors of the design. He speaks of the cost of attaining this ideal condition of governing at every service, and, in the same breath, tells of the several thousands of the governors that have been already applied in South London. Service governors, for the outlet of consumers' meters, were in the old flat-flame days advertised for the securing of economy, and to protect the consumer against the supposititious fraudulent conduct of the gas manager in increasing the pressure to make "the meter wheels go round." To-day the service governor is advocated on the ground of efficiency. The distribution department now costs much more than of old; but gas prices are receding and dividends are maintained, and have an upward tendency. If higher pressures and service governors are the directions (combined with reasonable and approximately regular calorific power) of future supply efficiency, the expense must be faced as part of the price to be paid for assuring stability and fair profits on the capital embarked in the business. Changes of this kind do not come about with the swiftness of a *coup d'état.* The several thousands of governors in South London were not fixed in a day. They have grown to their present number gradually; and the number, Mr. Carpenter mentions, is rapidly increasing. Questions of policy in the gas industry have certainly a tendency to multiply; and the Southern Association discussion on this matter adds another to those already on the table receiving or awaiting consideration.

High-Pressure Shop Lighting.

"What Mr. A. E. Broadberry does not know about high-"pressure gas lighting is not worth knowing" someone remarked at the Southern Association meeting on Thursday; and when the paper he then read on the subject—full of information of how to make high-pressure lighting a commercial success, and a combative force in the hands of a gas undertaking—is perused, it will be readily agreed that the commonplace quoted was not by any means misapplied. Record has already been made in the "Journal" of what has been done by the Tottenham and Edmonton Company in high-pressure gas lighting at the Alexandra Palace, and of the success that has attended the installation. But from the commercial point of view, the principal value of Mr. Broadberry's present communication will be awarded to the detailed narrative of effort that has resulted in schemes of co-operative shop lighting being launched, and immediately springing into a brilliant success, so much so that the tentative installation, which led to other isolated or independent installations, has grown to an extent that there has been, on the score of economy, a linking-up in one considerable area, with service from a central compressing-station. A well-lighted shopping street is undoubtedly an attraction; and time would be wasted to-day in trying to persuade tradesmen to the contrary. And when co-operative schemes such as those Mr. Broadberry tells about are introduced, no tradesman on the line of high-pressure pipes can afford to stay out, unless his premises are as brilliantly lighted as the others (though perhaps not so economically) by some other method. It is a good branch of business for a gas undertaking—both from the monetary and from the competitive point of view; and how to cultivate it is pointed out in the paper. The contribution, being so informative, is bound to incite others to go and do likewise; and that is not the least part of the intrinsic value attaching to its practical character. Any regret that there may be over the postponement of the discussion is modified by the fact that this will bring Mr. Broadberry to his feet again at a future meeting, to supplement, after further experience, the present information.

High-Pressure Lights in London.

From Victoria Street the new high-pressure gas-lamps, under the Westminster lighting contract, are being extended in the main thoroughfares as rapidly as possible. One of the most striking of the effects so far as the lamps have been erected is at the end of Parliament Street by the Houses of Parliament. This is an important spot; and one where at most times during the day there is heavy traffic. Our legislators this November and December sitting (which may be brief and momentous) will at any rate find their paths to and from the House—if not inside—illuminated in unprecedented manner. The Right Hon. John Burns, too, will be able to look out of the windows of the offices of the Local Government Board on a night lighting scene that will convince him as to the wisdom of his department exercising care over their sanctions for municipal electricity supply undertakings, and cautioning local authorities to be discreet in their money spendings in this direction. Turning to the City, inspection of the central trial suspension gas lighting in Cannon Street (some particulars of which were published last week) shows how thoroughly well the surfaces of the road and footpaths are lighted, apart from traffic shadows. Being in straight line with the centrally suspended flame arc lamps, comparison with them is readily made; and the palm for efficiency will not be conferred upon the latter by anyone making disinterested observation. Taking a perspective view along the street from the flame arc lighted section, the part of the street from Cannon Street Station to the London Bridge end of the thoroughfare is alive with light. Looking from the gas-lighted portion towards the flame arc section, the latter is distinctly dull in contrast. High-pressure lighting with the new inverted lamp has toned down the old meretricious characteristic of the flame arc lamp, the concentrated but oscillating effulgence of which was once upon a time regarded by electricians as representing the unsurpassable point in rational street lighting. We certainly thought our electrical contemporaries would ere this have published some curves constructed from the incomparable readings of the young men who pursue nocturnal investigations by the aid of illumination photometers. Surely they are losing a fine opportunity. Perhaps, however, it has been concluded that the present is an occasion when silence is golden. We are informed that there was an error in stating last week that the two burners in each lamp were of only 1000-candle power apiece. The figure should have been 1500 candles each burner.

Free Labour.

Some days ago, the National Free Labour Association held their eighteenth annual congress; and the time proved not to be inopportune for drawing attention to the fact that Trade Unionists, in spite of appearances, are by no means having things all their own way in the industrial world. The Free Labour Association boasts of over three-quarters of a million members—a not insignificant fighting force, when properly organized, as they seem to be under the leaders of this Association, for freeing workers from the necessity of abiding under a condition of things which many of them find irksome. The President, Mr. J. W. Roberts, explained the full meaning of the movement, when he told the delegates that he had always been a free workman, because he objected to tie himself down to drudgery for life by belonging to a Trade Union, and thus putting himself on an equal footing with men who were incompetent. He added that there were plenty of good workmen stuck fast in Trade Unions, absolutely committing industrial suicide by helping to keep the happy-go-lucky tribe of incompetents. This is a view of the matter which may be commended, for their most earnest consideration, to the workmen concerned. The advantages in some respects which, on the face of things, appear to be offered to workers who join a Union, are only too apt to prevent anybody who is not of a particularly inquiring turn of mind from looking closely into the possible disadvantages. However, even if the matter is put plainly before employees, it is to be feared that often they find themselves compelled to join the Union ranks, whatever may be their own feelings. It is the continual exercise of their power for the purpose of compelling to join the ranks those who wish to remain outside, which has been such an unwelcome feature of Trade Unionism. At present, in some branches of industry the Trade Unionists may have in their hands the means of enforcing their wishes on men and masters alike; but we look to the growth of the Free Labour Association, and the wide dissemination of

their views, to accomplish more and more as time goes on in the direction of altering this state of affairs.

And Free Workers.

Meanwhile, another style of "free" workers is attracting a larger amount of attention than the Association. We refer to the strikers in the South Wales coalfield, a section of whom—it is to be hoped, but a small one—have been behaving themselves in a manner which is exceedingly well calculated to alienate from their cause such public sympathy as it may previously have enjoyed. Disastrous as is the existing state of affairs to the coalfield, it may easily prove in the end to be still more calamitous to Trade Unionism. Refusing to carry out an agreement signed by the officials of their own Federation on their behalf, and later rejecting terms which were also accepted for them by their leaders, the miners have indeed drawn into the glare of publicity one of the strongest points against the Unions that can possibly be urged—namely, that while an agreement is binding on the employers, the labour representatives have no means of making it similarly binding upon the men. Rioting, looting, and the wilful destruction of valuable property have immeasurably weakened the case of the men; and we can imagine Mr. G. R. Askwith, of the Board of Trade, who visited Cardiff on Saturday for the purpose of interviewing the employers and bringing about a termination of the dispute (or disputes, for there appear to be several), found himself confronted with a particularly hard nut to crack. The present position is deplorable, and the outlook at the time of writing is even more threatening. Intervention may accomplish much; but there must be a point in the matter of concession beyond which it is impossible to go. Has this point already been reached without satisfying the demands of the men, and must the fight go on to a finish?

Personal.

Mr. H. M. Thornton (of the Richmond Gas Stove and Meter Company, Limited), who has been Chairman of the Ilford Council during the past twelve months, was recently presented with his portrait in oils at a large and influential gathering of prominent townspeople. It has been decided that the portrait shall be hung in the Council Chamber of the Municipal Buildings.

Arrangements have been made with Dr. Harold G. Colman to act as Consulting Chemist to the Richmond Gas Stove and Meter Company, Limited. Dr. Colman will pay frequent visits to Warrington, and undertake the general supervision of the laboratory and research work relating to gaseous heating, in conjunction with Mr. L. Dixon, who has for several years been the Engineering Chemist to the Company. Further extensive alterations are being made to the Warrington laboratories in connection with this appointment.

Obituary.

Mr. James Brown, well known in the West of Scotland as a retort-setter, died last Thursday afternoon, at his residence in Hamilton, in his 54th year. In the setting of retorts Mr. Brown had few equals; and he carried out contracts of this description far and near. He succeeded to the business only a few years ago.

After an illness of four months, the death occurred on Monday last week, in his 74th year, of Mr. Alfred Parker Gibbons. Some years ago, deceased was employed in the engineering department of the Phœnix Gas Company; and after the amalgamation with the South Metropolitan Gas Company his services were retained. He retired some ten years since.

The death is reported as having taken place on the 12th ult., of Professor Joseph Forster, Lecturer on Hygiene at the University of Strasbourg, and one of the Editors of the "Archivs für Hygiene." Deceased, who had attained the age of 66 years, was a distinguished pupil of Pettenkofer, and had devoted much time to the hygienic aspects of questions of lighting and heating and water supply.

The death occurred at "The Glen," Eastbourne, last Tuesday, of Mr. Charles Aird, brother of Sir John Aird, Bart., and of the late Mr. Joseph Aird. Deceased was in his 79th year. He was formerly a partner in the firm of Messrs. John Aird and Sons. After a complete breakdown in health, he retired from the firm some 34 years ago; and since then resided on the South Coast. Before joining the above-named firm, he was for a number of years Lessee and Manager of the Kingston-on-Thames Gas-Works, and was also at one time a Director of the Crystal Palace (now South Suburban) Gas Company. As a partner in the firm of Messrs. John Aird and Sons, he was in very close touch with all gas and water undertakings—the arrangement between the partners being such that he had control of this portion of the business. The funeral took place at the Eastbourne Cemetery on Saturday.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 510.)

A week full of important events closely touching the monetary world! American elections, the failure of the Conference, labour troubles, runs on banks, and a big Government issue, form a remarkable array of factors. In the turmoil, Consols have been a great sufferer. After marking 80 on Wednesday, they dropped to $78\frac{3}{4}$ on Friday. The opening was quiet but unruffled; and the day developed some good points. Many government issues were bought, and Consols advanced $\frac{1}{8}$. Rails were dullish; but other leading lines were strong. Tuesday was intent on the settlement, and fresh business was rather inanimate. But high-class issues were in demand. Consols were done at higher figures, though the nominal quotation was unchanged. Wednesday was agitated by various influences—political, industrial, and monetary. Consols began well, but closed $\frac{1}{8}$ lower. Rails were rather better. Americans see-sawed over the elections; but the Foreign Market was firm. On Thursday, the strong position of Government issues was seriously assailed by the attractive New Zealand Loan; and Consols receded $\frac{1}{4}$. Rails came in for some support by buyers. On Friday, general depression was caused by the failure of the Conference. Government issues of all sorts were put down at once—Consols losing $\frac{3}{8}$ for money and $\frac{1}{2}$ for the account. Everything else was weaker, more or less, except Americans. Nothing came to cheer Saturday; and, moreover, the settlement did not appear to have gone through quite smoothly. The general tone was weak; but Consols remained unchanged. In the Money Market, there was tightness in view of a short supply, and discount rates were stiffer. Business in the Gas Market was more active; some issues being more than usually dealt in. The tendency was quite favourable; movements, though slight, being in the upward direction. In Gaslight and Coke issues, the ordinary improved half-a-point, with transactions ranging between $104\frac{3}{4}$ and $105\frac{3}{4}$. The secured issues were unchanged. The maximum was done at $87\frac{1}{4}$ to $88\frac{1}{2}$, the preference at 103 to $104\frac{3}{4}$, and the debenture at $80\frac{1}{2}$. South Metropolitan was very firm; all dealings being within the limits of $121\frac{1}{2}$ and $122\frac{1}{2}$. The debenture marked 81. Nothing was done in Commercials. Among the Suburban and Provincial group, Alliance and Dublin changed hands at $88\frac{1}{8}$ and $89\frac{1}{2}$, Brentford new at $185\frac{1}{2}$ and 186 (a rise of 1), British at $44\frac{1}{2}$, and South Suburban at $121\frac{3}{4}$. Brighton ordinary advanced 1. In the Continental companies, business was more than usually plentiful. Imperial marked from 189 to $189\frac{3}{4}$ *cum div.*, and from $184\frac{1}{2}$ to $185\frac{3}{4}$ *ex div.* (or a rise of $\frac{1}{2}$). Union was done at from 85 to $91\frac{1}{4}$, ditto preference at 138, European fully-paid at from $23\frac{15}{16}$ to $24\frac{1}{8}$, ditto part-paid at $17\frac{15}{16}$ and $18\frac{1}{16}$, and Malta at $4\frac{5}{8}$. Among the undertakings of the remoter world, Primitiva was dealt in at $7\frac{9}{32}$ to $7\frac{7}{16}$, ditto preference at $5\frac{3}{16}$ to $5\frac{5}{16}$, San Paulo at $15\frac{1}{8}$, and Melbourne $4\frac{1}{2}$ per cent. at 100 and $100\frac{1}{4}$.

ELECTRICITY SUPPLY MEMORANDA.

Depressed Spirits—Fear and Tribulation—Unremunerative Capital Expenditure—Cramb on Meat-Choppers—The Workman and His Light—Metallic Filaments and Price per Unit.

The outdoor lighting number of the "Electrical Times," upon which comment was made in our issue for Oct. 25 (p. 250), seems to have fallen very flat. No one is heard speaking of it; and it is not being quoted as an authoritative pronouncement on any point. It was, as a matter of fact, like the street vendor's views of the Lord Mayor's Show, all too highly coloured and exaggerated. We rather think that electrical engineers are not in the habit of taking the "Electrical Times" very seriously. But there have been traces of gravity just lately in certain of "Meteor's" paragraphs when dealing with the question of street lighting. Bounce and pretence cannot survive long in face of actualities; and the new street-lighting effects in London by means of high and low pressure inverted gas-lamps are evidently toning down a little the volatile writer of the leader notes in our electrical contemporary. At length, and not any too soon, he recognizes that the new gas-lamps in London streets have intensified the infirmities of the bulk of the street lighting by electricity, though he grudgingly makes the acknowledgment in the words: "The new gas lighting in Victoria Street, with all its faults, is much better than arc lamp effects of twenty years ago." The sneer contained in the words "with all its faults" provides, as it were, a little rift through which sight is allowed of the vindictiveness and irritability that the present position of affairs has provoked in the electrical camp. There is, in truth, genuine fright. "Now that the battle has waxed fast and furious, can the supply authorities," asks our friend, "afford such a heavy loss in prestige." A "heavy loss in prestige!" Few words those, with much meaning attached. "Meteor" urges those authorities without loss of time to tear down the antiquities, and put the latest of flame arc lamps in their place. Nothing short of this drastic measure will do. The time has passed for keeping in use electric lamps whose low efficiency and whose high contributions to the exchequers of the supply authorities stand at the opposite poles. It has indeed more than passed; and gas has shown it to be so.

By the way, has "Meteor" inspected the lighting from the centrally suspended high-pressure inverted gas-lamps in Cannon Street, and compared the brilliance of the lighting with the (in contrast) subdued performance of the centrally hung flame arc lamps? If not, he should do so. He might also spend an interesting few minutes inspecting some new lamp erections at the end of Parliament Street, by the legislative establishment of the nation.

Into such a nervous condition has our esteemed friend fallen that he has been writing at large upon the Gower Street experiment, which is to help the Holborn Borough Council to decide upon which of the illuminants, electricity or gas, is to occupy their streets in future—the Gaslight and Coke Company being handicapped by their terms being known by their competitors before the trial takes place. One might have supposed there had been experiment enough in London. But perhaps it is natural that the Holborn Council, in the spirit of independence that has animated them through this business, should like a little trial on their own account; and this "Meteor" calls "An Exciting Contest." We looked upon the Westminster contest as more exciting than this; the Holborn contract being only one of a number of borough contracts that have fallen due this year for settlement, and the majority of which has, through the inverted gas-burner, been again netted by the Gaslight Company. But "Meteor" wants to dictate the terms of the "exciting" Holborn contest; and it is quite clear that he reflects in what he writes the uneasiness of our electrical friends at submitting the trial street-lamps to photometrical arbitration. There is something that is at once bland, saucy, and distrustful about "Meteor's" sentence: "We are sure that the Holborn authorities will now have every wish to dissociate themselves from the old basis of photometry." His peace of mind is apparently very much disturbed by the photometer. Here is another instance: "The illuminometer method has its drawbacks. In principle, the photometer may be preferable; but, in a street-lighting contest, the conditions are very different from those of the laboratory." Still further uneasiness is reflected in the expression of the impious hope that "the testing and specification will not be allowed to rest upon the candle power at certain angles, for such an arrangement often happens to be favourable to one competitor." This objection to the photometer (how often have Mr. Bradley's tests of the older type lamps been quoted?) was not always so pronounced on the part of electricians as it is to-day, when the constant steady light of inverted gas-lamps is seen in London highways and byways. But we cannot reconcile the strong objection to the photometer that "Meteor" now declares with the statement in the recent special issue of his paper, in the article dealing with photometers: "It would be incompatible with the completeness with which we deal with the question of street lighting, if we omitted mention of the photometer—a device which we anticipate that every street lighting authority will call to its aid in settling questions pertaining to the efficient illumination of streets." What has produced this quick change of front? Perhaps the robust faith of the Gaslight and Coke Company in consenting to a photometrical test of illumination (with a stiff penalty for default) has had rather a nerve-racking effect in certain quarters. But curious it is that the recent outdoor lighting number of his paper has not had a more inspiriting effect upon "Meteor." If it has failed with him, then what about other people? However, in the hour of electrical tribulation, we will be as merciful as business considerations will allow.

It has often been noticed in the papers devoted to the electrical industry that commercial ability is not editorially regarded as a striking or general characteristic of the section of the *genus homo* who occupy official positions in connection with electricity supply undertakings. Much as it goes against the benevolent feelings entertained towards our much-vexed electrical friends, we are at times driven to the conclusion that, in this matter, there is some truth in what the electrical papers say. There is one failing in particular that some electrical engineers have strongly developed, and that is in proposing time after time expenditure on cable extensions that must obviously be unremunerative; and they excuse themselves with the thought that "it is only a little bit, and will not much matter." But these little bits have a tendency to grow; and after a time they may represent anything but a negligible amount of capital. We know of a case where an expenditure of some £300 was incurred for cable to supply a motor which only runs intermittently, at a price per unit represented by a fraction of a penny, lying between 0·5d. and 0·75d. The income in this case does not provide the capital charges fairly attributable to this particular service. Hastings and many other towns have had similar experiences as to unremunerative cable expenditure; but the experience does not act as a deterrent to the propensity for increasing the amount of such expenditure. Take Hastings. There is the famous Clive Vale extension, over which capital was spent, and after a period of two or three years, the connections do not number more than half-a-dozen. But the lesson has failed to have any effect in evoking a greater exercise of care. At the last meeting of the Council, a proposal was passed for spending about £100 in supplying a single consumer; and it was suggested that two or three street lamps might be picked up along the line of this new piece of cable. It requires a good householder whose custom will pay all the expenses incidental to the generation and supply of the current, and the charges involved by a special outlay for cable of £100 of capital on his account. But what matters? The department wants to oblige; and it is such an easy matter to blink at a little supplement to the unremunerative capital. It is, however, a singular way of doing business; but it is, unfortunately for the ratepayers, the electrical way. Perhaps the Local Government Board will make a note of these lapses from sane commercial procedure when there is an inquiry shortly into a proposed application for £2000 odd for cable extensions as required—required by the Department.

Mr. Alex. C. Cramb, the Manager of the Electricity Department of the Croydon Corporation, has been dilating on the fascinating subject of meat-choppers, and has come a cropper at the hands of, we take it, a firm of butchers—Messrs. Rolfe and Taylor—who exercise intelligence, decline to take all Mr. Cramb's opinions at the valuation he himself places on them, and who evidently are of opinion that municipal trading, carried to the length that the Electricity Department carries it in the borough, is not altogether of advantage to the tradesmen ratepayers. We know that from the smallest causes, big issues sometimes spring. The trouble in this instance, is as indicated above all over meat-choppers. Mr. Cramb has written a letter to certain local butchers in the town that seems to suggest that he would, given the opportunity, have the effrontery to try to teach his grandmother how to suck eggs. The letter to the butchers insinuates that Mr. Cramb believes he knows a great deal better than the butchers how to manage their business in the most profitable way. His advice is that all that is necessary is to adopt an electric meat-chopper which would save the butchers' time, increase the ground meat sales, increase the consumers' confidence—in short, the installation of the electric chopper, in addition to the electric light, "makes an ideal business proposition above criticism." Further, this wonderful business-boosting machine, can be fitted with a bone-grinder, and "in view of the importance now attached to ground-green bone as a chicken food," in Mr. Cramb's mature butchery judgment, "it will be found a sound investment." Mr. Cramb says "will be;" so that there can be no question about it. On receiving this informative communication, Messrs. Rolfe and Taylor had some hesitation in accepting Mr. Cramb's representations; and, in addition, they wanted to know what the Croydon Borough Electrical Engineer was doing touting for custom for a meat-chopper made by an American firm, following this up with the suggestion that the American firm might come to Croydon, open a show-room, so contribute to the rates the same as other tradesmen, and relieve the Borough Electrical Engineer from canvassing on their behalf. It is rather an ugly complexion that the firm manage, in a few terse sentences, to put upon this touting by Mr. Cramb, a Corporation servant, for the placing of mechanical meat-choppers. But the Borough Electrical Engineer lost an opportunity by, in the first instance, ignoring Messrs. Rolfe and Taylor's letter; and his neglect caused them annoyance. A reminder that the letter had not received the courtesy of even an acknowledgment brought from Mr. Cramb the curt reply that both letters had been received, and had been duly filed. This is rather a high-handed proceeding; and does not show the diplomatic and conciliatory method that should be cultivated by a municipal officer when any ratepayers address an inquiry to him. But the larger question is as to municipal touting for orders for a machine not made in this country, but which, if required, can be obtained through the agency of one of the local traders. It is stated in a local paper that Mr. Cramb's circular letter was sent out indiscriminately, and caused considerable surprise to the recipients. The publication of the Engineer's method of dealing with correspondents who do not see eye to eye with him, has no doubt had the same effect.

There has been an undue amount of publicity given to what is termed the success of a scheme at Eccles for the electric lighting of workmen's dwellings; but when the details of the scheme are known and considered, gas suppliers will see that they need not quake through any alarm that electricity has at length been proved to be the poor man's light. The experiment has been carried out in a block of twelve workmen's dwellings erected by the Health Committee of the Corporation; and we can imagine that the occupants of these dwellings would take very good care, being under the control and observation of the Health Committee, not to infringe in any way the conditions laid down, particularly with the threat of a prosecution hanging over them if—poor souls—they use any other lamps than those supplied by the Borough Electrical Engineer, remove any lamp and use it in some other room, or replace a lamp by one of their own, or interfere with, or remove or replace, any fittings without the written permission of his highness the Electrical Engineer. Of course, these are essential conditions in a scheme in which a meter is not used for each consumer. But a prosecution for any such offence! Then these poor souls for the twelvemonth of the trial were condemned to (these were specially good houses we should imagine for workmen's dwellings) a 12-candle power light in entrance hall and scullery, a 32-candle power one in parlour and kitchen, in one bedroom a 16-candle power light, and in each of two other bedrooms and the bathroom one 12-candle power light. Fancy the occupants of rooms so lighted reading or doing needle work! Among several agreements these poor folks entered into was one that, when rooms were not being used, the electric light must be switched off, and that no lamps were to be left burning after tenants had retired to bed at night or during the daytime. The charge was 6d. per week, in addition to which the lamp renewals were priced out at 2s. 9d. each for 32-candle power lamps and 2s. 6d. each for 16 and 12 candle power ones. Cottagers would not want many of these extra charges in a year to make them "sit up." But it is reported that only nine new lamps were required in these dwellings during the whole twelve months. These

were especially good tenants—for aught we know employees of the Health Committee. The first cost of wiring, fittings, lamps, and auto-transformer amounted to £61 10s. The aggregate consumption in the twelve months, by these tenants careful not to incur the displeasure of the Health Committee—some of the tenants probably had the convenience of more hours of lighting than others—amounted to 1205 units; and the Health Committee have been charged for these 3·106d. per unit, which works out to the sum of exactly the year's income at 6d. per week from the twelve houses, with nothing over for capital charges and depreciation. It is proposed that the landlords at Eccles should adopt the scheme, wire their cottages, and afford the same facilities to their tenants. We fancy that we can see the office of the Eccles Electricity Department thronged by landlords eager to enter into the speculation. While on this subject, can anyone give any information—perhaps Mr. Charles Carpenter can oblige—as to what has become of that philanthropic company that was started in South London for the propagation of electric lighting among the enlightened workers there?

The question of altering the price of current to consumers in view of the use of metallic filament lamps has been again to the fore through certain supply authorities having adopted this expedient for checking the fall in the lighting revenue. The Legal Correspondent of the "Electrical Review" has been discussing the legal aspect of the question of the right to alter the price of current; but, in the result, he has only emphasized the doubt that exists as to the right of differentiating in the matter of charge between consumers who employ metallic filaments and those who continue the use of the old carbon filaments. Electricity suppliers who boast of the economy of electric lighting ought to be ashamed of themselves for proposing to show any undue preference to the adherents to carbon filaments, both on moral and legal grounds; on the latter because they are commanded by the Electric Lighting Act of 1882, not to, under like circumstances, show "any undue preference to any local authority, company, or person." We cannot imagine that it was contemplated by the Legislature in 1882 that the voluntary use of a different lamp by a consumer would constitute a "circumstance" entitling them to the right of supplying at a different rate. Another obstacle is that the Act expressly provides that the undertakers are not entitled to prescribe any special form of lamp or burner to be used by any consumer, or in any way control, or interfere with, the manner in which the electricity supplied to them is used. In effect the undertakers would be exercising some control and interference by making the metallic filament lamp user pay more per unit than the carbon filament lamp user. A question might also be raised as to whether a supply authority have the right to charge a price to a shopkeeper for outside arc lamps different from that charged to a neighbour who prefers lighting his shop window internally by metallic filaments. We will not follow the Legal Correspondent of our contemporary through the law relating to charges; but on the point to which we have referred, he says: "Upon the whole, it is submitted that the undertakers may have alternate prices. The consumer who uses the modern form of lamp gets the same amount of light [the Act does not say anything about the charge per unit of light] for the same price. In such circumstances, he could not allege that he was unfairly treated." But the gentleman of the long robe does not say—and this is particularly the point on which his readers would like to have his opinion—whether the consumer could not say that he was illegally treated. We would rather be on the side of the consumer when it came to the legality of this matter, and likewise if the common-sense of it was under consideration.

MR. ALEXANDER SIEMENS ON PROGRESS.

At the Opening Meeting for this session of the Institution of Civil Engineers the President—Mr. Alexander Siemens—delivered an address devoted mainly to an exposition of the part played by engineering in bringing about the present state of civilization. The following are some extracts from the portions of the address bearing specially upon this subject.

In order rightly to appreciate the share taken by the engineering profession in bringing about the present state of civilization, a comparison should be made between the conditions prevailing (say) in the Greek States during the Fifth and Fourth Century before Christ and those existing in the Twentieth Century. The history of knowledge from the prosperous period of Greece down to the present time showed that, whether in literature, in art, or in philosophy, we could not boast of being greatly superior to the ancients; but so far as engineering problems were concerned, we had enormously advanced, thanks to the practical application of scientific theories. Comparing generally the conditions of life then and now, the difference might be summed up by claiming that our progress was due principally to the improvement of means of communication and the saving of manual labour by the introduction of mechanical power. These main features had caused a general lowering of the cost of "obtainables." Both of these features characterizing modern civilization were the outcome of the work of the engineering profession; and it might be claimed in addition that progress had by no means ceased.

In attempting to recognize true progress in the material conditions under which we are living, it was not unreasonable to expect that any further advance would be made on the same lines as those differentiating our present civilization from that of the ancients, and that "lowering the cost of obtainables," based on improvement of communications and upon the saving of manual labour, would furnish a trustworthy test as to whether a change suggested to be made in our material surroundings was worth adopting, or was merely an alternative without any prospect of being generally accepted. Everybody readily agreed that improving the means of communication was a desirable form of progress, and that any innovation which had this result had come to stay. But, curiously enough, the consequences of improved communication—implying that people and merchandise could reach distant parts in shorter time than before, and that information could be imparted to most parts of the earth almost instantaneously—were not yet fully appreciated; and the saving in manual labour was still regarded with suspicion by those most concerned. The cry of the workman ever since machinery was introduced had been that displacing manual labour by mechanical power meant diminished opportunity of employment for him; and even nowadays, when the fallacy of this argument had been exposed over and over again, the leaders of the workmen strenuously opposed improvements in this direction as being inimical to their interests.

Coupled with this anomalous attitude regarding machinery was another fallacy, equally difficult to eradicate, which was indicated by what was usually called "restriction of output." This sentiment had its origin in a desire to remedy unemployment; and its promoters always argued that, in order to maintain our present mode of living, a certain amount of work had to be performed daily. If, therefore, each man performed as little work as possible for "living wages," more people must be employed, and workers would have enough to maintain themselves comfortably. The weak point of this view lay in the assumption that the work really necessary to be carried out daily was enough to give employment all round; and the supposed remedy failed because it increased the cost of production. Enhanced cost meant diminished demand, and consequently decrease of sale; but if the sale fell off, producers had to be dismissed. The consequence of restriction of output was therefore restriction of employment—the very opposite effect of what was intended by its advocates. Conversely, it might be argued that cheapening the necessaries of life enabled the consumer to spend more money on luxuries, if by this expression was designated all that was not absolutely necessary for keeping body and soul together. From these considerations, it followed that increase of employment could be effected only by increasing the demand for luxuries; and this could result only from the lowering of the cost of obtainables, indicating by this expression the necessaries of life as well as its luxuries.

Bearing in mind that the distinguishing features of modern civilization—viz., the saving of time, of exertion, and therefore of money—were the outcome of engineering science, it would be conceded without further argument that "lowering of cost" should be the guiding principle of all engineering design; and by accepting this we admitted that successful engineering must be based not only on technical knowledge, but on the proper understanding of economic laws. The extent of the influence of commercial considerations had steadily increased since the middle of last century, owing principally to the great improvement in the means of communication, which, so far as technical knowledge was concerned, placed engineers of all countries on an equal footing, and permitted unlimited competition between manufacturers wherever their works might be situated. Every effort should be made by the designing engineer to facilitate economy of manufacture.

Among the new Mayors, we notice the following who are associated with gas or water supply: Mr. E. Finn, who has filled the position of Mayor of Lydd on twenty-eight occasions and for twenty years in succession, was formerly Chairman of the Lydd Gas Company; Mr. S. R. Groom, the Mayor of Harwich, is a Director of the Gas Company; Alderman F. S. Phillips, the Mayor of Salford, is Chairman of the Gas Committee; Mr. H. W. Sadd, the Mayor of Maldon (Essex), is Chairman of the Water Committee of the Corporation; Sir Samuel Sadler, the Mayor of Middlesbrough for the third time, is well known to "Journal" readers as the head of an important firm of chemical manufacturers, and also as a member and Past-President of the North of England Gas Managers' Association; Mr. H. K. Stephenson, the Lord Mayor of Sheffield, is a Director of the Gas Company; Sir W. H. Stephenson, the re-elected Lord Mayor of Newcastle-on-Tyne, is Chairman of the Newcastle Gas Company; and Alderman T. A. Rising, who has for the second time been elected Mayor of Great Yarmouth, is Deputy-Chairman of the Gas Company and Secretary of the Water Company. In addition to the foregoing, we may note that Alderman G. S. Elliott, who is for the fifth time Mayor of Islington, is Vice-Chairman of the Metropolitan Water Board; Mr. J. U. Fulford, the Mayor of Bideford, is Chairman of the Water Committee of the Corporation; the Marquis of Londonderry, the Mayor of Durham, is head of the Londonderry Collieries; Mr. C. A. Head, the Mayor of Thornaby-on-Tees, established, in association with his brother, the firm of Messrs. Head, Wrightson, and Co., Limited, Stockton-on-Tees; and Sir Benjamin Scott, the Mayor of Carlisle, has been closely identified with the gas and water supply of the city.

WORK OF THE GAS HEATING RESEARCH COMMITTEE.

Conference at the Leeds University.

The members of the Gas Heating Research Committee of the Institution of Gas Engineers, being of opinion that many connected with the industry would like to take part in a further discussion of the work which has been carried out in the Fuel Department of the University of Leeds during the past two years, arranged for a conference to be held last Wednesday afternoon in the University buildings. It had been announced that Mr. E. W. Smith, the Research Chemist, would give a summary of the work done and a short account of the questions involved; an invitation being extended to gentlemen representing gas undertakings and gas-stove manufacturers to be present on the occasion. There was not a very large attendance at the conference—only about thirty in all being present, including Professor Arthur Smithells, the Chairman of the Committee; Professors Bone and Cohen, the University's representatives on the Committee; Mr. J. H. Brearley, of Longwood, one of the representatives of the Institution of Gas Engineers on the Committee; and the principals of a number of firms engaged in the production of gas appliances.

Professor Smithells, in opening the proceedings, extended to all present a cordial welcome on behalf of the Committee and the University, and expressed the hope that at the conclusion of the meeting they would feel that their visit had not been in vain. The reason for calling them together was to afford them an opportunity of discussing the work of the Committee more fully than was possible at the annual meetings of the Institution of Gas Engineers; and the Committee had convened the meeting quite independently of Mr. Smith's movements—being of opinion that a discussion of this kind must be fruitful. Whether or not it was fruitful depended, of course, upon how far those present were willing to discuss the subject, and what Mr. Smith had been working upon. He (Professor Smithells) recognized that there were certain difficulties in the way of discussion; but he hoped they would not be insuperable. By way of starting the discussion, Mr. Smith would give the meeting a brief account of the work that had been done and the experiments carried out. Of course, a good deal of work had been done by Mr. Smith since the Committee presented their last report to the Institution; and this would form the subject of a supplementary report to be submitted next year. Those present were no doubt aware that Mr. Smith was leaving the University for a more important appointment in Birmingham, and he was sure they would understand that this would mean a very great loss to the work of the Committee, so much so that they had recommended to the Council of the Institution that for the time being research work should be suspended. The action of the Council in regard to this would doubtless be communicated to the Press through the official channel in the ordinary way. In the presence of Mr. Smith, he would not attempt to appraise the work done by that gentleman; but he believed he was right in saying it was highly appreciated by all connected with the industry. With these introductory remarks, he called upon Mr. Smith to address the meeting.

MR. SMITH'S ADDRESS.

Mr. E. W. Smith said he had not the time at his disposal to go in detail through the reports of the Committee; but he proposed to consider the gas-fire, part by part, referring to the results of his experiments, and giving the meeting the results of his own observations and experience. In dealing with the gas-fire from a seller's point of view, he took it there were three separate matters to be considered and kept in mind. First, there was the appearance of the fire; next the cost, including maintenance; and then, thirdly, the efficiency of the fire. He would leave the question of appearance, as well as that of cost, with one remark, not because these were of less importance than the other, but because the manufacturers could probably say more on these points than he could.

Radiant Efficiency of the Gas-Fire.

With regard to efficiency, he might point out that at the beginning of his work it was decided to make a special study as to the radiant efficiency of the gas-fire. Though radiant heat had been proved the better heat to encourage in gas-fire work, it was not the total efficiency of the gas-fire, as there was the convected heat from the sides and casing. Personally he had always taken it as a standard that if the temperature of a room was raised from 38° to 60° Fahr. by convected heat, this would be satisfactory; and then they could pile on the radiant heat, so long as by its employment they did not increase the convected heat above 60° Fahr. He was aware that in connection with a gas-fire there was a tendency to consider only radiant heat as being of any value; but it was his personal opinion that the percentages of radiant heat and of convected heat in a room should be taken together as the efficiency of the stove.

Construction of the Gas-Fire.

Passing on to deal with the construction of the gas-fire, Mr. Smith said he believed in the casting being made as plain as possible, consistent, of course, with public taste, for they could not set ideals before the people in these matters. This, however, was a point for the individual manufacturers to consider in the making of the stove. Then came the question as to the extent to which the casing of the fire should be perforated at the top, in order that the air should pass up behind the stove and ensure the fire giving off a larger amount of radiant heat. Considerable difference of opinion existed as to the advisability or otherwise of cooling down the back of the stove. They might take it, however, that the higher the temperature of the back brick, and the lower the loss of heat through it, the greater was the amount of radiation from the front of the stove. Therefore, it was not advisable to cool down the back brick. But this did not preclude them from cooling down the top part of the casting by means of directed air currents. He believed it was quite possible to maintain the temperature of the fire-brick and reduce the heat at the top, so that the air would pass freely and very little of the products (if any) get into the room. There were many ways of stopping the products of combustion from passing into the room. It could be done by the alteration of the outlet of the stove, giving a greater draught, or by a shaped hood that caught the products as they went up. These were points, however, which he did not want to labour, as they could be brought up for discussion later.

The Fire-Brick Back.

As to the fire-brick back, very little attention had been paid to this until quite recently. The material should be as light as possible; and it should be baked at a mean temperature, the reason for which was obvious. As far as practicable, the material at the front of the fuel should have a high heat conductivity, and that at the back a low one, in order that the heat radiated from the back striking the front should pass through the latter as easily as possible. How far this depended upon the thickness, composition, porosity, and shape was a matter for special experiment. There was no doubt, however, that the conductivity of the baked fire-brick did depend upon its thickness, porosity, and shape or form. It had been demonstrated by practical experiments that the lower the temperature at which the fire-brick was baked, the lower the conductivity. Another thing that had to be studied was the formation of the front of the brick, so that it might fit the so-called "fuel;" and the question of "fuel" brought him to the subject of surface combustion. To what extent could they get combustion of the gas taking place actually in contact with the surface of the fuel fire-clay, or of the fire-brick, or actually in the pores of the fire-brick itself? Anyhow, it was clear that the fire-brick at the back should be made to fit the "fuels," or the "fuels" should be made to fit the brick at the back. Then it was essential for the flame to be properly fitted to the "fuels" and brick, so as to get the best results. Many of those present had no doubt proved this by experiments. Having illustrated by diagrams on the blackboard this part of his subject, he said that, for his own part, he thought the fire-brick back should be very similar in shape to the new form of coal-grate brick, sloping out towards the front at the top. A double purpose was served by this. Not only would it cause the products of combustion to stick to the fire-brick, but it would cause a good draught. They would also have a certain amount of convected heat from it; and it would reflect radiant heat, especially if widened to send the heat out into the room, instead of going up into the framework.

"Fuels" and Shape of Flame.

Turning to the subject of "fuels," the speaker said the shape of the "fuel" depended absolutely on the shape of the flame. They must decide either the shape of the flame or that of the "fuel." When they had settled the shape of the "fuel," or of the flame, one must conform to the other. There was a tendency at present to fall away from this, and to arrange the burners in such a way that the flame would be not only inside the "fuel" but outside it. It might, however, be taken as a general principle that it was wise, once they had settled the shape of the flame, to adapt the "fuel" to it. The inner surface of the fuel should be in close contact with the whole of the outer cone of the flame. Interference with the flame or with combustion did not occur when they had the "fuel" in contact with the outer cone of the flame. It was only when they interfered with the inner part of the flame that incomplete combustion took place and gave off a smell. There had been a great advance made in this fitting of the "fuel" to the flame; and he thought more work in this direction would be beneficial. He was quite certain it would repay anyone to deal further with the subject of the shape of the flame, and ascertain to what extent it was affected by the shape of the "fuel" and the composition of the gas. As they knew, the flame from hydrogen was a long, thin one; and thus a "fuel" suitable for a hydrogen flame would be absolutely useless with the flame of Mond gas. The shape of the flame therefore depended upon the composition of the gas to be used. In their last report, the Research Committee showed that the radiant efficiency depended absolutely on the shape of the flame, and, of course, the calorific value of the gas. It was true the latter might vary to some extent without affecting the radiant efficiency of the fire; but if the shape of the flame was varied, in any given type of stove, then the radiant efficiency would be decreased. He was

of opinion that if they had a "fuel" which tapered to the top, the back of the fuel should almost be made up, leaving just sufficient space for air to enter, and that the front of the fuel should be open and irregular. The last point was not his idea of what should be; but the public would have something that conformed as near as possible to the ordinary coal-fire in appearance. Then as to the "fuels" used, they should be as light as possible, and be baked at a mean temperature. They should not be brittle, not soft or hard, but between the two. The reason for this was obvious. It was necessary they should have low conductivity at the back, and high conductivity in front, in order that the radiant heat from the back striking the front should pass through as quickly and with as little obstruction as practicable. The "fuels," like the back, should be as porous as possible on the surface. As to the reason for this, he could not offer a suggestion; but it was evident, in looking at a fire, that the rougher the surface of the "fuel" the better its radiant efficiency. A further point in connection with the "fuels" was that he held the opinion that it was wiser to have the upper $1\frac{1}{4}$ or 2 inches of the "fuel" dark than incandescent right to the top. They knew that the products of combustion always left the top of the "fuel" at a higher temperature than the bottom—the products would leave at a temperature of 950° C. But if they constructed the "fuel" so as to be radiant up to about two-thirds of the way, then the top part would take up part of the heat of the products of combustion. Not only this, but the top part would help to keep warm the fuel below; and they would have a larger surface of fuel radiant.

The Burner Question.

Passing on to deal with the question of burners, the speaker said he had just finished some work on this part of the subject, and he had no doubt it would be published in the course of a few weeks, as soon as the Committee had seen it. On general grounds, quite apart from what had been done, he said that in the design of the burner the endeavour should be made to get an even mixture of gas and air, and even sizes of flame. It was a fact that some burners required more air than others with the same consumption of gas; and therefore it was not so much the amount of air that was pulled in at the burner. If they took a burner with a large number of small holes, it would be found that it required less air than one having larger holes, and this with the same consumption of gas. The explanation was that in the former case the smaller flames presented a larger percentage of surface to the atmosphere, and consequently less primary air was required at the burner. The burner should be noiseless; but he confessed that he had found it impossible to get a burner that was absolutely noiseless. He thought they would find that the longer the tube was from the nozzle, the greater was the humming noise, and *vice versa.*

Temporary Cessation of the Work.

This was all he thought he need say about the work done; but if any one present desired to put questions, he would answer them, if he could. He might add, in conclusion, that it had been decided that the Research Committee should be dissolved and its work discontinued for the present. But it should not be assumed that they were of opinion there was nothing further that required doing. Personally, he was of opinion that the research work on gas-stoves was only just commencing; but any further work would require much greater facilities than could be possibly obtained in a University. Further work, he suggested, might be undertaken by the makers themselves. They were showing a desire to continue and extend the work that had been commenced at the Leeds University by engaging well-trained men. He considered this would be found to be thoroughly worth while. They should, however, not regard the engagement of such men as a fad or an advertisement, but give them the opportunity of carrying on sustained research of a really advanced character. Many good research men might be found spending the whole of their time either doing routine analyses, or continually at the beck and call of the heads of departments in attempts to solve the hundred-and-one little problems that cropped up in the course of a day in the works. A man of this kind was extremely useful —he was a works chemist, but not necessarily a research chemist.

Discussion.

Professor Smithells, in announcing that the discussion was open, said it must be understood that Mr. Smith had been expressing his own views and opinions.

Mr. H. M. Thornton (London) said he thought that they were much indebted to the University Authorities for allowing them to take part in this important meeting; and, if he might be allowed to say so, it was a fitting conclusion to the splendid work which Mr. Smith had done for the industry. They were greatly obliged to him for the way in which he had carried out his research work, and also for the manner in which he had put the results of his labours before them. The different points dealt with had been placed before them in a very clear way; and they, as gas-stove makers, would miss Mr. Smith very much. The research work carried on by him generally had afforded them the opportunity of seeing whether or not the gas-stove makers had been working on the right lines. He did not propose to go over the whole ground covered by Mr. Smith in the course of his address. This was not necessary. He would like to say, however, that most of the points Mr. Smith had raised had been already very largely dealt with by the manufacturers of gas fires and other appliances. There were, of course, points of detail well worthy of further experiments; and he thought most of them were now engaged in conducting these experiments, and in research work generally in this direction. There were one or two points mentioned by Mr. Smith which he thought gas-stove manufacturers were dealing with. There was the question of the shape of the flame. Manufacturers had, of course, been experimenting very largely in this direction. He was speaking for his own Company; but they were not alone in this respect, and he believed there was room for further experiment. Undoubtedly, the shape of the flame must guide them in the shape of the "fuel." The two were so closely connected that the shape of the "fuel" should be in accordance with the shape of the flame; and this was the case with his firm. The other point he wished to deal with was that of finality. What manufacturers did want was to reach finality, if it was at all possible. They wished to know, for instance, how much convected heat should be employed in connection with gas-fires. He was glad that the opinion of Mr. Smith—and he thought it was the opinion held by a great many men—was that a certain percentage of convected heat was not only desirable in the attaining of the best results, but was a distinct advantage in connection with gas-fires as a whole. Another important matter—and one they felt very strongly upon —was that they desired to see some definite standard of testing gas-fires adopted by gas undertakings, so that they might know under what conditions their apparatus was to be tested. At present, they found that in some cases it was tested by certain methods, and in other cases by different ones. The consequence was that different results were obtained. He hoped some final solution might be arrived at in this matter; and then they would know in what condition they would have to send out their goods. With reference to the length of fuel to be made incandescent, he was of opinion that they would get a slight gain in efficiency by leaving a part at the top dark. At the same time, he thought they must give attention to appearance, and, if necessary, sacrifice a small percentage of efficiency to obtain it. He was not quite clear as to what they were there for that afternoon. He did not know whether they were to be asked to support a movement for further research on gas-fires, or what. Was there a suggestion that they should support further movement in this direction? He thought they ought to know with more or less certainty what was meant. Apart from this, he desired to express, on behalf of his Company, their grateful thanks to Mr. Smith and the Research Committee of the Institution of Gas Engineers for what had undoubtedly been exhaustive experiments which had been of advantage to the gas industry at large.

Mr. Smith said that whenever a maker quoted efficiency, he should give other details as well. He should give something more than the gas consumption—such as the total superficial area of the heated surface. If it was a 12-inch stove let it be called a 12-inch stove. It might be taken as a fact—and it was raised in their last report—that for every inch increase in the stove they obtained 1 per cent. increase in efficiency. He agreed there should be a standard type and size of fire, and that they should always test against the same size. He explained that he was now engaged in the design of a special absorption radiometer. Various circumstances had prevented him completing it; but he intended to continue until he had done so. He was of opinion that it would turn out all right, and by it he would be able to get a curve of radiant heat all round the hemisphere. In testing fires for radiant efficiency, pressure did not count—it was only the gas consumption and the quality of the flame that counted.

Professor Smithells, answering Mr. Thornton, said that the Research Committee, after the establishment of the Livesey Advisory Committee, which represented the Institution of Gas Engineers, came to the conclusion that their position had become somewhat anomalous. In fact, the Research Committee thought that work of this kind, if it had to be done at all, might be better done under the direction of the Livesey Advisory Committee. Consequently, the Research Committee were recommending their own dissolution. What work would be done in the future, or whether any work similar to this would be done at the University, he could not venture to say. This would be a matter for the Livesey Advisory Committee and the University authorities to consider. When they called this meeting, they did not know that Mr. Smith was leaving—it so happened that the two things coincided. They must understand that they were called there that day, not only to listen to Mr. Smith, but to say anything they liked on the question of research work. If they considered it was important that the research work should be continued, they were perfectly at liberty to say so.

Mr. J. H. Brearley (Longwood) said that Professor Smithells had accurately expressed the views of the Research Committee and the reason they had resolved to recommend its dissolution. He had already expressed his admiration of Mr. Smith's work; but as this was perhaps the last occasion he might have of doing so, he desired again to express his appreciation of his services to the Committee. He would only repeat that in Mr. Smith they had an investigator who had the greatest enthusiasm in his work. Not only this, but he had the highest scientific qualifications to support his enthusiasm in the work he had in hand. He wished him every success and prosperity in his new work at Birmingham. It had not been his (Mr. Brearley's) intention to say much that afternoon on the question of the research work carried out by the Committee; but one or two points had been raised upon which further research would be required. There was, for instance, the question of the shape of the flame. Seeing that they had so many

makers present, he would like to ask whether it had been found that gas-fires that were perfectly satisfactory in one town were anything but satisfactory in another. He should rather doubt they had, because gas supplies varied enormously in their composition. They had heard that afternoon that a "fuel" suitable for a hydrogen flame would not do for a flame containing a large percentage of carbon monoxide. This was the conundrum facing the makers; and they had his sympathy on this point. There had been a great deal of talk as to a standard burner for testing illuminating power. And while he was in complete sympathy with a desire for a standard burner, he thought that a standard for the quality and composition of gas was even more important. With regard to Mr. Smith's suggestion that the top part of the "fuel" should be left dark—the proposal being that one-third at the top should be dark and the remaining two-thirds incandescent—he would like to ask if this would be necessary if makers provided a sloping back brick. The sloping back was intended to intercept certain heat and reflect heat; and he wanted to know if this would not assist in keeping the efficiency of the "fuel" right to the very top. The last point he would like to mention was with regard to the conductivity of the materials put in. They had very little knowledge at present on this point. He believed the Institution had a Research Committee at work on refractory materials and making some experiments as to the conductivity of fire-clays and their composition; but he did not know whether this would help them much. At any rate, that was one matter which required the attention of the Research Committee.

Mr. Smith said he could not state if the sloping back mentioned by Mr. Brearley would fulfil the conditions of the dark top of the "fuel." At the moment, he did not think it would be sufficient to meet the conditions.

Mr. A. J. Forshaw (Birmingham) did not believe there was a great deal left for the Committee to do with regard to gas fires. The Committee, to begin with, had not the facilities for making "fuels" and burners for experimental purposes that the manufacturers had, and except it was in the direction of devising a method or methods for the better testing of gas-fires, he did not know what the Committee could do further. Some of their methods were certainly cumbrous, and improvement was necessary. Mr. Smith had made several suggestions to them that afternoon—for instance, in regard to the use of convected heat from gas-fires. His (Mr. Forshaw's) Company had taken a strong stand on this point—to have as little convected heat as possible; and he might say they had been successful. It would be difficult to maintain the temperature of a room at less than 60° if they kept pouring into it convected heat and radiant heat at the same time. On the question of flame contact, it appeared to him that what they should aim at in gas-fires was to get as much heat out of the gas into the "fuel" as possible, before the gas went up the chimney. Of course, long "fuel" was one way of doing this; and another method was to have a corrugated back. As to the "fuel" fitting the flame, he confirmed what Mr. Smith had said. He had been trying Mond gas in a fire; and it was surprising to find how much gas it took to heat up the fuel. This was simply due to the flame of the Mond gas being thin and attenuated. With reference to the giving off of carbon monoxide, he had tested many appliances, and was satisfied that very little (if any) was given off.

Professor Smithells remarked that the hygienic point ought not to be forgotten; and this was a question that might with advantage be taken up more fully than it had been. Dr. Cohen, who was a member of the Research Committee, had carried out some investigations in this direction; and he asked him to give them the benefit of his experience.

Professor Cohen said that he became interested in gas-fires when he went to Leeds some twenty years ago. It was then he started serious research on the condition of the atmosphere as regarded smoke; and he thought it desirable he should carry out in practice what he preached. Therefore he had three or four gas-fires put in at his house. Shortly after this, he attended a lecture at the University on ventilation; and in the course of the lecture reference was made to gas-fires. The lecturer stated that they gave off carbon monoxide into the room, and were not to be recommended. This statement, naturally, made him (Dr. Cohen) very uncomfortable; and he asked the lecturer if he could give him some reference to an authority for the statement, or whether it was made from his own observations. In reply, he was told by the lecturer that he could not give him a reference to any authority, nor had he made any observations himself. He added, however, that he felt quite sure it was so. Well, of course, this diagnosis might be satisfactory to a medical man and others interested in the matter; but it was not satisfactory to the chemist. He (Dr. Cohen) thought he should like to carry out investigations of his own; and he applied to Mr. James Wilson, asking to be allowed to make experiments with his gas-stoves. To this Mr. Wilson agreed, and also accepted the stipulation that whatever the result was, he (the Professor) should be at liberty to publish it. The result of a number of tests carried out with the stove was that he failed to detect carbon monoxide gas passing into the room from the fire—in fact, he did not discover any carbon monoxide passing into the flue at all. There were a number of hydrocarbons found in the flue; but, so far as his test went, there was no carbon monoxide. These results were published; and it was his opinion that no carbon monoxide was given off from gas-fires. With reference to Mr. Forshaw's statement that there was nothing more for the Committee to do in regard to gas-fires, he could not agree. He (Dr. Cohen) thought there was still a great deal to be done; and he hoped it would be done. There were certain problems on the subject which required dealing with. One of the most important questions in connection with the efficiency of the gas-fire was the relation between temperature and radiation. It was certain that there was a connection; but they did not know the proportion of the connection. They might get a high temperature, but no proportion in radiation; and it was certain there were a great many uncommon things which connected the two. This was a subject which ought to be scientifically investigated. If the work of research was to be continued, as he hoped it would be, under the supervision of the Livesey Advisory Committee, he thought this problem should receive attention. He was in agreement with Mr. Smith's conclusions in regard to radiant heat and convected heat. He asked why it was that, in the summer time, with no form of artificial heat, people felt comfortable indoors? They had no radiant heat indoors from the sun; and the only logical answer was that the air in the room was warm. It therefore seemed to him that if they could maintain this condition in the winter by means of artificial heat, they would be getting the same conditions as they had in the summer, which would be perfectly healthy and hygienic. He was of opinion that they should have the air in their living-rooms heated to a certain temperature—not too high, so as to cause any feeling of discomfort—before they started their radiant heat. This principle was now being applied most satisfactorily—that was, the fresh air in the room was heated up to a certain temperature and the further heat required was obtained by radiation.

Mr. James Wilson (Leeds) said there was just one point he would like to deal with, which had been raised during the discussion, and that was the testing of gas-fires. It seemed to him there were only two ways of testing them. It must either be in the room or in the chimney; and the question was whether it was easier to carry out the test in the room or in the chimney. A simple method, he thought, might be devised of testing the efficiency of gas-fires by means of the heat found in the chimney, without dealing with the radiant heat. Certainly they needed some simpler method of testing the efficiency of the stove without dealing with the question of radiation.

Mr. A. P. Main (London), having paid a tribute to Mr. Smith for the services he had rendered to the Research Committee and the gas industry, expressed the hope that something would be done to continue the work. They were now really only at the beginning of the gas-fire business; and he ventured to remark that nobody could say what the gas-fire would be ten years hence. He was of opinion that they were a long way off reaching finality in this matter. It was of great importance to the gas industry to have a scientific body to go into the question of standardizing some form of testing gas-fires. No one but those who had tried knew of the difficulties they had to contend with in the matter of testing. He did not think it was beyond the powers of the Research Committee to devise some simple method of testing. Professor Smithells had referred to the hygienic aspect of the question; and he (Mr. Main) was quite sure that the University could give them some definite pronouncement on the matter. At Glasgow, an interesting series of lectures on the question of smoke abatement had been arranged, which might be followed with advantage in other centres. He did not think they had been sufficiently alive to the fact that we were at the dawn of a new era—that the time was coming, and coming rapidly, when smoke pollution of the atmosphere would be prohibited by Act of Parliament. This being the case, the question of the provision of smokeless heating appliances was one of the greatest consequence to this country; and for this reason he strongly held that the work of the Research Committee should not be allowed to relax in any way, because he felt they were just at the stage when they needed their advice more than ever.

Mr. J. A. Ransome (Warrington) much regretted that so few gas engineers were present at the conference that afternoon, and proceeded to say they all knew that the gas-fire sold to the public to-day by the makers was a great improvement on those of a few years ago. These improvements had not been obtained without a lot of work and a good deal of cost; and yet many of their gas engineer friends seemed to think they should have the improved fire at the old figure, or even at a lower one. They seemed to forget that the "fuel" of to-day could not be produced at anything like the cost it was a few years ago. If only gas engineers would recognize the difficulties which had to be overcome and the extra cost entailed, and take more trouble with the fires, when they got them, than they did at present, it would be to the advantage of all concerned. He appealed very strongly that the work of the Research Committee should not be allowed to drop.

This ended the discussion; and those who had been present availed themselves of the invitation extended to them by Professor Bone to inspect the Fuel and Metallurgical Department of the University. Here light refreshments were served.

The Council of the Roads Improvement Association (Incorporated) and a few friends entertained Mr. Rees Jeffreys at dinner at the Trocadero Restaurant, W., some days ago. The function was made the occasion of a presentation by the Association to their guest of a roll-top desk and an arm-chair, as a mark of their appreciation of his valuable services in connection with the movement for the improvement of roads during the last ten years.

SOUTHERN DISTRICT GAS ASSOCIATION.

The General Meeting of the Association was held on Thursday last, at the Hotel Cecil, Strand, W.C. In the absence of the President (Mr. C. Stafford Ellery, of Bath), Mr. H. C. Head, of Winchester, occupied the chair. There was an excellent attendance of members.

President's Unavoidable Absence.

The Chairman said, before starting the usual business, he had to announce with regret that the President (Mr. C. Stafford Ellery) was unable to be present that day. He wrote to the Hon. Secretary the previous day, saying that he was having an unfortunate experience with the connections of one of his gasholders; and most probably he would not be able to attend the meeting. A telegram had been received from Mr. Ellery that day, regretting his unavoidable absence, expressing best wishes for the meeting, and thanking the authors of the papers to be read. He (the Chairman) would propose that the Hon. Secretary be instructed to send a letter to the President sympathizing with him in his difficulty, and wishing him a speedy solution of it.

The suggestion received hearty approval.

Minutes Confirmed.

The Hon. Secretary (Mr. W. E. Price, of Hampton Wick) presented the minutes of the spring and excursion meetings; and they were confirmed.

Election of Officers.

Mr. J. W. Helps (Croydon) proposed that Mr. H. C. Head, of Winchester, be elected President of the Association for the coming year. He (Mr. Helps) did not think that anything he could say would tell the members better than they already knew how well fitted for the position Mr. Head was. He had been trained all his working life as an Engineer, he had had considerable experience at Bournemouth, and in his present position at Winchester, and they all knew what good work he had done for the Association. He had read a useful paper; and he had taken a great share in the deliberations of the Committee for many years. He had also devoted himself to the interests of one of the branches of the Association's work—that was, the Commercial Section. He (Mr. Helps) did not think it necessary to say more to commend Mr. Head's name to the members.

Mr. R. Beynon (Torquay) seconded the motion, which was unanimously carried.

The Chairman observed that he thanked Mr. Helps very much for the kind manner in which he had proposed his election as President, and the members for the way they had received the proposal. The post of President of the Association was not altogether an easy one to fill. A long line of Past-Presidents had set a high standard, which it would be somewhat difficult to keep up to. But the members might be assured that anything he could do for the benefit of the Association, and to maintain its high standard and traditions, would be done.

Dr. Harold G. Colman moved that Mr. B. R. Green, of Mitcham, be the Vice-President for the coming year. The name of Green had long been identified with the Southern Association—in the case of the father, and now the son; and the members would agree with him that Mr. Green would occupy the position in a very fit manner. They knew him to be a man of progressive character and moderate views; and they would look forward with great pleasure to having him as their Vice-President.

Mr. A. E. Broadberry (Tottenham) seconded the motion, which was heartily carried.

Mr. Green, in acknowledging his election, thanked the members sincerely for the honour conferred on him. He could only say that he would do his best to fill the office as the members would wish him to. He began, however, to already feel the weight of responsibility in connection with it. He hoped that Mr. Head would have a successful year as President, and enjoy health and freedom from difficulty during that period, so that he (Mr. Green) would not be placed in the position that the Vice-President had found himself that day.

Mr. W. D. Child (Romford) remarked that he had great pleasure in proposing Mr. Price as the Hon. Secretary of the Association. Mr. Price possessed the happy geniality of disposition that specially qualified him to carry on the work of this office. The position had been held in the past by some eminent men; and Mr. Price would not allow the high position to fall back owing to want of any efforts on his part.

The Chairman seconded the motion, and it was unanimously agreed to.

Mr. Price, in his acknowledgment, observed that he should do his best to keep the standard of efficiency in the performance of his work as high as it had been maintained by his eminent predecessors in the office.

Mr. Harold W. Woodall (Bournemouth) moved that Messrs. H. Buckley, Mr. A. E. Broadberry, and Mr. H. O. Carr be elected to fill the vacancies on the Committee.

Mr. S. Carpenter (Dorking) seconded the motion, which was unanimously carried.

On the proposition of Mr. C. E. Botley (Hastings), seconded by Mr. A. F. Browne (Vauxhall), Messrs. J. L. Chapman and A. Dougall were re-appointed Hon. Auditors.

New Members.

The Hon. Secretary read the names of the candidates for election to membership. They were as follows: Mr. James W. Auchterlonie, of Cambridge; Mr. John Mackay Campbell, of Margate; Mr. Arthur Easton, of Faversham; Mr. William B. Farquhar, of Ilford; Mr. Charles Hulme, of Uxbridge; Mr. Alex. A. Johnston, of Brentford; Mr. George Mead-Robins, of Sutton; Mr. John Mitchell, of Friern Barnet; Mr. Lawrence W. Nuttall, of Gosport; Mr. F. W. Rapkin, of Dartford; Mr. W. Netherway Westlake, of Exeter.

The Chairman said there were eleven applications for membership, which was a matter on which they ought to congratulate themselves, and their Hon. Secretary for the excellent manner in which he was looking up everybody. The whole strength of an Association such as this rested on its being fully representative of the entire district. He had pleasure in moving their election.

Mr. T. Price (Walton-on-Thames) seconded the motion, which was unanimously carried.

Institution Benevolent Fund.

The Chairman said the next item on the *agenda* was a statement by the President with regard to the Benevolent Fund of the Institution of Gas Engineers; but he (Mr. Head) had no information as to what Mr. Ellery would have said to them on this subject had he been present. The main point was contained in the circular-letter that Mr. Ellery had addressed to the members regarding new subscribers to the Benevolent Fund. He (Mr. Head) did hope that those members who were not already subscribers to the fund would extend their support to it. He had never had anything to do with the management of the fund, but he was told only the other day that there were three or four cases last year which would have been helped had funds permitted; and these were all deserving cases. He repeated that he hoped those who were not now subscribers would quickly subscribe. Subscriptions as low as 5s. a year were gratefully accepted.

Papers Read.

There were three papers read, as follows:

"Sulphate Manufacture for Small Works." By Philip G. G. Moon, of Bournemouth.

"District Pressure." By Thomas Price, of Walton-on-Thames.

"High-Pressure Gas-Lighting." By A. E. Broadberry, of Tottenham.

The papers are reproduced in other parts of this issue, together with reports of the discussions on the first two. Mr. Broadberry's paper was illustrated by some magnificent lantern views of some of the high-pressure lighting that the Tottenham and Edmonton Company have carried out at the Alexandra Palace and shop lighting in various parts of the district. The paper was not discussed on this occasion; but there is a proposal that Mr. Broadberry should at a future meeting supplement it, and that then the present and supplementary contributions should be discussed together.

At the close of the paper,

The Chairman said he thought that the members would agree with him that the hour was too late to have a proper discussion of such a magnificent paper. Mr. Broadberry had been unable to let the members have copies of the paper in advance, so that they might prepare themselves for getting more information out of him on a subject that he knew so well, and so much better than most of the members. He (the Chairman) was going to suggest that the discussion might be postponed until next year. It was rather a long time to which to look forward; but Mr. Broadberry said he would then read a little supplementary paper to bring the matter up to date again. By that time, he (the President) hoped many of the members would have had more experience than they had at present of high-pressure lighting, and, so equipped, there should be a fine discussion. In conclusion, he proposed a vote of thanks to the authors of the three papers.

Mr. B. R. Green, in seconding the motion, remarked that he was sure they would read Mr. Broadberry's paper with great benefit. It had interested him considerably, more particularly seeing that Mr. Broadberry had given him information which had enabled him to start similar installations in the district of the Mitcham and Wimbledon Company; and the installations had been highly successful. He, for one, would look forward with a great deal of interest to the deferred discussion.

The motion was cordially passed.

This concluded the proceedings; and almost immediately afterwards "high tea" was served.

It was the intention of the Chemical Society earlier in the year to give a banquet in honour of certain Past-Presidents; among them being Professor Odling, F.R.S., Sir William Crookes, F.R.S., and Dr. A. G. Vernon Harcourt, F.R.S. It was postponed on account of the death of King Edward; but it took place at the Savoy Hotel last Friday.

RECENT PROGRESS IN, AND THE PRESENT STATUS OF, GAS LIGHTING.

By F. W. Goodenough.

[Extracts from a Paper Read before the Illuminating Engineering Society, Tuesday, Nov. 8.]

The object of this paper, as I understand it, is to put before those responsible for, or interested in, the illumination of premises or thoroughfares information respecting recent developments and the present possibilities of gas lighting; so that, should that illuminant be selected for any installation, the greatest efficiency may be secured and maintained at the least cost.

This is not the occasion, nor is the platform of the Society the place, for any discussion of the relative costs or merits of rival illuminants. That is a battle which must be, as it is being, fought out in the less peaceful atmosphere of the commercial world; and, while not averse from taking a modest share in the combat when occasion serves, I hope that I shall now and at all times succeed in keeping anything I may say at a meeting of the Society (which stands or falls by its power to avoid commercial as opposed to scientific controversies) free from offence to my good friends who are interested in other illuminants. For this and other reasons, I have reluctantly come to the conclusion that it is only possible to deal with my subject on the most general lines; and this must be my apology for the meagreness, and, I am afraid, the dull and uninteresting character, of my paper, which is confined strictly to general terms.

The Inverted Burner and Shop Lighting.

Consideration of the recent history and the present position of the science of lighting by coal gas necessarily centres itself upon the inverted incandescent burner; whether one is considering the utilization of gas at the ordinary district pressure of (say) 3 inches head of water, or the use of gas under special pressure of (say) 6 inches head of mercury, which is becoming very general, especially of late, for, among other purposes, the exterior lighting of rows of shops. In such cases, the gas at increased pressure is supplied from a common centre and charged for on the basis of estimated consumption for a predetermined number of hours per annum (arrived at from an agreed time-table for lighting and extinguishing), *plus* maintenance charges and working costs. For this co-operative system of lighting, there is undoubtedly a large opening. It will certainly improve the appearance of the streets in which it is adopted, as the striking lack of uniformity in—the enormous difference between—the power and character of the lights employed by the various shops in our streets at the present time detracts very largely from the general effect.

History Repeats Itself.

It is of interest to note that the inversion of the burner has been the means of increasing the light obtained per cubic foot of gas consumed in both of the two distinct eras of gas lighting—the era of the directly luminous and that of the Bunsen, or indirectly-luminous, burner. The inverted burner of the Siemens or Wenham type increased the efficiency of the luminous burner nearly threefold—viz., from $2\frac{1}{2}$-candle power per cubic foot in the ordinary batswing burner, or $3\frac{1}{4}$-candle power per cubic foot in the argand burner, to 8 or 9 candle power per cubic foot in the Wenham lamp. The result was, of course, due to the heating of the gas and air prior to combustion.

Welsbach's great discovery of the incandescent mantle, with its ultimate efficiency in the supported—or, as it is generally called, the upright—form of from 20 to 40 candle power per cubic foot, according to the pressure used, necessarily eclipsed the inverted luminous burner. But history has repeated itself in this case. The inversion of the incandescent burner has brought about a materially increased efficiency; and the inverted mantle has now eclipsed the fork-supported type. This is due not only to the higher efficiency of the former, but also: (1) To its lending itself to the use of shadowless lamps; (2) to its capability of being used in considerably smaller units of light—from, say, 25-candle power upwards instead of a minimum of 50-candle power; (3) to its consequently lending itself more readily to artistic effect in illumination; and (4) to its further capability of being used in larger units of light—any power up to 4000-candle power in one lamp being obtainable.

High Efficiencies and Light Distribution.

The latest pattern inverted burners supplied with gas at the ordinary district pressure of 3 inches (water-gauge) give an efficiency of 30-candle power per cubic foot consumed; while used with a pressure of about 90 inches water-gauge (equal to about $6\frac{1}{2}$ inches mercury gauge), the inverted burner gives an efficiency of 70-candle power per cubic foot consumed. These higher efficiencies are due to a higher flame temperature being obtained by the pre-heating of the gas and air, which, after admixture, descend to the point of ignition through a tube surrounded by the ascending products of combustion. The figures given are maximum candle powers averaged between the angles of 10° to 40° below the horizontal—that being, in my view, the direction in which it is desirable that maximum illumination should be available to ensure as even a diffusion of light as possible.

With the light emanating from a source of the shape of an inverted mantle, which gives direct rays in every direction except immediately upwards, and which is not obscured in any direction below the horizontal, adequate light is always assured in the immediate vicinity of the burner; and as the greater the distance the light has to travel to reach the object to be illuminated, the greater the initial power of the far-travelling rays must be in order to produce illumination approaching in efficacy to the illumination of objects more nearly under the source of light, it is of importance to the illuminating engineer that the burner he

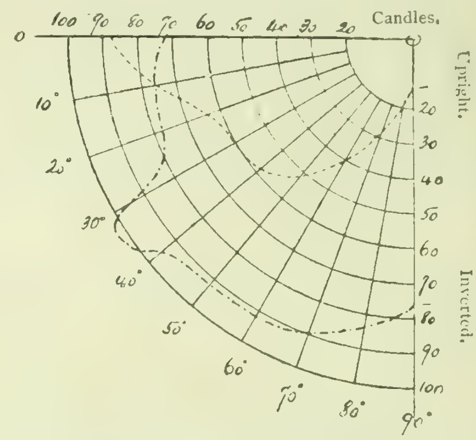


Fig. 1.—Characteristic Curves of Upright and Inverted Low-Pressure Gas-Burners.

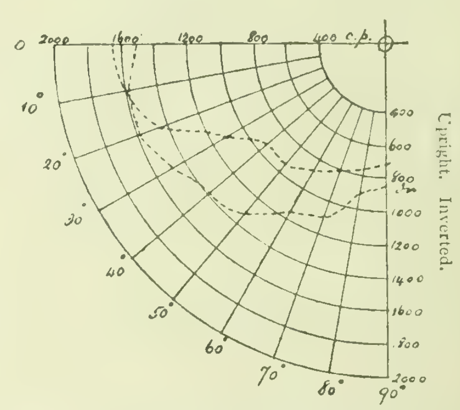


Fig. 2.—Characteristic Curves of Upright and Inverted High-Pressure Gas-Burners.

uses should be capable of doing its best work in the direction in which most light is wanted. At the same time, the light in other useful directions must be proportionately adequate; and that is a valuable characteristic of the inverted mantle. This is illustrated by figs. 1 and 2, showing the characteristic lighting curves that are obtained from inverted burners of both ordinary and high-pressure types, compared with those obtained from burners of the upright pattern.

Light Concentration and Reflectors.

Where greater concentration of light in any particular direction is essential for specific purposes—as, for example, for lighting shop windows from without, or for drawing-boards, machines, compositors' frames, and the like, lighted from above—this can, of course, readily be obtained by means of suitable reflectors. Here, again, the inverted burner possesses advantages over the older type, owing to there being no obstruction whatever of the downward rays. The effect of imposing suitable reflectors for downward lighting is illustrated by figs. 3 and 4.

Street Lighting and Central Suspension.

The advantage of the light from an inverted burner being entirely free from obstruction below the horizontal enables it to be used effectively for street lighting, not only in the column-supported lamp, but also in suspended lamps, whether from brackets as in Fleet Street (high-pressure) and the eastern end of Cheapside (low-pressure) or centrally hung from cross wires as in the eastern end of Cannon Street. The central hanging of gas-lamps from cross wires, the gas being conveyed to the lamps either by flexible metallic tubing or by barrel with flexible joints—enabling the lamps to be drawn to the side of the street, and lowered for purposes of maintenance—is one of the latest adaptations of gas lighting in this country, though it has been adopted in several towns in Germany for some time past. The trial installation of this system at the eastern end of Cannon Street (which is only just in course of completion) will, therefore, be of interest to those who favour the system of lighting streets by crosssuspended-lamps, which I personally, as an illuminating engineer, regard

as radically unsound, and, as a humble citizen, consider an unnecessary aggravation of the already too frequent disfigurement by overhead wires of the, at all times, too restricted amount of sky vouchsafed to our town-tired eyes.

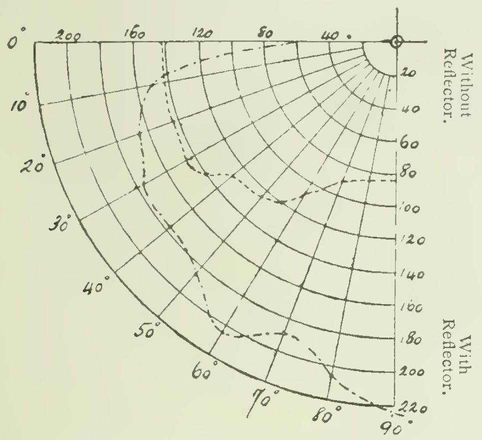


Fig. 3.—Alteration to Curve Obtained from an Inverted Burner by Fitting a Reflector to Concentrate Light on Office Desks.

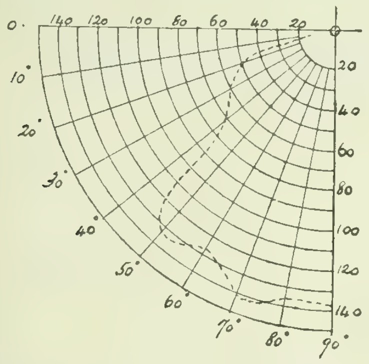


Fig. 4.—Curve Obtained by Use of Pyramid Reflector with Inverted Burner for Giving an Intensified Light on Drawing Table.

Illustrations of Usual Methods of Application.

The application of the inverted burner to the more usual method of street lighting—viz., by column-supported lamps, has recently been illustrated on a considerable scale by the substitution of inverted burner lamps, both low and high pressure, for the older pattern gas-lamps in portions of the City of Westminster. Good examples of the latest high-pressure inverted gas-lamps will be found in Victoria Street (one being conveniently placed opposite the offices of the Society) and in Parliament Square and Whitehall; while as good specimens of street lighting by low-pressure inverted lamps, I might mention Great George Street, Ashley Gardens, Vauxhall Bridge Road, Kensington Road from Knightsbridge to Queen's Gate, Prince Consort Road, St. James's Square, and Carlton House Terrace.

Some photographs (taken at night by the light of the lamps) which I have had reproduced illustrate as well as such photographs can the even diffusion of light obtained.* This is due mainly to the fact that the rays of highest power are those at an angle of 10° to 40° below the horizontal; but partly also to the fact that the shortness of the mantles, and the height (and distance apart) at which the mantles are placed in the lamps, ensure that one mantle does not obscure the light of another in any useful direction.

It is a matter of congratulation to the honest and respectable wayfarer by night that our local authorities are becoming more and more alive to the imperative need for a higher standard of efficiency in street lighting in the Metropolis, which has arisen out of the rapid and ever-increasing growth of fast motor traffic in the streets. At night, motors at a distance must be made clearly visible to pedestrians if the crossing of a street is not to become a matter not only of anxiety but of serious peril. Illuminating engineers who have influence with local authorities may do good service to their fellow-citizens by laying stress upon this point.

Automatic Lighting and Extinguishing.

A further point of interest to mention in connection with recent developments in gas lighting for streets, is the extending use of automatic appliances for the lighting and extinguishing of street lamps. Those of the clock-actuated mechanism type are not well suited to districts where irregular lighting of the lamps is from time to time necessitated by the sudden advent of fog, for which purpose the necessary staff no longer exists if clockwork lighters have been installed. This is a point that needs to be borne in mind by any Metropolitan authority who are considering the adoption of automatic appliances for street-lamp lighting. The objection does not apply to the class of automatic apparatus which is operated by an increase of gas pressure given at the lamp from the gas-works when required, for either lighting or extinguishing. There are several forms of pressure-operated apparatus, some of which are best suited to districts having a simple system of distribution from a single works, but which do not, as other appliances do, meet the peculiar conditions of undertakings having a complex system of distribution from a number of works supplying a common network of mains. The latest form that is being tried in London has the peculiarity of being affected by sudden slight rises in pressure deliberately applied without being operated by gradual increases such as occasionally take place after lighting-up time, due to variations in load on mains that are working to the full capacity. It may be remarked, in passing, that a much closer approximation of the pressure-register line to a constant reading than in former years is one of the modern developments of gas supply.

Automatic methods of lighting and extinguishing can also be readily applied in the case of both low and high pressure gas supplies where all the lamps to be lighted are on a common service. This, of course, applies to either street or internal lighting. In the case of high-pressure installations, the act of starting the compressor will light up all the lamps supplied from it by the higher pressure opening valves that remain closed at ordinary pressures; and this system is widely adopted. At the Victoria Station of the Brighton Railway, the platform lamps are controlled in alternate series by cocks at the platform ends; so that the lighting of the platforms can be increased, diminished, or extinguished altogether from one point. There is in this case a constant bye-pass supply to all the lamps.

Pneumatically operated valves on single burners to enable small units of light to be lighted with the aid of a bye-pass from a distant point, have been widely adopted in recent years for both domestic and other indoor lighting; while electrically operated appliances, which light as well as turn on the gas, are also coming into use.

Mantle Life and Maintenance.

With the inverted burner the life of the suspended mantle is distinctly longer than in the case of the supported mantle, chiefly by reason of its more compact form. This is a point of great importance to illuminating engineers, in connection with the question of mantle maintenance. In this respect, the gas industry has made substantial progress in recent years, both in regard to the quality of the mantles obtainable (I use the word advisedly, as distinct from obtained) and in regard to the facilities offered by gas undertakings to consumers for the periodical inspection and cleaning of their burners and the renewal of mantles when necessary, at a fixed annual or quarterly charge. This periodical attention to incandescent burners by competent men, is commended to illuminating engineers and their clients on several grounds. First and foremost of these is that a gas company is in a position to ensure that no mantles shall be used other than the best obtainable. The low-priced, but dear, because unsatisfactory, mantle is as great an enemy to the gas industry as the low-priced but also low efficiency and short-lived lamp is to the electrical industry; and it is the business of all concerned in either industry to do everything possible to eliminate the undesirable.

A gas company can and should, as many do, submit samples of the mantles sold to them to a continuous and severe test, and ruthlessly reject the bulk when the samples fall below the highest standard. The Gaslight and Coke Company take haphazard samples out of stock every week, and submit them to photometric tests (continued at intervals over a period), and also to shock-resisting tests on a machine devised for the purpose by Messrs. Woodall and Moon. They do not issue any specification for the supply of mantles—it being a matter for competition among the manufacturers to produce the highest combination of efficiency and durability; and those who succeed secure the business, and retain it so long as they keep up to the standard they have set, and no longer. The result is, therefore, that the consumer who places his lights under a maintenance contract with the Company ensures that the mantles used will give him the best light obtainable for the gas consumed. A further result is that the burners will be freed from the inevitable accumulations of dust from the atmosphere; the glassware will be thoroughly cleaned and its transparency maintained; the necessary new mantles will be supplied—all at sufficiently frequent intervals to ensure the maintenance of a constantly good light. Another advantage incidental to a maintenance contract is that the consumer can estimate beforehand, or find out at any time, with certainty, his cost for up-keep, which otherwise, except in business houses where costs are carefully kept and closely analyzed, is a matter of doubt and consequently of uneasiness to the consumer.

I am confident that no supplier of illuminant can afford, nor ought he to be content, simply to supply the commodity and leave the consumer to work his will with it, unadvised or unassisted. I have spoken of new mantles being supplied at sufficiently frequent intervals to ensure the maintenance of a constantly good light. The question may be asked: What should be the frequency of these intervals, and how is one to determine when a mantle requires renewal because of loss of power as distinct from obvious damage? This is a question the answer to which cannot be precise, because everything depends upon the local conditions under which the mantle is used. It may, however, be stated as a general proposition, founded upon a large series of tests, that if the burner

* Five of the photographs here referred to appeared in the "JOURNAL" for Sept. 27, pp. 831-3; the other two shown are those accompanying this paper, p. 470.—ED. J.G.L.

St. James's Square. Photograph taken by the Light of Low-Pressure Inverted Gas-Burners.

receives such periodical attention as it would from an ordinary qualified maintenance fitter, a mantle that would pass a gas company's tests (such as I have mentioned) will not sensibly diminish in candle power in 500 hours, and will not lose more than 10 per cent. in 1000 hours of burning. The average of some tests made some time ago of vertical mantles, tested on the horizontal, shows a drop of 7 per cent.—namely, from 20 to 18·6 candle power per cubic foot—after 806 hours burning. The depreciation I have referred to is, of course, apart from the question of damage due to vibration or other external cause, to which, however, mantles are not now nearly as sensitive as formerly, especially when used, as they are now used to a considerable extent in London and on the Continent, for contract maintenance work without having been collodionized. In actual practice, the efficient life of a mantle on a burner properly maintained averages from about 500 to 600 lighting hours in public lamps. The "best on record" that I know of was a mantle that gave a good light in a lamp in St. James's Park for two years—say, 8000 lighting hours—and became an object of affection to the lamplighter, who was quite grieved when the mantle at last broke down.

In private installations, including factories, public houses, and other premises where the percentage of breakages from external causes is highest (and which are the first to be placed under contract when such a service is offered by a gas company), the average life is about one-half the before-mentioned number of lighting hours, leading to an average use of about five to seven mantles per burner per annum. In residences, on the other hand, the average life is generally higher than in public lamps. It is not an uncommon thing to find a mantle to last twelve months in a private house.

The quality of mantles is steadily improving in the direction of both illuminating power and durability; while the extended use of non-collodionized mantles by gas undertakings—introduced into this country by Mr. Corbet Woodall, as a result of his observations of the excellent results obtained in Berlin, where the average life of mantles in the public lamps in some districts is 1000 hours, with never a defect to be observed—promises to be of much value to the consumer by reducing contract charges for maintenance. This reference to Berlin is based on personal observation. In that city, I have inspected some thousands of public lamps; and I have never found a defective mantle in a single instance, and non-collodionized mantles are used there. I also find that in Germany, the use of non-collodionized mantles is very common for the maintenance of private installations; and they are being used very considerably in that direction in this country now.

Photograph taken by the Light of High-Pressure Inverted Gas-Burners while the Street was Wet from Scavenging.

CONFIDENCE IN THE FUTURE.

In conclusion, I would say that those of us who are engaged in the gas industry, while looking back with some satisfaction upon the advance made in recent years, are by no means content to rest on our oars, but rather look forward with a lively expectation to further advance in the future. The efficiency of gas lighting, viewed as a problem of converting heat into light, is still very low in comparison with other methods—that is to say, the illuminating power produced is far less in relation to the energy consumed—say, 125-candle power per 1000 B.Th.U.—than it obviously might, and in all probability at a future date will, be, though already very far in advance of what it was in the era of luminous burner lighting.

Discussion.

The PRESIDENT (Professor Silvanus P. Thompson, D.Sc., F.R.S.) said Mr. Goodenough had referred to his paper as being, to use his own adjectives, meagre, dull, and uninteresting. He (the President), for one, had not found it either dull or uninteresting; and its shortness did not arise from any meagreness of internal interest. Mr. Goodenough had described the method of lighting streets by the central suspension of lamps as being, from the point of view of an illuminating engineer, radically unsound. He gave no reasons for the condemnation; and he (the President) wanted to pin him down to give some reasons for objecting to putting a lamp over the centre of the roadway. He also wished to congratulate Mr. Goodenough upon the excellence of the photographs in the paper; but he wondered how the author had been able to secure photographs of lamps by their own lights so extraordinarily free from that which was a usual defect of photographs of the kind—atmospheric glare round each lamp. In these, it was conspicuous by its absence. He hoped to hear something more regarding the question of the deterioration of mantles in modern lighting. Much had been said on this head by way of criticism of mantle lighting; but he himself thought that mantles had been unjustly condemned, because, like other means of lighting, they grew old with time. The improvement apparently effected by not collodionizing mantles was also a subject on which they would like to hear more. Regarding the discussion, he asked that the paper be discussed on its merits, and let them have the best information on the latest developments of this important branch of applied science. There was a word he should like to say as their President, and at the request of the Council. It was that they earnestly hoped, in coming that evening to the discussion of the latest forms of gas lighting, they might steadfastly avoid entering upon that which was not the subject of the paper—that was, the comparative merits of gas lighting and other illuminants. They were not there to discuss such a polemical subject. One of their distinguished visitors was Mr. Charles Carpenter, the Chairman of the South Metropolitan Gas Company; and he would ask him to open the discussion.

Mr. CHARLES CARPENTER said he had much pleasure in complying with the President's request. In the first place, he should like to congratulate the Society on the evening's programme, for two reasons. One was the choice of Mr. Goodenough to give the paper, because he did not know of any gentleman who was more qualified to deal with up-to-date gas lighting than the author. He now had the control of (he supposed) something approaching 100 square miles of the best part of the Metropolis; and his wits were being constantly sharpened by that friendly competition of which he had spoken, with twenty or thirty electricity suppliers; and he (Mr. Carpenter) therefore might conclude that what he did not know about modern gas lighting was not worth knowing. Another reason why the Society were to be congratulated that evening was upon the presence in the chair of a distinguished physicist. He did not remember a similar occasion on which a gentleman of the scientific attainments of Dr. Thompson had taken the chair at the reading of a paper on gas lighting; and he thought the gas man might take it as a sign of the times that it was being recognized that the knowledge of gas lighting was on a more scientific basis than was the case a few years ago. While he was listening to the paper, he was reminded of a circumstance that happened some seven years since when he was attending a congress on photometry at Zurich. He was sitting in a beer garden, smoking a cigar, with a distinguished scientific man; and his friend, looking at one of the upright incandescent gas-burners, said: "What a pity so many of those rays are going the wrong way. If we could turn the mantle upside down, and use these rays below the horizontal, what an improvement it would be." One would have thought that gentleman would have been responsible for the initiation or the invention of the inverted burner; but he was not. The prophecy, however, had been fulfilled, because, when gas lighting was spoken of nowadays, they almost invariably thought of inverted burners. He considered Mr. Goodenough was right in giving so much attention to them in his paper that evening. There was one cause for the efficiency of the inverted burner that Mr. Goodenough had not mentioned. It was a physical one; and he thought it could be described in this way: In the vertical burner the particles of gases rising from the burner top were in continually increasing upward motion, and they were getting away as fast as possible from the mantle it was their business to illuminate. In the case of the inverted burner, the particles were moving vertically downwards at a gradually decreasing rate. They then come to rest; the direction of their flow was reversed; and they rose upwards. But there was that certain pause in their flow; and one might almost imagine that they were doing their duty, and giving their effect, in a still atmosphere, or in an atmosphere still in comparison with the lively atmosphere in which the vertical burner was working. At any rate, with equal pressures and equal quantities of gas, there was no doubt that the efficiency of the inverted burner flame was higher than that of the vertical burner. One of the reasons for the efficiency of the burner was the one he had explained. It was not only that the rays were turned downwards in the most useful direction, but the energy of the gas was being put to better use. There was still another matter which was, he thought, of importance to the suppliers of gas; and that had regard to the type of burner used. It was well known among gas engineers that the chemical composition of town gas as supplied was not the same in all towns. There were for this very good reasons, into which he need not enter. The burners used for obtaining light by inverted burners were supplied from various makers; and in order to localize their operations, the burners were provided sometimes with air adjustment and sometimes with both gas and air adjustment. By these means, the burner was adaptable to the special conditions regarding gas composition. A week or two ago, he saw in the "JOURNAL OF GAS LIGHTING" a reference to a proposal of an inventor to—instead of providing means for a variation of that kind—take the gas in each town, and select the most suitable burner for giving the best results with the particular quality of gas there, without the use of any adjustment; and he arrived at the burner that was the best by means of tests which he explained—his contention being that inverted burners of this kind should be supplied to the gas consumers. He (Mr. Carpenter) believed that was the proper system; he thought it was a disadvantage it should be necessary to have the gas or the air adjusted. In connection with the Company with which he (Mr. Carpenter) was associated, they had been making for the last eighteen months a good many experiments in this direction, and during most of the time the streets in South London had been illuminated by inverted burners having no adjustment for either gas or air. The area of the gas-jet and the area of the air-supply openings were predetermined by the pressure and composition of the gas, and they were not alterable by the lamplighter. They had also been testing during the last twelve months similar burners for indoor use; and these were just in the position of being available in South London for the winter's work. The burner had no adjustment; and it was slid into the socket on the fitting in the same simple manner as the electric lamp. London, he might say, was the most difficult city in the world for the use of the incandescent burner, owing to the large amount of dust the atmosphere contained; and therefore one of the necessities in a practicable burner was that it should be easily cleaned. The burner of which he had spoken could be taken off, blown through, and replaced in a few seconds.

Mr. C. W. HASTINGS remarked that the paper was a thoroughly practical one, not only to the professional man, but to the layman. Reference was made in the paper to the difficulties of pressure; and for domestic lighting, pressure was the *crux* of the whole thing. The new burner referred to by Mr. Carpenter appeared to get over many difficulties; but he should like to ask Mr. Goodenough whether, in connection with his Company, they had taken any steps for giving the consumer normal pressure—say, by putting a regulator or a governor on the Company's side of the meter. A consumer really knew nothing of the pressure of the gas with which his house was being supplied.

Mr. W. H. Y. WEBBER said he was pleased to have an opportunity of testifying to the value of this excellent record of the progress that had been made in the application of gas for lighting. The author had, with rare self-denial, debarred himself from some of the very interesting points that he might otherwise have made if his paper had been less of a record, and more of an active piece of propaganda for gas. As the author truly said, this was not the time for that; but, after all was said and done, combat was more interesting than writing history. He could not but help feeling this himself. He (Mr. Webber) wished to say, in reference to a point mentioned by the President, that he personally heartily supported the author in his objection to axial lighting of main thoroughfares. He thought it was the wrong place for street lamps for one or two reasons. In the first place, it put most of the light where it was not wanted. In the second place, the direction of the light was unfortunate for both vehicular and pedestrian traffic where there was axial lighting. The omnibuses travelled with their entrance side in the shadow; and it was very difficult to see the announcements on the side of the omnibuses as to their destinations. In the case of vans unloading goods at (say) a warehouse, the inside of the van was, with the lights in the centre of the roadway, as dark as a vault. It was difficult, too, to ensure that entrances of warehouses or private places were efficiently lighted as far as the main door. A friend told him once that, in walking down Cannon Street, he observed a guardian of the peace enjoying a quiet smoke in a small triangular patch of shadow in one part of the side of the street. If refuges could be so provided for guardians of the peace, they might also form refuges for objectionable persons. Light in the streets was really required more for pedestrians than it was for the central line of the thoroughfare, which was scarcely used, except by firemen. There was a very interesting reflection in connection with this paper. It was that most of the improvements—the advancement in brilliancy—spoken of by the author were due to the infinite pains taken by those who had laboured in this department of engineering. The actual elements of present-day incandescent

burners remained as they were a good many years ago; but there was no doubt whatever that, by the constant application of skill and observance upon the part of manufacturers, helped by the criticism of officers of gas companies like Mr. Goodenough, the net result had been a very considerable improvement in the efficiency of all classes of gas-burners.

Dr. Rudolf Lessing, referring to the statement in the paper as to the high efficiencies of inverted incandescent burners being due to the high flame temperature, said he thought the words put the whole question of the high efficiency of the inverted burner in a nutshell. There was no doubt that the temperature of the incandescent body was, after all, the factor that regulated the light that was emitted from it; and he thought it had been proved that, in the range of the temperature of the bunsen flame—from 1500° to 1900° C.—an increase of about 100° C. was capable of doubling the lighting effect to be obtained from the incandescent burner. Thus it was certainly the temperature of the body of the incandescent mantle that regulated the efficiency. The temperature was conditioned by several factors. First of all, by the flame temperature itself. As those present were well aware, the bunsen flame was dissected into different cones at different temperatures. Allowing a flame to burn as they had it in the laboratory bunsen burner, they had an inner cone which was comparatively cold, while the outer cone, which received sufficient air to allow the theoretical combustion to take place, was very hot. The inner cone was much cooler than the outer one—a difference of something like 300° was possible. If they added to the gas sufficient air to obtain the theoretical mixture, and therefore the best possible combustion throughout the flame, they would be in the position to place the body of the mantle in the hottest zone. On the other hand, the length of the flame would be considerably shortened; and a second advantage was obtained—that the heat that had to be given out by the flame as a whole was more concentrated. They had not only the total possible heat given out by the flame; but the heat was concentrated on the body which had to be heated to emit light. Therefore the regulation of the air supply seemed to him to be necessary. He should not like to question Mr. Carpenter's statement as to the advantage that would, and no doubt did, accrue from burners that could be used without the regulation of the air supply. The majority of burners possibly went into the hands of people who were not capable of handling the minute adjustments they required. On the other hand, he did not think every gas undertaking was in the happy position, as was the one over which Mr. Carpenter presided, to supply gas of something approaching uniform composition; and the majority of gas undertakings had to be considered as well, seeing that adjustment of the burners in their areas would appear to be necessary. The temperature of the flame was dependent upon the air supply. But there was another point—the one quoted in the paper—as to the preheating of the gas and air mixture. Putting together all the factors that would possibly control the available heat of the flame, they would be the amount of heat developed, the volume and temperature of the products of combustion and their specific heat, and the temperature of the gas and air mixture brought to the point of ignition. The volume of the gases and the specific heat were responsible for all the heat that would be abstracted by the excess of air, and this had to be avoided as far as possible. On the other hand, the preheating would allow the mixture to be ignited at the optimum point, and thus give the best possible conditions. In putting the regenerative system of preheating into any lamp, they were in a better position to see the scientific basis underlying the whole question than they were a few years ago. It was now possible to bring lamps to such a nicety that the excess of air in the products of combustion was reduced to a minimum, so that the maximum heat, or nearly obtainable maximum heat, was applied to the heating of the incandescent mantle. The preheating of the gas-air mixture was dependent on the temperature, velocity, and heat conductivity of the flue gases and on the surface and temperature of the wall separating the air supply and flue-gas exit. To allow of a rapid exchange of heat, the endeavour must be in the direction of keeping a large surface, which should be as thin as the construction would allow without deterioration by the heat applied to that part of the lamp. The factors quoted were nearly all constant in any case; but there was one—the temperature of the flue gases—that largely influenced the efficiency of the lamp. Its maximum could be easily determined by simple means—that was, by analyzing the flue gases. If they did this, they could find what, if any, excess of air was present in the flue gases. He called to mind one or two cases of modern high-pressure inverted lamps, where it had been possible, after ascertaining these conditions and drawing the practical conclusions by constructional alterations, to reduce the excess of air by about 30 or 40 per cent. of the excess present in previous designs, with a consequent increase to the same extent in the efficiency of the lamp.

Mr. W. J. A. Butterfield (called upon by the President) said he did not expect to have the opportunity of speaking; and Mr. Goodenough had covered the ground which he set out in his paper to deal with, so fully and so clearly that there was very little that one could fix upon—certainly not for criticism, and very little to enlarge upon. In regard to the question of central suspension lighting, he quite agreed with the author that it was highly objectionable, not only on the grounds that Mr. Webber had referred to, but because overhead wires in the streets were objectionable on account of their interference with the raising of ladders and fire escapes. The objection equally applied to tramway conductors. Regarding the question of maintenance charges, when, some seven years ago, he was preparing a text-book on a rival illuminant to town's gas, and since when revising the work, he was very glad, although he knew the facts in regard to town gas, to have indisputable figures in regard to the cost of gas lighting, inclusive of maintenance. It was not difficult to obtain the average photometrical value of a gas-lamp; but those responsible for rival illuminants constantly wondered whether the maintenance charges were not much higher than those responsible for gas-lighting represented. The fact that a gas company would undertake to maintain a burner for so much per year or per quarter gave a sure basis of computing the absolute cost for gas lighting per annum for a good light. Then in regard to the life of mantles, speaking purely in a domestic capacity as a householder, he had had in the case of one burner a very favourable experience. The first mantle on this burner lasted well. It was a No. 3 or No. 4 Kern burner; and the mantle continued in good condition for three years, with a falling-off in the light of not more than 15 per cent. A second mantle on the same burner was now in use, and had been running for two-and-three-quarter years. This was in the entrance hall in his house, where it was exposed to draughts. But this was admittedly an exceptional case. Speaking generally, he agreed with Mr. Goodenough that the life of the inverted mantle was considerably higher than that of the upright mantle. He could also fully confirm what Mr. Carpenter had said as to the efficiency of the burners for inverted lighting in which there was no air or gas regulation, when the burners had been standardized for the particular gas which they consumed. He had watched the work of the burners designed by Mr. Carpenter both on the coal gas (which, as Dr. Lessing had said, was of uniform composition) in South London, and also on the mixed gas supply in the South Suburban district; and the results obtained in both areas were eminently satisfactory. It was curious they were coming back to fixed conditions in the burner for lighting between the air and gas supply, while the heating apparatus makers were going in the other direction for stoves.

Mr. A. E. Broadberry (Tottenham) said he much wished Mr. Goodenough had dealt with some of his points at greater length, because many of them were capable of a great deal of development. But he could quite appreciate his reasons for denying himself the opportunity that he had had. With regard to high-pressure lighting generally, he (Mr. Broadberry) had not the slightest doubt that distribution pressure in gas supply would be a constantly increasing one—not only for what was known as actual high-pressure purposes, but also for ordinary purposes. He thought gas supplies would be constantly, though gradually, on the upward trend as to pressure; and as they proceeded in this direction, they would likely develop much better efficiencies. In the earlier days of incandescent gas lighting, burners were adjusted for 1 inch water pressure; but it was very soon found that higher efficiencies were to be obtained by higher pressure; and the tendency had ever since been upwards. Personally, he felt that they were merely on the outskirts of what could be obtained from gas, and that they would go on advancing their efficiencies, so that in a few years' time they would look back on the present systems as being as old-fashioned as those of ten years ago were regarded now.

Mr. S. E. Thornton (Chairman of Messrs. William Sugg and Co., Limited) said he thought that not only professional men, but the general public were interested in the subject of Mr. Goodenough's paper; and he hoped it would be circulated broadcast. There was no doubt that inverted burners were the best things for lighting the streets. But they had some beautiful public buildings in London; and their external illumination ought to be considered. They could by illuminating them get some very artistic effects in the streets.

Mr. R. W. Edwards (Aldershot), while warmly congratulating Mr. Goodenough, felt constrained in the same breath to reprove him, because he had restrained himself to the disadvantage of those present who would have liked a little more information on some of the points treated upon. Perhaps Mr. Goodenough considered it inadvisable to give too much detail at present; but no doubt at some later date he would supply them with information in the fullest sense. Dealing with the first question of maintenance, they would like to know whether, from Mr. Goodenough's experience, he had found it best to take on consumers' maintenance at an inclusive charge per quarter or per annum, whether the payment included labour and mantles *ad lib.*, or whether, as opposed to that, he would recommend a system of providing the materials at cost, or something near to it, and supply the labour free; or whether he would suggest doing the labour at so much per burner (say, 1d. per burner per visit), and charge for the material. He (Mr. Edwards) would be personally interested in information on the point from the author. Like the President, he had an adverse opinion to Mr. Goodenough in regard to the question of lighting across the street. Some years ago, he remembered a street in Liverpool—a somewhat narrow street—that was lighted by slung central lights, to the great advantage of the thoroughfare; and, in narrow thoroughfares, he did think the cross or central lighting was much more efficient than side lighting. Side lighting was unquestionably better in wide thoroughfares with broad footpaths. As to the high-pressure distribution in the West-end, he should like to know whether the gas was compressed at a central station, or decentralized; what was the motive power used; and was there

any auxiliary power? He should also be pleased to learn whether Mr. Goodenough had any experience where the gas and air were mixed at the compressing plant, as at the Brighton Railway Station. Mr. Carpenter had mentioned that in South London he was able to supply burners without any means of regulation. He (Mr. Edwards) was rather surprised at this; and he must say it spoke well for the manufacturing arrangements at the gas-works. But Mr. Goodenough would agree that the use of such a burner would be somewhat difficult in districts where mixed gas was supplied. It was impossible to get the same evenness in the composition of the gas where a mixture was distributed as was necessary for such a burner; and therefore, in his opinion, the regulation of burners was advisable.

Mr. Carpenter asked to be allowed to add that the non-adjustable burner to which he had referred had been working privately under his own observation in Westminster, on the gas supply of the Gaslight and Coke Company, with complete success for the last twelve months.

The President said that one gentleman had expressed some surprise that mere physicists should take an interest in such a subject as gas lighting. He (the President) thought the mere physicist should take an interest in gas light; for it was a thing of scientific invention. Not a great number of years ago, they were only getting 2 or 3 candles per cubic foot of gas consumed; now it was possible to obtain 70 candles by the use of mantles and high pressure. Such an extraordinary improvement—the result of the consumption of material obtained by strictly scientific means—was most interesting for the scientific man from whatever quarter he might come. The room of the Society of Arts in which they were assembled had been the centre of scientific wonders for over a century. It witnessed the birth of gas lighting; and there were discourses there when Winsor laid the first gas-pipes in London for the Chartered Gas Company. He (the President) himself had heard a lecture in the room, in the seventies, in which the lecturer was confident he had lived through the gas era. Now they had Mr. Goodenough showing them that the era of real gas lighting had only just begun.

Mr. Goodenough, in reply, remarked that his paper had been criticized as being too short. He thought the shortness of the paper was justified by the fact that it had given time for the discussion; the remarks that had fallen from the various speakers having been more valuable than anything he was himself able to say. Dealing first with the President's challenge as to why he considered the lighting of the roadway by lamps suspended over it as unsound, Mr. Webber had partially answered the question. The light tended to throw shadows from vehicles on to the pavement; and a person trying to see the destination of an omnibus had the disadvantage of having the side of the vehicle in shadow instead of in light; and if he attempted to get into the vehicle, he also found the entrance in shadow. There was another very strong objection to the lighting of the roadway by suspension lamps. It was this: They had to have the lamp sufficiently high above the roadway for the wires to be cleared by the passage of fire escapes or tall ladders; and if they were put sufficiently high to ensure anything like the distribution of light on to the pavement, they were so high that, if there was a fog, there was not the slightest chance of the road and pathways being lighted by the lamps, situated (say) 28 or 30 feet above the roadway. Most of them had had experience of fogs in London. He had looked down from one of the windows of his flat through the clear upper air on to a dense bed of fog underneath, with an arc lamp shining merrily above the fog. He had gone down, and stood at the foot of the column, and could not see the light, though the lamp was only 18 feet above the road-level. If the height of such a lamp was increased to (say) 28 feet, the chances of the light finding its way down to the street when a real fog prevailed, were very remote. He had to thank Mr. Carpenter for the very complimentary remarks he had made; and he did feel that the paper had been justified if only by securing Mr. Carpenter's presence, and hearing what he had to say on gas-lighting matters, upon which he was such an eminent authority. He (Mr. Goodenough) was particularly interested in Mr. Carpenter's explanation of the causes of the efficiency of the inverted gas-burner as against the upright form—an explanation that had not previously occurred to him. He was glad that Dr. Lessing confirmed him in his belief as to the main cause of the increased efficiency. Particularly interested would he be to see and to test the burner of which Mr. Carpenter had spoken with its fixed gas and air supply; more especially as Mr. Carpenter was able to assure them that it had been found to work with perfect satisfaction upon the Gaslight Company's supply—namely, a mixture of coal and water gas, distinct from the straight coal-gas supply in South London. He had quite an open mind on the subject. There was one point that occurred to him, and it was that the adjustable nipple by which the supply of gas was regulated served the double purpose of regulating the gas and of clearing the nipple from any temporary obstruction that might be in it without dismantling the lamp for the purpose. A turn of the regulating-screw to and fro, so as to drive the needle through the injector and back again, would often improve—would often make a substantial improvement in—a defective light. Mr. Hastings raised the question of pressure. The variations of pressure in a district were not, as he had said in his paper, by any means so material as at one time they were. Owing to the considerable higher average pressure that was now in use in the district—say, 3 inches instead of perhaps $1\frac{1}{2}$ inches as formerly—a $\frac{1}{4}$-inch variation in pressure was not nearly so high a proportional variation as it was when pressures were lower—that was to say, a difference between $1\frac{1}{2}$ inches and $1\frac{1}{4}$ inches was proportionally much greater than a difference between 3 inches and $2\frac{3}{4}$ inches. He had been told by a gentleman interested in the manufacture of instruments of precision in regard to pressures and so forth, that he had never found in his experience a straighter line on his recording-gauge than he found in Westminster nowadays. A great deal, of course, depended on the adequacy or inadequacy of the internal fittings. If the fittings internally were of a limited character, then there would be variations in pressure (even though the district pressure was constant) according to the demand made upon the supply. This was a point upon which they would be glad if architects would consult the gas company when drawing up their specifications for the piping of premises. There was a great tendency to put in internal piping when houses were in course of construction that was altogether inadequate. With adequate fittings, there was little need in most districts for pressure governing; but where internal fittings were at all on the small side, it was undoubtedly a great advantage to fix a governor on the outlet or inlet of the meter, so as to secure a constant pressure at the burners whatever the demand might be. Mr. Butterfield gave them some interesting experiences in regard to the life of mantles. He (Mr. Goodenough) was interested to read in the "Journal of Gas Lighting" that day a report from the Chief Inspector of the Brentford Gas Company of their experience in the use of mantles on high-pressure lamps at the Japan-British Exhibition, where their average for six months was not two mantles per burner. This would probably give five mantles per annum, allowing for the fact that the months of use were summer and not winter ones. Mr. Thornton's suggestion as to the illumination of fine public buildings would commend itself to gas and electric lighting companies, but perhaps not to the ratepayers. [Laughter.] Anyway, he (Mr. Goodenough) would welcome the adoption of the suggestion. Mr. Edwards asked for an expression of opinion as to the best system of charging for mantle maintenance—whether he would advise an inclusive charge (a fixed price per annum or quarter to include all materials and labour), or whether he would recommend materials at cost and labour free. He was a strong advocate of the system of charging fixed prices per burner inclusive, because he did not like leaving to the decision of a consumer whether a mantle should be continued in use or not. If a consumer had to pay so much per mantle, according to the number of mantles used, the consumer's tendency would probably be (as it was when they looked after their own mantles) towards economy rather than efficiency. He (Mr. Goodenough) preferred that it should be a matter for the decision of the gas company's fitter as to whether or not a mantle was required rather than leave the decision to the consumer, if the consumer had to pay. For these reasons, he strongly recommended an inclusive charge per annum or per quarter. Mr. Edwards also referred to central lighting for narrow streets; and, for such purposes, he (Mr. Goodenough) thought that bracket lighting was preferable as freeing the streets from any obstruction from columns, which were perhaps a nuisance in narrow thoroughfares. A great majority of the narrow streets in the City were well lighted from brackets. Then, Mr. Edwards also asked as to the system of high-pressure distribution. The Gaslight and Coke Company were supplying high-pressure gas for lighting in Westminster from a central station at their head office in Horseferry Road—the compressors being run by gas-engines with adequate stand-by; so that if one engine was not available, another was. In regard to the question of supplying a mixture of gas and air at the compressors, instead of the mixture taking place at the burner, they had not put in any installations of this nature themselves, but there were one or two on their district. The suggestion that more standards should be used in the streets was one that was rather difficult to deal with, because there was such an enormous variation as to the number of standards that were used in streets. In some streets, the number of standards was very considerable per thousand yards; in others, very scanty. Personally, he favoured the use of a number of units of moderate power, placed not too high above the ground, rather than lighting the streets by high units placed a greater distance apart, and fixed higher above the ground-level. By these means, better uniformity in the distribution of illumination was obtained.

The President remarked that, as to central lighting, he was not adopting any position of antagonism to the author. He had thought that the whole point of Mr. Goodenough's objection was the question of suspension. He was not an advocate for central pillars; and suspension did not appear to him to be much worse—except from the fire-escape point of view. There was one other matter to be referred to. They had had certain questions prepared by the Hon. Secretary in anticipation of this meeting and discussion; and two correspondents had sent certain answers to some of the points. One of the replies was from Mr. Keith. In it he touched upon a matter that had been mentioned. He asserted that it was impossible to give any fair statement as to the maximum efficiency in candle power per cubic foot of gas by the high-pressure burner unless the kind of gas was specified; but he added that, with an average kind of gas, using high pressure, he obtained 60 candles per cubic foot. With extra good gas, he had got as high as 73 candles per cubic foot; and 120 candles with specially good oil gas. In Mr. Keith's opinion, too, the most accurate way of expressing the illuminating power of a lamp was to take the mean lower hemispherical power.

On the motion of the President, a hearty vote of thanks was accorded to Mr. Goodenough.

SULPHATE MANUFACTURE FOR SMALL WORKS.

By Philip G. G. Moon, F.C.S.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 10, 1910.]

Ammonia, the residual from which gas undertakings of a fair size expect to make a respectable profit, is to very small works often nothing but a nuisance and a source of loss. Any ammoniacal liquor that may be made presents great difficulty in its disposal, as the cost of carriage absorbs all the profit on its sale, unless the works are very favourably situated; and the capital expenditure necessitated by the installation of a sulphate of ammonia plant of the ordinary type would not in most cases be justified, in view of the small quantity of liquor to be dealt with and the fact that the plant would be standing idle for (say) eleven months during the year. Furthermore, sulphate plant of the ordinary type requires constant attention of a more or less skilled character, and monopolizes the whole time of one man while it is in operation.

It is, therefore, not an uncommon thing to find that in a small works no attempt whatever is made to recover ammonia from the gas. The water in the purifier lutes and gasholder tanks is converted in time into weak liquor; and the gas distributed to the consumer is full of free ammonia. The inevitable result is trouble on the district caused by the sticking of taps and the corrosion of burner nipples and fittings. The weak liquor that is unavoidably produced on the works is allowed to drain away, either into some adjacent water course or into the public sewer, and is bound sooner or later to give trouble.

The works at Wareham, supplying about 5 million cubic feet of gas per annum, were in much the above plight about eighteen months ago. We were concerned as to how best to improve matters; and on the suggestion of Mr. Wilton, we decided to instal a small experimental plant on what are, I believe, somewhat novel lines—at any rate, in ordinary coal-gas practice. At Wareham, there is only one man on shift by day and one by night, with the manager to read meters, do all necessary fitting work on the district, and attend to public lighting, &c. Obviously any plant to be successful would have to be so simple that an ordinary country workman could not fail to understand it, and so arranged that it would not entail any considerable extra labour on the staff.

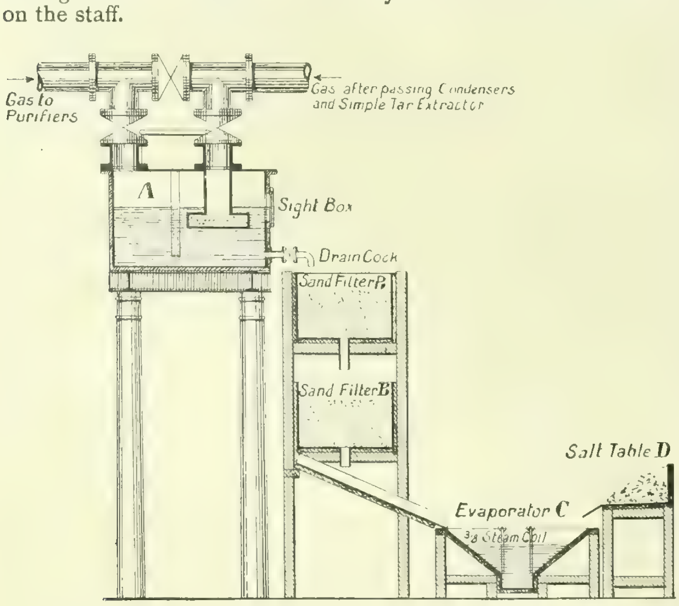


Fig. 1.—Arrangement of Sulphate of Ammonia Plant at Wareham.

The plant installed at Wareham is shown in fig. 1, and has now for several months proved to admirably fulfil the above conditions. The coal gas, after passing the condensers and a small purifier filled with heather, which acts as a somewhat crude tar extractor, enters the lead saturator A, and bubbles through the weak sulphuric acid contained therein.

We have proved by careful experiments that there is no apparent loss of illuminating power due to the absorption of hydrocarbons from the gas, so long as the strength of the acid is kept below 4° to 5° Twaddel. In starting the acid washer, therefore, the acid is mixed to about 3° Twaddel. At this strength, the avidity with which it will absorb the ammonia renders it unnecessary to work with more than 1 inch to 2 inches of seal in the washer. Sulphate of ammonia is formed in solution; and the specific gravity of the washing liquor slowly rises.

A simple calculation gives approximately the amount of sulphuric acid that should be added from day to day to neutralize the ammonia produced from the amount of coal carbonized per twenty-four hours. This amount is added to the saturator in half quantities each twelve hours. Roughly, about 23 lbs. of acid of 142° Twaddel would be required per ton of coal if all the fixed and the free ammonia had to be neutralized. Where the free ammonia only is dealt with, as at Wareham, about 13 to 16 lbs. only is required. These amounts will, of course, vary according to the kind of coal carbonized and the heats used. Adding acid in this way, in the quantities necessary only for each day's make of ammonia, the specific gravity of the washing liquor increases regularly; but the amount of free acid in solution is never high enough to affect the illuminating power.

When the strength of the solution reaches 45° to 50° Twaddel, it is drawn off in small quantities each day, so as to keep the seal approximately constant, passed through the two small wooden, lead-lined filters BB (filled with sand on a layer of felt), and, when enough has accumulated, transferred to the evaporator C. This, at Wareham, where exhaust steam is available from the exhauster engine, is a wooden, lead-lined vessel of the shape shown, with a flow-and-return lead pipe for the steam. Very little concentrating is needed, as at 45° to 50° Twaddel the sulphate of ammonia solution is very near crystallizing point.

In works not using an exhauster, and therefore with no steam available, a cast-iron lead-lined evaporator of convenient shape, sitting either on the waste-gas flue or on top of the beds, would be quite effective. Crystallization soon takes place, and the salt is put on the draining board D to drain; the small amount of mother liquor left being mixed with the next batch for concentrating. Very good coloured salt is made by this process; and the sample of Wareham salt exhibited gives an analysis of 25·2 per cent. of ammonia. A good local sale can usually be cultivated with very little trouble, as most small works are of necessity situated in a country district.

In a small works such as Wareham, the amount of virgin liquor from the hydraulic main is hardly sufficient to warrant the installing of a lime still to liberate the fixed ammonia. But the whole of this liquor, and the stronger liquor from the condensers, is pumped through the hydraulic main twice; so that as much free ammonia as possible is driven off into the gas. The virgin liquor run to waste at Wareham amounts to approximately 11 gallons per ton of coal, containing free ammonia equal to 1·1 lbs. and fixed ammonia equal to 4 lbs. of sulphate. This is equivalent to a total waste of 5·1 lbs. of sulphate of ammonia per ton. The plant has been working for three months; and over this period 14 lbs. of sulphate of ammonia have been made per ton of coal carbonized. In addition to this, gas entirely free from ammonia has been distributed, and the waste liquor to be disposed of has been considerably reduced in both strength and quantity.

It is necessary with a process of this kind to keep the saturator liquor constantly on the acid side. If it were allowed to become alkaline, sulphuretted hydrogen and carbonic acid would be absorbed; and when the next acid was added, these gases would be given off in considerable quantities. The purifiers would be overtaxed by the burst of sulphuretted hydrogen, and the illuminating power of the gas would certainly suffer temporarily from the extra carbonic acid if oxide only were used for purification. Fortunately, it is quite easy to avoid this trouble.

With regard to the financial side of the question at Wareham. As there is no fuel or labour bill to be met, practically the only charges against the sulphate sold are the cost of the acid used and the interest and depreciation on the plant itself. The capital outlay is, however, so small, and the wear and tear of plant so inappreciable, that these charges do not amount to very much per ton. I estimate that, selling the sulphate of ammonia produced at £11 per ton, there will be a net profit of £7 per ton sold. This will yield a total profit for the year equal at Wareham to an increased dividend of 0·6 per cent.

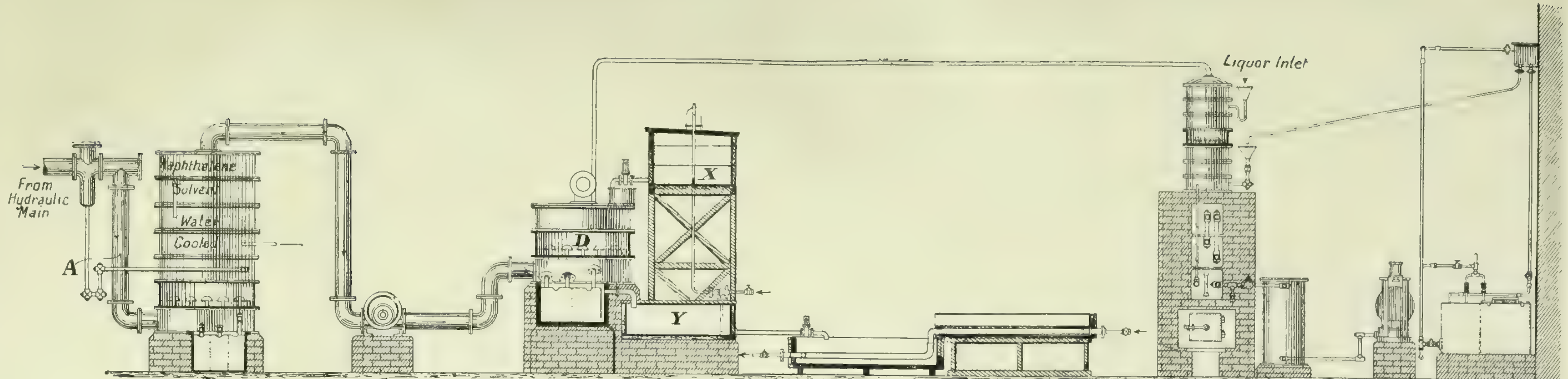
What has been done at Wareham on a very small scale, has been done on a larger scale, and therefore much more thoroughly, at Dunstable, by Mr. Phillips, who has kindly accorded to me permission to give you the particulars of the plant and his experience with it up to date. At Dunstable, between 2000 and 2500 tons of coal are carbonized per annum; and the fixed ammonia therefore is sufficiently significant to be worth recovery. The gas as it leaves the hydraulic main is passed through a specially constructed condenser-washer, so arranged that, as the liquor condenses, it flows in a reverse direction to the gas, and leaves the apparatus warm and containing very little free ammonia.

This liquor is conveyed to a direct-fired distillation apparatus, where it is treated with alkali and the ammonia driven off to the acid washer through which the main stream of gas passes. The spent liquor, which averages about 10 gallons to the ton of coal carbonized, is conveyed to a shallow tank on the top of the retort-bench, and is evaporated to dryness. It will be seen that the quantity of effluent by this system is only about one-fourth of that which would be produced by the ordinary method of water washing and steam distillation. Thus at a small works carbonizing (say) 10 tons of coal per day, there would only be 100 gallons of effluent to dispose of; and this, if desired, could be easily evaporated in the ash pans.

Referring to fig. 2, B shows the fractional condenser-washer, consisting of six bubbling trays each working with a seal not exceeding ½-inch. The hot gases from the hydraulic main enter the washer at the bottom, and pass upwards through all the six trays. The two top trays may be used as naphthalene washers by filling them with a suitable solvent, such as oil tar, which also serves to remove the last traces of coal tar from the gas. The middle two trays are provided with cold water circulating pipes, which may be adjusted so that the exit gases are reduced to any desired temperature. The bottom two trays receive the condensed liquor from the trays above, and also the tar and liquor from the hydraulic main. The hot gas bubbling through the liquor in the

two trays raises its temperature considerably, drives off most of the free ammonia, and the liquor passes away from the washer at about 100° to 120° Fahr., or very little lower than the temperature of the inlet gas.

Through the exhauster C, the gas now passes to the acid washer D. This is arranged with trays so that the gas is washed three times. Sulphate of ammonia solution is formed, and is constantly circulated through the receiver Y and overhead tank X. Acid is added at intervals, so that the liquor entering the washer contains 1 per cent. and leaving the washer only 0·1 per cent. of free acid. The strength of the sulphate liquor gradually increases; and when it reaches 45° to 50° Twaddel, it is run off to the evaporator G, where it is concentrated by means of a small steam coil and crystallized. The salt drainer H is also provided with a steam-coil, so that each batch of sulphate can be dried before removal—thus making it unnecessary to have a lead-lined store.



A. Gas Main. B. Condenser Washer. C. Exhauster. D. Acid Washer. E. Spent Liquor Tank. G. Evaporator. H. Drainer. I. Direct-Fired Liquor Still. J. Spent Liquor Receiver. K. Pump. L. Liming Apparatus.

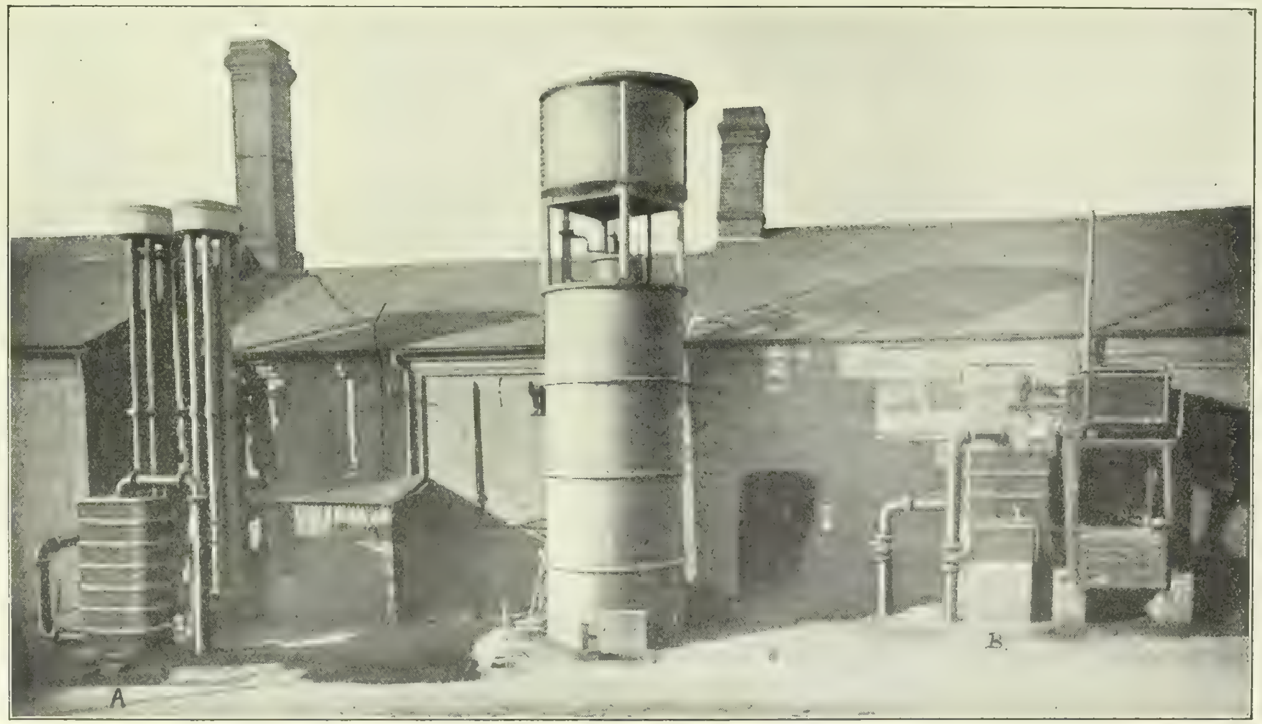
Fig. 2.—Arrangement of Sulphate of Ammonia Plant at the Dunstable Gas-Works.

The virgin liquor containing the fixed ammonia is pumped from the outlet of the condenser to an overhead tank, from which it flows by gravity to the direct-fired still I. A direct-fired still is used in preference to the usual type, so as to prevent the increase in bulk of the effluent liquor due to the condensed steam. It is easy to operate; and it is of importance to note that the lime deposit does not adhere as with steam, and is therefore quite easy to remove. Finally, the effluent liquor is pumped into two tanks 8 ft. by 3 ft. 9 in. by 6 in. deep, laid on the top of the retort-bench, where it evaporates to dryness.

The whole plant is exceedingly simple to operate, and does not call for any increase whatever in the works staff. Liquor-tanks become quite unnecessary, and there are by this process no smells of free ammonia and sulphuretted hydrogen about the works. There is no effluent, and no possibility of nuisance of any kind; and the Alkali Inspector will, I venture to think, not find it necessary to visit any works manufacturing sulphate in this way. It has not yet been possible at Dunstable to obtain figures with regard to the make of sulphate per ton of coal; but as there can be no escape of ammonia at any point in the process the yield must of necessity be fairly high. The first plant installed at Dunstable was hardly so complete as that described; but it was sufficiently successful to warrant the construction of the more complete system outlined above.

Engineers who have seen the process in operation at Dunstable have been considerably impressed with its simplicity and efficiency; and at the time of writing this paper, at least four engineers have placed orders for similar plants.

The only criticism that can, I imagine, be made on a process of this kind is that one loses the purifying power of the ammonia for the partial removal of carbonic acid and sulphuretted hydrogen. If the best use possible by ordinary scrubbing methods is made of the ammonia, about 200 to 300 grains of carbonic acid and 100 to 120 grains of sulphuretted hydrogen per 100 cubic feet of gas are



The Dunstable Gas-Works Sulphate Plant, showing the New Washers A and B, and the Condenser and Scrubber out of action.

removed by the scrubbers. In works using oxide only for purification, the extra sulphuretted hydrogen would be absorbed by the purifiers without trouble, and the carbonic acid would pass forward into the gas, increasing the volume by about 0·5 per cent. and reducing the illuminating power by about 0·3 candle. In most small works, this would be quite unnoticed, and would in any case be well within the ordinary variations of illuminating power. Where lime only is used, the net result would be a slightly increased use of lime, the cost of which would be much more than covered by the profit from the sulphate, and the great advantage of distributing gas free from ammonia.

As a matter of fact, in most small works anything like full duty is very seldom obtained from the ammonia as a purifying agent for carbonic acid or sulphuretted hydrogen, and the additional quantities of these gases passing to the purifiers would not amount to anything like the figures given above. Although the process up to the present has been applied to small works only, it has advantages which, under special local conditions, might make it worthy the attention of much larger undertakings. Scrubbers, either of the tower or rotary type, and large liquor storage tanks would become quite unnecessary, and the waste exhaust steam that abounds in many works could do the necessary work instead of the plentiful supply of live steam required by the present methods. In addition to this, one would have a practically continuous process of manufacture instead of an intermittent one.

In conclusion, I should like to take this opportunity of thanking Mr. Phillips for his kindness in placing the particulars of the Dunstable plant at my disposal, and Mr. George Wilton for the help he has given me throughout.

Discussion.

The Chairman (Mr. H. C. Head, of Winchester) said they were very grateful to Mr. Moon for bringing forward a subject such as this—a subject which dealt with the improvement of very small works. For many years very small works had been neglected; and he feared that in most places they were disreputable little holes. The gas sent out had most of the ammonia left in it; and it was very unpleasant to use, and the effluent from the works was exceedingly disagreeable. Mr. Moon had given a very complete description of a sulphate plant suitable for small works; and this plant would, he (Mr. Head) was sure, be well worth the consideration of those who had anything to do with very small works. The description was most complete; and the author had foreshadowed to them where difficulties might arise, and how to avoid them—in fact, he thought he had told them all about the plant excepting the cost. This was a point they would like to hear something more about. One other point he had not mentioned, and that was whether any difficulties were likely to arise in using such a plant in a works where there was no exhauster. Many of the small works (which were only one-man works), making 2 or 3 millions a year, had no exhauster; and anything that increased back-pressure was of importance.

Dr. Harold G. Colman (London) said the paper Mr. Moon had read was in many respects a very timely one; and from more than one point of view. One the Chairman had already expressed—namely, that it was of great importance that matters of advantage to small works should be brought forward at their meetings. Apart from this, it was a very timely paper because the question of the methods of the removal of ammonia from gas was at present very much in the air. From the time that ammonia recovery from gas was regularly carried out, practically the process with which they were most familiar, and which was universally employed, was the use of water for washing out the ammonia. When about ten or twelve years ago the Mond process was brought out, this method of removing the ammonia proved disadvantageous on account of the large volumes of gas dealt with, and great dilution of the ammonia in the gas. And therefore they had recourse to absorption by dilute sulphuric acid. Curiously enough, for very different reasons, ammonia recovery by the use of water had proved more or less a failure in small works; and here again they were having the process which Mr. Moon had so ably put before them, in which the ammonia was recovered by the action of dilute acid. Further than this, in connection with bye-product coke-ovens, ammonia recovery directly from the gas by means of sulphuric acid was at present being largely undertaken. In the two processes that were now being adopted to a considerable extent—the Otto-Hilgenstock and the Koppers processes—a stronger acid was used, and the sulphate was obtained by direct treatment of the gas with sulphuric acid. At the present time, as most of the members were aware, several attempts were being made to get the direct recovery of sulphate of ammonia from the gas by utilizing the sulphuretted hydrogen which it contained to form the sulphuric acid. The two processes which were now being experimented with on a fairly large scale, and to the results of which they were looking forward with a considerable amount of interest, were the Feld process on the one hand, and the Burkheiser on the other. It seemed as though, in the course of the next few years, the gas manager would have added to the perplexities which already faced him with regard to the best system of carbonization, further perplexity as to what was the best system to adopt to remove the tar, ammonia, and sulphuretted hydrogen. Turning now to the actual process under consideration, he had little to say, because the plant that Mr. Moon had described seemed very well suited to the necessary conditions of small works. It was simple; it was inexpensive in construction; and it was of such a character that an ordinary workman was quite capable of looking after it. There was one point he should like to ask Mr. Moon. It was whether he had found (though most probably the time was too short to show it) in the subsequent purification, which he (Dr. Colman) presumed was done with oxide of iron, any difficulty whatever with the oxide. The reason he asked the question was this: It seemed to him there might be some difficulty in this respect, owing to the gas being absolutely free from ammonia. So long as the gas passing through the oxide was slightly alkaline (which was always the case when the gas was washed with water only), the iron sulphide formed revivified readily on exposure to the air, re-forming oxide of iron. If, however, ammonia was entirely removed, and the gas entering the purifiers was neutral or slightly acid, as might easily be the case when the ammonia was removed by sulphuric acid, iron pyrites (FeS_2) was sometimes formed. This sulphide did not revivify on exposure to air. If such a difficulty should occur in this case, it would be quite easy to overcome it. All that would be necessary would be to bye-pass a small quantity of gas containing ammonia to the purifier inlet. It would contain sufficient ammonia to keep it slightly alkaline, and so prevent the formation of iron pyrites.

Mr. W. B. Randall (Waltham Cross) said it would perhaps be interesting to the members if he stated that he had the pleasure of seeing the plant at work at Dunstable a few weeks ago; and, as far as he could see of the process, he came to the conclusion that, to many small works and to many medium-sized works, it was undoubtedly applicable. The author had so ably presented the points of the plant and process that there were few left to criticize. When he was at Dunstable, he made certain inquiries. One was in regard to the matter Dr. Colman had referred to. Although not using water, the oxide revivified exceptionally well, and the purifiers lasted longer than they did before the plant was put in. The point in which he was interested was that of reducing the bugbear which he was sure most gas-works would suffer from more or less in the future—namely, the question of the spent liquor; and he thought that here was a great step towards the solution of the problem. There was not the least doubt that near the London district more especially, where the Metropolitan Water Board had great powers, they would be compelled to purify the liquor to a much greater extent than they had done in the past; and if they could decrease the amount of this by two-thirds—say, 10 gallons, instead of 30 gallons—it would be a great step towards the solution of what would probably be a difficult question in the future.

Mr. Harold W. Woodall (Bournemouth) said he did not think he had anything to add to what Mr. Moon had already said. He could say this, that, during the year the plant had been installed at Wareham, it had been of the greatest possible advantage to them. They had two stokers, who were formerly agricultural labourers, and they had a manager who five years ago was a painter. Between them, they ran the plant with complete success. There was no trouble at all. It was a plant anyone could run; and he was bound to say it was a plant that could be installed by many other works a great deal larger than those at Wareham. He was recently at a small works where there was a sulphate plant—a plant which made a ¼ ton a day; and he then referred to the amount of labour that was being employed. He was again at the works only a week or so ago; and he tested the effluent liquor. He found the Twaddel in the saturators ran up to 63°; and the man was fishing horrible looking salt. On calling attention to this, the explanation was that he (Mr. Woodall) had complained that there was too much labour in the yard, and so this man had been employed turning over oxide. Through this, he had forgotten to put in the lime, and to look after the saturator. It was a gas-works making upwards of 15 million cubic feet a year. He (Mr. Woodall) was sure such a works would be much better off with a simple sulphate apparatus than they were with an old-time, though accepted, form of plant. The plant that had been described was a nice looking plant, and one that was up-to-date for small works. It was one that was worthy of consideration by companies of quite considerable outputs, as well as by very small companies such as Wareham.

Mr. A. E. Broadberry (Tottenham) said he should like to thank Mr. Moon for contributing this paper, which, he was sure, all the members had found most interesting. Certainly the information would be very useful in the future. There was one thing he should like to say in connection with it. Mr. Moon spoke of the process as being a novel one. But it was really a matter of history repeating itself, because he (Mr. Broadberry) remembered well, when he first went to the Tottenham Gas-Works, there were two old vessels there which had been used by Mr. Alexander Croll, when he ran the Tottenham works in the years from about 1845 to 1848. He manufactured sulphate of ammonia in very much the same way. He (Mr. Broadberry) had looked up the first volume of "King's Treatise," published in 1878; and he found there (p. 395) a reference to Mr. Alexander Croll's patents for the purification of gas in 1840: It said: "The sulphuric acid process for the removal of ammonia was in operation for some years, and answered most successfully. The claim was for the gradual addition of sulphuric acid to water, so as to maintain the solution with an excess of acid of from 2 to 3 oz. per gallon of liquid. This had no injurious effect on the illuminating power of the gas; and the liquor was run off just below the crystallizing point. It was then boiled down; and a very fine, white sulphate of ammonia was obtained." This was a matter of over half-a-century ago. The legends which existed at the works when he

first went there hardly confirmed the last statement about a fine, white salt being obtained. What he heard about it then was that the process was given up because the sulphate of ammonia came out like a lot of black sludge. But this process was worked many years ago; and the probability was that they did not take the trouble to properly filter the solution of sulphate of ammonia in the way Mr. Moon suggested; and very likely this was the cause of the salt being so dirty, as legend reported. He thought that perhaps the information that such a process had been at work in the past would be of interest to the meeting.

Mr. Moon, in reply, thanked the members for the kindly way in which they had taken his small effort. In regard to the Chairman's request for the cost of the plant, he was afraid he could only give the cost of the small plant that they had installed at Wareham. It was £50. As to the Dunstable plant, he had no particulars. Then a further question raised by the Chairman was as to the possibility of operating the plant in works without an exhauster. He took it the question in Mr. Head's mind was that of back-pressure. The back-pressure thrown by the plant at Wareham was 1 inch only, and it could be reduced to ¾ inch quite easily; and he thought ¾ or 1 inch could be quite easily added to the pressure of a country works. The disadvantages of the back-pressure would be more than compensated by the clean gas that was obtained. He appreciated Dr. Colman's remarks with regard to the possible effect of a neutral gas upon oxide of iron. So far as their present limited experience went at Wareham, they had not found any difficulty in this respect. If they did, they would certainly bear in mind Dr. Colman's suggestion to bye-pass a tiny stream of gas so as to get a small amount of free ammonia in the washers. It had been most interesting to hear Mr. Broadberry's extract from "King's Treatise." It was to all intents and purposes a brief summary of the plant he (Mr. Moon) had described that day, and most unwisely in the paper called a "novel" plant. What he really meant, and had in mind, was the fact that at the present time it was not in use in ordinary gas-works. With regard to the dirty sulphate legend at Tottenham, it was possibly due to the lack of attention with regard to the extraction of tar. If tarry vapour were formed, the acid precipitated certain hydrocarbons, and this had a deleterious effect upon the sulphate. It was to remove these dirty hydrocarbons that careful filtering was necessary. Mr. Phillips had kindly intimated that he or Mr. Wilton would be pleased to see at Dunstable anyone interested in the plant.

DISTRICT PRESSURE.

By Thomas Price, of Walton-on-Thames.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 10.]

It is not the writer's intention in this short paper to introduce anything new in the direction of distribution practice, but rather to put forward some of the difficulties to be met with at the present time, with a view to promote a discussion that may be helpful to himself and others.

The time is now long past when it was thought to be the best policy to keep down the pressure in the distributing mains to the lowest point consistent with the possibility of providing sufficient to give a fairly shapely flame to a flat-flame burner. But it is well within the memory of most when a pressure of one inch at the consumers' burners was considered to be the ideal, and gas-stove makers designed their apparatus and rated the consumption at this pressure. The very rapid extension of the use of gas heating and cooking stoves after a time demanded that an increase should be made in the day pressure. It was feared that this increase would have the effect of increasing the leakage from the mains and services; but an examination of the returns of gas undertakings since higher day pressure has been given has proved this fear to have been groundless—in fact, the writer's experience with his own Company has been quite the reverse; for coincident with the greater pressure given there has been an actual decrease in the gas unaccounted for.

It may be that this is partly due to the fact that more careful and systematic supervision and testing of consumers' meters have been organized, and are producing the desired effect. But it has also occurred to the writer that the higher pressure during the day time has led to the discovery of leaks which would not otherwise have been detected. Again, an increase in pressure was found to be necessary to give a proper and steady supply to incandescent burners, which, in a comparatively short space of time, have almost completely superseded other forms of gas lighting. Adequate pressure is without doubt absolutely necessary for the production of the maximum light with these burners, especially with those of the inverted type.

The demand for higher pressures which have been found necessary for the proper working of burners and gas-stoves, as the writer has here attempted to outline, has led to the maximum available constant pressure as given by the gasholders being utilized. The word "constant" is here used to signify the pressure that may be given by the lightest uncupped holder, as it is recognized that it would be useless to depend upon the extra weight of a holder when cupped, if it should cause a sudden fall of (say) 3 inches at the time of greatest demand by incupping, as this would cause inconvenience to consumers and result in numerous complaints. In order therefore to increase this initial pressure, the writer is introducing a pressure-raiser of the fan type to get over the difficulty and to utilize the whole of the storage capacity. As this apparatus is not yet installed, he is not in a position to say anything from his own experience as to its utility; but as it has been for some time successfully used in many works, he has little doubt that it will fulfil his requirements.

It is claimed that by this means the enlargement of existing mains otherwise necessary may be in many cases postponed; but inasmuch as the principal extensions taking place in a district usually occur upon the outskirts, it has occurred to the writer that great and undesirable fluctuations may follow through raising the initial pressure by any such apparatus. Even at the present time, and under existing conditions, there are very wide variations in pressure occurring owing to the constantly changing demands. An instance of this was particularly noticeable when the writer was recently experimenting with an automatic pressure operated lamplighter. This instrument, after working admirably at no great distance from the works, when fixed three miles away (having operated to light at the predetermined time) was extinguished unintentionally about an hour afterwards by the pressure reducing owing to the consumption increasing, and again rising as the consumption fell off. After the pressure had been reduced at the works to the minimum for the night, and the consumption had still further dropped to practically *nil*, the pressure crept up, and the lamp again lighted. Of course, this was due to the local conditions of that particular part of the district, size of main, attitude, and consumption; but the conditions were not such as to call for an enlargement of the main—it being found, upon taking a chart, that the pressure had not dropped below 25-10ths during the evening.

The point upon which elucidation is required is: What is the range of variation in pressure within which it is advisable to keep, in view of present-day methods of consuming gas, in order to give satisfaction to consumers and to maintain the superiority of incandescent gas light over other means of illumination for quality and steadiness, and the best method of maintaining it within that range? Now, with inverted incandescent burners and gas-fires which have nicely regulated gas and air adjusters, a very uniform pressure is necessary to ensure their perfect working, and nothing is more annoying to consumers than to find a burner at one time making a popping and spluttering sound, and, after having carefully adjusted the same, to find later in the evening a readjustment necessary owing to a falling off of the pressure.

It would appear that an ideal state of things would be such that would give as nearly as possible a straight line on the pressure chart at all times during the twenty-four hours; but this would entail with many of us an enormous expenditure in enlarging and rearranging the mains; and the writer is not acquainted with any district in which such a state of things exists. It is not so much that it is desirable to keep the pressure down to a point which may be considered sufficient for all purposes, as that, whether kept moderately low or high, there should not be very wide variations.

In a certain road in the writer's district, where there are a number of workmen's dwellings, it was found that numerous complaints were being received of insufficient pressure for cooking purposes on Sundays. It was stated that when the ovens were first lighted there was quite enough gas for the purpose, but that before long the gas went down, and the result was that when the time came for dishing-up, the dinner was but half-cooked. Now, in order to meet the demands of the slot consumers, who, as a rule, take the advantage of having a hot midday meal on perhaps the only day on which they are all at home, it has been the custom to raise the pressure at the works from 20-10ths to 35-10ths at from 11 to 11.30 in the morning. A chart of the pressure taken at one of these houses revealed the fact that about 30-10ths were recorded when the increase was first made; but this gradually fell to 18-10ths as the number of people using their cookers increased. This lower pressure should, of course, have been sufficient to cook successfully; but as the taps had been adjusted when it was at 30-10ths, there was not sufficient gas at 18-10ths without further adjustment, and this the consumers in question failed to make.

Seeing that it is practically an impossibility to regulate the pressure to that most suitable to every consumer by means of station governors, and to maintain it at that pressure at all times, it has occurred to the writer that the point at which this should be done most effectually would be at the consumers' meters. He does not claim that there is anything novel in this proposal; but it has certainly not come into universal practice. If a thoroughly reliable governor can be found that is not too bulky or too expensive, and it be fixed with every meter, it is the writer's opinion that its adoption would amply repay the outlay. By preventing the fluctuations and variations that now occur, and thus giving a steadiness to the lights and lessening the waste of gas from the use of improperly regulated gas-stoves, or other apparatus that may be in use, the insurance of the best results would obtain, and confidence and contentment of consumers follow.

Discussion.

The Chairman (Mr. H. C. Head, of Winchester) said he was sure the members would all think Mr. Price's paper a timely one from many points of view. To begin with, at this time of the year, most of them were looking round their districts in search

of weak spots, where new mains were required. Another point was that the pressure of a district wanted to be as constant as possible, both with regard to time and place. They did not want to have 6 inches in one part of the district and only 1 inch in another; and they did not want to have 6 inches in a house at one time and only 1 inch at another. With a varying gas pressure, no consumer would be happy. With reference to the suggestion as to governors to each service, a point that had a bearing on this was that they had not got them at present; and they had rather to mend existing conditions, and leave ideal conditions to later on. He thought much could be done in regard to district pressures by taking the average pressure at some representative part a distance from the works, and trying to keep this as constant as possible. If a drop of 1-10th was found at any time, then 1-10th could be added at the governor.

Mr. W. B. Farquhar (Ilford) said that fortunately in his district they had mains of sufficient size, so that they could give 3 inches pressure at the works, and get it all over the district. But where a district was under-mained, it was impossible to regulate with one governor at the works so that one could get a straight pressure line throughout the district. He was struck with one part of the paper. The writer spoke about 20-10ths pressure. This appeared to him (Mr. Farquhar) to be a low pressure to which to work. In his district the pressure was 3 inches; and they went up to 4½ inches. A number of years ago, they used to regulate the governor in the morning to meet the cooking hours. They then took the pressure off again; put on more pressure at dinner time, then took it off again; and then put more on again in the evening. He was now working with a view to getting a constant pressure right through. He started at five o'clock in the morning with 4½ inches pressure, and kept this steadily throughout, until about twelve o'clock at midnight, when the pressure was changed to 3 inches until five o'clock in the morning, when it was again 4½ inches. There was an advantage in this to the gas-works. The fitters could go out during the day to fix gas-fires and adjust burners at the pressure at which they were going to be used. If they adjusted them to only a pressure of 3 inches, when the night pressure was put on there was trouble. The burners were not regulated to the increased pressure. Now they could during the day adjust the burners precisely to the pressure conditions under which they were going to be used in the evening. A reference had been made to governors on the meter. If he remembered rightly, Messrs. Milne and Sons made a meter called Macfie's patent governor meter, in which there was fixed (inside) a small regulating governor, which could be adjusted to suit any pressure that the meter might be put under. A fitter could regulate the pressure to any given point; and, of course, it would remain at that. He had had no experience with these meters, and so could not say whether or not they were of real utility. He had had a pressure-chart taken two or three days ago, to verify the pressure on his district; and he found the charts at two or three points at the extreme end of the district showed practically a uniform line with the pressure given in the works. But he recognized that this was a very fortunate position to be in.

Mr. J. H. Cornish (Bridgwater) remarked that it seemed to him the writer of the paper had almost entirely struck the conditions under which they suffered in his own case a few years ago. Their main supply was drawn from a holder which was large in diameter, but shallow in depth, and only gave, on a dropping pressure, something like 28-10ths. Every member would realize that this was not much good in these days of inverted burners, gas-stoves, engines, and what not. He made inquiries—and he believed he got his ideas from Bournemouth—as to the best means of overcoming the difficulty. He was struck with the simplicity of the Sturtevant fans, coupled to De Laval turbines. It seemed to be a simple apparatus, and inexpensive. He procured a set, and installed it; but as soon as he started to make his connections, he found he had a nice combination of circumstances. He found that the main by which he was drawing gas out of the big holder, and forcing it into the town main (it was a 12-inch one) was a common main running between the two holders; and the outlet to the town governors was taken off between the two. Of course, as soon as he began to draw out of the 28-10ths holder, he started to at once fill the telescopic holder on the other side, and this gave him 6½ inches pressure, which for a small district like theirs was sufficient for the present time. He conceived the idea of stopping this holder—not allowing it to go above a certain point. What he did was to simply put a cantilever on the top, and this was effectual. It was certainly necessary to control the governor of the De Laval turbine, because driving at a speed of something like 16,000 revolutions per minute, and the fan at 4000 revolutions, it gave them 13 inches pressure; and 13 inches pressure on a small holder would tend to blow the cups. Putting a weaker spring in the governor, he found it quite easy to reduce the speed one-half, and he got the 6½ inches pressure which the telescopic holder gave. This had now gone on for something like three years; and it was the most effectual apparatus he had ever seen in a gas-works. It ran beautifully; and the quantity of gas required from it did not make the slightest difference. The holder on the other side was kept full of gas, and acted as a buffer or like a gas-bag; and it kept up the supply on the inlet of the governors at 6½ inches pressure, and enabled them to distribute at 40-10ths pressure, which was maintained during the lighting hours over the evening. If Mr. Price met with the same success as they had done at Bridgwater, he would be delighted with the apparatus as he (Mr. Cornish) had been.

Mr. W. D. Child (Romford) remarked that Mr. Price in the early part of the paper stated that, since raising the pressure for his day consumption, he had actually had a decrease in the quantity of gas unaccounted for. In order that Mr. Price might make his paper perfectly clear, he should like to ask him whether this was really a decrease in the quantity of the gas unaccounted for, or whether it was a decrease in percentage, owing to the increased quantity of gas sold for cooking and heating purposes in the day time.

Mr. Price: It is an actual decrease in quantity.

Mr. Child (proceeding) said that Mr. Price also stated that he was putting down a fan for boosting up the pressure in his district. Owing to the temporary disablement of a holder, he (Mr. Child) had been compelled to adopt some means for raising the pressure in an outlying district; and had found it inconvenient and difficult to maintain an even pressure, owing to the varying consumption in the district. Sometimes the pressure would be very high, and then it would fall again. It had occurred to him whether a desirable effect might not be obtained by boosting up to a high initial pressure on the inlet of the governor, and so enable one to send out the gas at any pressure that might for the time be desired.

Mr. W. E. Price (Hampton Wick) observed that the condition of affairs described by Mr. Farquhar must be considered as ideal, and not as a condition that would be met with in the majority of cases—at any rate, not in the districts controlled by members represented at the meeting. He thought they would have to almost generally look at a condition of affairs similar to that described by the author in the paper. Then it came to the question as to what was the best thing to do in the circumstances. The question of boosting seemed to him, at any rate, to be all right when it was a case of mains being too small, and it was desired to get a larger amount of gas to a weak spot. This appeared to be the cheapest way of doing it in these days. Of course, the alternative was the relaying of mains. The point that appealed to him most strongly was that of the variation of pressure—not so much the question of not having sufficient pressure, but the variation that was bound to occur in the ordinary canalization in the district. When he said "ordinary," he meant as distinguished from the condition described by Mr. Farquhar. He (Mr. Price) naturally supposed they all more or less used a pressure-register, and kept a chart of the different parts of their district, and so found out their weak spots. Having done this, they had then to set about trying to draw up a programme of pressure increases or decreases (as the case might be) at the district governor, and endeavour to keep a constant pressure at the spots at which they had found the variations. So far so good. But they had only succeeded in keeping this constant pressure at the one spot, after all, from the works. But the pressure varied most near the works and least nearest to the spot which was the most difficult one to supply. So, after all, having done this, they still had the trouble of the consumers' complaints as to variations of pressure—variations which were noticeable with incandescent burners. He was speaking of what he had himself tried, and had attempted to overcome. But there was no satisfaction in it after all, because the district which was nearest the works was still having varying pressure, and only a small portion of the district was getting constant pressure; and anywhere between these two points there was a variation more or less. Therefore this brought them back to the use of governors. Of course, he was now assuming the mains were not large enough to give constant pressure. He had come to the conclusion that there was only one way in which they could give constant pressure, and that was by having governors fixed in each house. It was a question of cost; but it was also a question of convenience. He did not see how the control of the pressure from the works could overcome all their difficulty; and he was bound to say the only way he could see out of it was the use of governors.

Mr. D. H. Helps (Reading) thought the last speaker had raised the most important point in this matter—the variation of pressure that was taking place between the works and the confines of the district. He had himself been looking into this matter during the last twelve months in a part of his district where the pressure was lower than in any other part of the outlying area. One could improve matters in these outlying districts by boosting at the works; but it did not get over the question of varying pressure through the arteries and larger mains. One could introduce a high-pressure main in the outlying district, but that was a very expensive way. If one had to boost, the best thing to do was to see that the fall in pressure throughout the area was equal in every direction. If there was some particular spot where the pressure was very low, it would be better, before adopting boosting, to enlarge the mains on the line, and then they would not have to boost unnecessarily high at the works to raise the pressure at this particular point. He quite agreed with Mr. Price that it was desirable they should use consumers' governors, if they could find a small reliable one.

Mr. F. W. Cross (Lea Bridge) said that one or two of the speakers had gone from the point that Mr. Price wished to make—that was, that the boosting was done on the inlet of the governor. He took it that this was what Mr. Price was referring to; whereas most of the remarks made alluded to the boosting of the gas on to the district. He (Mr. Cross) was now putting down plant for boosting direct on to the governor; but as the plant was only just being erected, he would not pretend to say anything on the subject. Was there not, he asked, some mistake in the

paragraph of the paper where it was said the author's plan on Sundays, in giving sufficient pressure for cooking, was to put on increased pressure—from 20-10ths to 35-10ths—from 11 to 11.30? Was not the latter figure a misprint for 1.30?

Mr. Price explained that between 11 and 11.30 was the time when the increased pressure was put on, and not merely the duration of the supply at the higher pressure.

Mr. A. E. Broadberry (Tottenham) said there were one or two points that he might make, which perhaps would be interesting to the members, in regard to the question of boosting. Mr. Price suggested that it was sometimes claimed that this would save the expenditure of a great deal of money in laying new mains; but he seemed to fear that saving of money on mains in this way might lead to a great many variations in pressure. But if the work was carefully carried out, he (Mr. Broadberry) did not think Mr. Price need have any fear on this score. Since 1902, they had been boosting on to the inlet of the governors, and cutting down from the governors according to what was required in the district. But at the time they introduced the system, they isolated the leading mains from the works right out to the centre of the district—to the more populous places. Their works were situated on the margin of the area of supply; and the mains were connected from the central points, and gradually led back to the outskirts of the district, and, among other directions, in that where the works were situated. By isolating the leading mains out as far as the central parts, and by running just a few feeding-mains to other important centres lying a little away from the actual trunk main itself, they had succeeded in establishing fairly even pressures all over the district, and they were able to keep the pressures on the margin all round fairly even. From the fact that some of the district mains led back to just outside the works, a pipe was carried from these mains (which were small on the margin of the district) into the governor-house; and they worked according to the pressure on these marginal mains, although they varied the pressure on the governors themselves. This did not affect the consumers lying between the works and the central portions of the district, because the mains were untapped up to this point. He thought that if Mr. Price could add such a system as this to the boosting plant he was now putting in, he would find it very beneficial. With regard to inadequate mains when using automatic lighters and extinguishers, he (Mr. Broadberry) had had a good deal of experience in this connection; and he had come to the conclusion that these were the finest indicators they could have of the insufficiency of their mains. Of course, he did not know what sort of lighter it was that Mr. Price was using; but he imagined it was one that worked on just the differential pressures, and did not get the full pressures, and had no margin between the high operating point and the low operating point. As to house governors, he thought their use would undoubtedly afford satisfaction to the consumers by giving them a very level gauge. But in such a case as Mr. Price had mentioned, where in one street the consumers could not get enough gas on Sunday morning for their cooking purposes, the employment of a house governor was not going to give them sufficient pressure to do their cooking, nor was the lack of sufficient heat to do the cooking merely dependent, as Mr. Price seemed to assume, on the bad adjustment of the burners. He (Mr. Broadberry) had tried experiments with ordinary atmospheric burners in the boiling of a given quantity of water, or raising it a given number of degrees with all sorts of adjustments of air; and it made practically no difference at all, so long as they did not get a steady flame, as to the consumption of gas per unit of heat obtained, whatever the air adjustment might be.

Mr. P. P. Channon (Haywards Heath) said the author's main point was that they should maintain even pressures; but the discussion seemed to be wandering away from that. Mention had been made of the method of obtaining uniform pressures at the consumers' meters by using governors on the outlet of the meters; and it seemed to him (Mr. Channon) that this was certainly the most satisfactory way they had of giving their consumers equal pressures at the present time, as their system of mains was of necessity imperfect. But there had been remark made on the fact that, though one maintained equal pressures at the works, one would get varying pressures over different parts of the district, owing to the inadequacy of the mains. Now if equal pressure was maintained on the outlet of the consumers' meters, they would still get varying pressures over different parts of a house, owing to the inadequacy of the pipes. He had known such instances as a big gas-pipe put to a ½-inch pipe, and twenty or thirty burners taken off it. Would it not be better to control the pressure at the point of ignition, or as near thereto as possible—that was, at the burners themselves? In the latter days of flat-flames, nearly all governor burners were used; and they worked fairly efficiently. Was it not possible to get governors capable of attachment to "C" and inverted gas-burners, and small governors for cooking-stoves and gas-fires as well? He could not help thinking this would be a better and cheaper way of giving an equal pressure at the point of combustion, and so affording satisfaction. One other point. He had found that gas-fitters, in putting a governor on the outlet of the meter (it might be a very efficient governor) sometimes forgot to regulate it to the minimum pressure ever given at the meter. They put it at something above the minimum pressure, and when the minimum was given, there was trouble.

Mr. Charles Carpenter said it was not an easy matter to contribute any remarks on this paper, because the subject was so wide and important. He was perfectly certain that the time given to a paper of this kind, which dealt with such a vital part of their industry, would give them better value than any discussion on abstruse chemical matters with regard to the direct conversion of sulphuretted hydrogen to sulphuric acid. This question overshadowed enormously comparatively small, though interesting, chemical questions. With regard to the paper, he was extremely sympathetic with the author's views. The ideal condition in gas supply, was to give a uniform pressure to every consumer at his meter. The only other course was the one mentioned by the last speaker. But, having experimented for several years on the subject, he (Mr. Carpenter) found there were considerable difficulties to be surmounted before producing, on a commercial scale, a governor that would control, under all the conditions of working, incandescent burners which were now the vogue. And one of the reasons was that a more accurate adjustment was required, now that the quantity of gas flowing through a burner was much smaller than it used to be. With the flat-flame gas-burner, the consumption was never less than 5 cubic feet an hour; but now the burner that had become most popular—at any rate in London—for indoor lighting was a small size one, burning 1½ to 2 cubic feet of gas an hour. When one got down to these small quantities, the difficulty of a governor attached to a burner increased very considerably. He had, therefore, reluctantly come to the conclusion that what would be done on the large scale before many years passed, would be in the application of governors to the consumers' services. He had reluctantly come to this conclusion, because it was clear to anyone who had considered the matter that the expense of doing this would be considerable. One of the members had spoken of a level line of 4½ inches from five o'clock in the morning till midnight, and 3 inches from midnight to the morning. If they all had conditions such as these, they would not want consumers' governors at all. But his own conditions in South London were different from those. Mr. Farquhar's memory was quite clear when he said that Messrs. Milne and Sons made a meter with a regulator attached. It was a dry meter with a single valve. In South London, though they had several thousand governors in use, the number was rapidly increasing. The governor they used had a double valve, which gave most accurate results. It would take some time before they got this state of things generally existing. Meanwhile, they had had to do something else. As had been pointed out, the incandescent burner (and especially the inverted burner) was more sensitive than other form of burner to variations in pressure. They had therefore been engaged in investigating the physical problems—they were many, and most interesting—appertaining to inverted burners. They had now got one (which they were introducing this coming season) which complied with the condition laid down of a minimum pressure of 2 inches and a maximum pressure of about 4 inches. Under these conditions, the burner gave good results. But this was the intermediate step towards the realization of what he thought would be the proper condition of affairs—that was, a level pressure line for every consumer. There would be other advantages in this than for lighting. There was the question of cooking. It was much easier to cook one's food properly if one knew exactly what pressure was going to be obtained at the stove, and how much gas would be burnt in an hour. Cooking by gas was ideal with the conditions uniform. He thought they could obtain what was required perfectly well with a piece of leather as a diaphragm and a piece of spring between the valve and the diaphragm. By such simple means, they would be able to produce a level line, and enable cooking (which was an increasing portion of their business) to be done in a correct manner. A cook ought to know exactly the time it should take to do a certain amount of work all the year round. With regard to boosting, there was no difficulty in giving any increase of pressure that might be desired. The inner lifts of many gasholders were not high enough for the requirements as regards pressure. But it could be easily done by boosting—and this on the inlet of the governors. There was no difficulty with regard to doing this on the outlet of the holders; and it was really better to do it this way, and rely upon that beautiful piece of apparatus, the automatic governor, to control it. He thought it better to do it in this manner than attempt to bye-pass the governor, and put the pressures on the leading mains. Not every manager of works was in the same position as Mr. Broadberry. But where it could be done, it made the work extremely easy—that was, with a back gas pressure, so to speak, the pressure on the confines of the district far removed from the governor was brought back to the governor-house. Connected up to a gauge (as he fancied was done in Mr. Broadberry's case), they had a given pressure on certain predetermined lines that would give the pressure to exactly that which was needed to meet the requirements of the district. In South London, they had from 100 to 200 automatic pressure recorders for plotting out pressures on the district. They were the only means by which an engineer could satisfy himself that any consumer was getting his full supply of gas. These recorders were most easily applied—being simply hung on to the pitching-iron of the lamp-column; and there they could get a register of the pressure at any time they pleased. The author of the paper had tackled a difficult problem, and a very important one. He (Mr. Carpenter) felt sure the conclusions, in the main, were the right ones and those which would have to guide them largely in their future practice.

Mr. Price, in replying to the discussion, said with regard to the

President's remark about giving constant pressure at one point, this was what, as a matter of fact, they did in his own case; but the point happened to be the gas-works, which were just about centrally situated in the district. The district ran practically three miles in every direction. Of course, if they took any point, and determined to maintain a given pressure there, a variation occurred between the works and the point. Mr. Farquhar said he was giving from 3 to 4½ inches pressure; in his own case, they were giving from 2 to 3½ inches at the present time. But he was hoping to go to a higher pressure when the booster was in operation. The reason the minimum was put at present at 2 inches was because the upper lift of a light holder only gave this pressure; and it was useful sometimes to be able to work out the lift. He was very much obliged to the members for the way they had taken the paper; and the hints they had given. Of course, his intention was, when the booster was in operation, to give a much higher pressure with a reliable governor—giving a much higher pressure at the inlet of the station governor, and also a very much higher one on the district mains. He did not see why they should not give 5 or 6 inches, or 10 inches if preferred, providing there were proper governors at consumers' houses. Of course, with the pressures that had hitherto been given—perhaps 1½ or 2 inches—governors were very unsatisfactory in the consumers' houses, owing to the small pipes that were usually found in them. Under these circumstances, they might get sufficient pressure in one room, but not in another. If they gave 5 or 6 inches pressure at the inlet of the consumer's governor on his service, setting the governor to give as much as was being afforded now without a governor, or 3 or 4 inches if preferred, there would then be sufficient pressure to supply all the requirements of the house.

HIGH-PRESSURE LIGHTING.

By A. E. Broadberry, Assoc.M.Inst.C.E., of Tottenham.

[A Paper read before the Southern District Association of Gas Engineers and Managers, Nov. 10, 1910.]

On being asked to supply a paper for this meeting, it occurred to the writer that a discussion on the subject of high-pressure gas supply would be welcome at the present time, when the various high-pressure systems are doing such great work in maintaining the position of gas lighting far in advance of all rivals.

In the following remarks it is not proposed to draw any comparisons between the several excellent systems now before the public, but rather to describe the successful installations of outside shop lighting carried out on a joint principle for the benefit of the various shopping centres which have in the past two years been inaugurated by the Tottenham and Edmonton Gas Company, and place facts and figures before the members of the Association, in order that those who have not already adopted similar arrangements may be able to judge of its advantages, and so that those who are doing similarly may add their testimony to the mutual benefits which follow its adoption. The writer has no claim to be the first to promote such a scheme, and does not doubt there are other cases where an even better success has been obtained; and he is hopeful that, in placing his case before the Association, he may gain for himself and other members some assistance and advice in further improving the position of gas as the best lighting agent for almost all purposes.

Progressive Pressures.

The term "high pressure" as applied to gas supply is a comparative term only. The science of gas supply is advancing so rapidly, and the conditions change so completely from year to year, that standards are no sooner set up than they may become obsolete. With the introduction of the incandescent mantle, pressure at once became a matter of great importance, and although at first an inch of water pressure was spoken of as the standard for the Welsbach light, it soon became evident that better results were obtained at higher pressures. Conditions again changed when the inverted burners were introduced. With this type of burner, good pressure is so essential that, in the writer's opinion, any gas engineer who permits the pressure in any part of his district to fall below 3 inches water pressure during the ordinary lighting hours is doing an injustice to himself, to his company or council, to his consumers, and, above and beyond all, to the industry that he serves. The author asserts that gas would much more readily maintain its easy lead in the matter of artificial lighting if more strict attention were paid to the proper maintenance of district pressures.

In the Tottenham Gas Company's district, a system has been adopted of placing pressure registers in various spots likely to be the worst served; and the shocking results at first shown led to the rectifying of faults which has had most gratifying results. No difficulty has been experienced in finding people who, for a small remuneration, will attend to the simple matter of taking the diagrams and posting them daily to the works. Those gas engineers who have not already adopted this system would do well to do so at once; and some surprising results will be experienced. But the author would like to emphasize that the registers should be placed in absolutely the worst spots, so as to avoid the undignified mistake attributed to the ostrich when in danger. It is hoped that these remarks, though somewhat beside the mark in regard to "high pressure," may not be considered out of place.

When upright burners alone had to be considered, 8 inches water pressure was regarded as "high by Messrs. Keith, Blackman, and Co., who put in many brilliant installations; but the power required for this slight increase was small, and the best suggestion of the firm then was to use a compressor worked by water pressure. This left the success of the gas installation at the mercy of the water company, which was a distinct disadvantage. As an alternative, an electric motor was suggested. But even at the present day electric supply is sometimes known to fail; and the position of gas lighting was very undignified if when the electric lights should chance to suddenly leave a district in darkness, instead of triumphantly shining on, the gas lighting had to acknowledge itself unable to stand alone, notwithstanding all its great reserve of power.

Messrs. William Sugg and Co. came to the rescue with a compressor driven by a gas-heated hot-air engine, which left gas quite secure in depending on itself. It was with one of these plants that the Tottenham Company first began to operate in higher pressures. A tradesman who had been offended with gas lighting on account of his constantly neglecting to clean his lamps and burners, and also to re-mantle the latter, had adopted a well-known incandescent oil-lamp system, which, for some reason, he did not find so satisfactory as he had anticipated. He therefore agreed to put in a Sugg plant four years ago; and the plant is still doing good work and giving every satisfaction to-day.

From this start many similar individual installations were put in, and continue to increase. Meantime, though Sugg's 12-inch water pressure and Keith's 8-inch pressure gave such good results with upright burners, a member of this Association, Mr. Onslow, was engaged in experiments on far higher pressures, and proved beyond doubt that at 40 inches water pressure he could obtain still better results; and several fine installations of factory lighting were introduced. Then came the startling results of 67 candles per cubic foot realized by the Keith inverted regenerative incandescent lamp.

Parade Lighting by High-Pressure Gas.

At the same time, it was becoming evident that tradesmen who had not adopted, and were not prepared to adopt, individual installations of high pressure, were being placed at a disadvantage; and it was decided to propose a joint lighting scheme for Green Lanes, Harringay (a most important shopping centre), on the lines previously adopted at Ilford, and called "parade lighting." After seeking advice from Mr. Farquhar of that town, a circular emphasizing the fact that "trade follows good lighting" was sent to a row of imposing shops known as "Grand Parade," suggesting a joint scheme, whereby each lamp should be supplied free of charge by the Gas Company, fixed, kept clean, lighted, extinguished, mantled, and supplied with high-pressure gas for an average of three hours per day, at an inclusive charge of £1 per quarter, which was to be the sole expense which the customer must meet.

The proposal was left as free and untrammelled as possible; but a minimum of fifty lamps for one year certain was asked for as a start. As tradesmen on the opposite side of the road asked to be admitted to the scheme, the fifty were soon obtained, and the supply commenced December, 1908. The estimate in the report to the Directors, which induced them to sanction the first installation, showed that with a hundred lamps a margin might be expected of £47 14s. 2d.; and with only fifty lamps, 13s. 4d. A well-founded faith in the proposed system induced them to permit the experiment.

The installation consisted of two (afterwards three) "A" type rotary compressors, fitted with a continuous lubricating device, and direct coupled to ¾ H.P. Gardner gas-engines. The lamps (600-candle power Keith-Blackman burners in 1000-candle power bodies) were fitted with Keith's distant lighters. The lamps and lighters may be best described in the makers' own words.

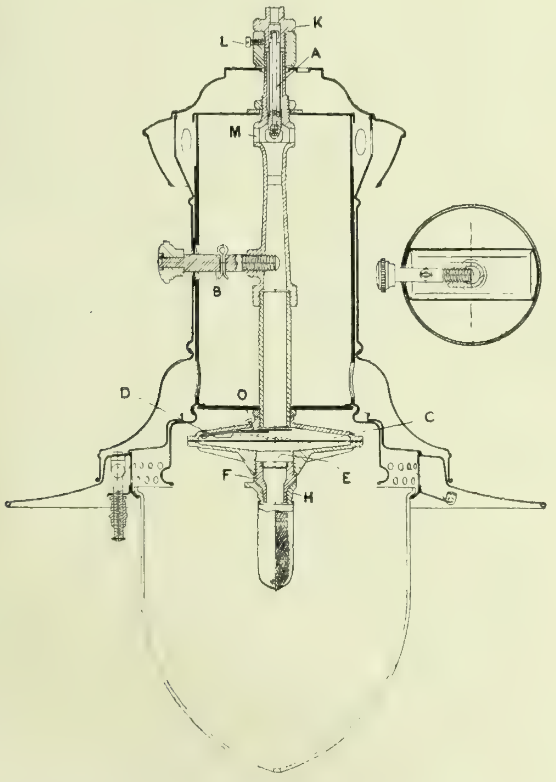
Keith Inverted High-Pressure Lamps.

As will be seen from the illustrations, the body of the lamp is double cased, which greatly increases the durability of the lamp for outside use. The outer globe is dropped into a hinged gallery, from which it can be readily removed. The wire protection for the outer globe is attached in a simple way to the gallery, permitting removal if necessary. The globe can be readily lifted out of the gallery, leaving the wiring in position, which facilitates cleaning without risk of damaging the wire. The lamp is suspended from a connection K, to which is attached a tube A, which carries the gas-nipple, and also contains an efficient dust-trap. By unscrewing the lamp bodily from the connection K, first slackening the set screw L, this nipple can be readily examined or adjusted to suit the gas, without breaking any gas-joint or taking the lamp to pieces. The lamps can be arranged, when specially ordered, with a stirrup piece on the top, which permits of the nipple being withdrawn without taking down the lamp.

The air adjustment B consists of a screwed plug with a porcelain head projecting through the casing. The inner end of the plug passes into the bore of the burner, and by more or less obstructing the flow of the mixture, according to its position, regulates the amount of air that is drawn in at the openings M. The heater C is fixed on the bottom of the burner-tube, and takes the form of two shallow cones fixed base to base, with a diaphragm between perforated at the outer edges, which has the effect of spreading out the mixture of gas and air over a large area of highly-heated surface before reaching the nozzle F. Access to the gauze E is obtained by unscrewing the nozzle F. It will be found in practice that, under ordinary circumstances, it is not necessary to clean this gauze regularly, as in the case of our upright burners, as the

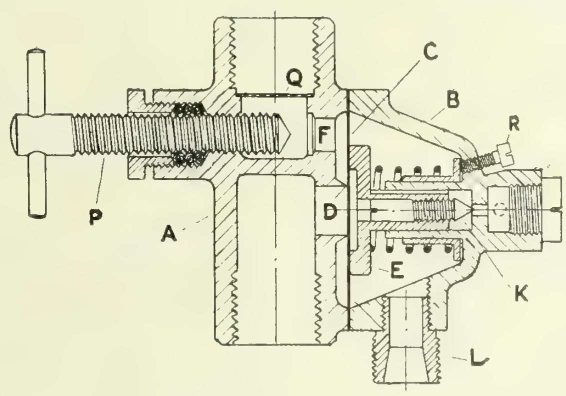
The Tottenham Gas Company's Head Offices at Night.

high velocity of the mixture through the gauze tends to keep it clean. Whenever the mantle is renewed, however, it is advisable to examine the gauze, in case it may have accidentally burnt through owing to the lamp lighting back. Care should be taken to see that the new gauze fits snugly into position.

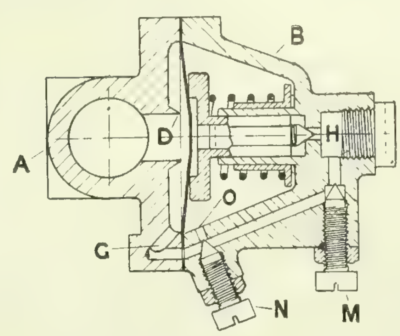


The nozzle F is threaded on the outside; and on this the mantle-ring H is screwed. In the 1500-candle power and 1000-candle power heaters, an arrangement D, termed the thermostat, is fixed. This consists of a compound strip of brass and a special alloy of low expansibility, with the brass uppermost, one end of which is attached to the outer edge of the heater. On the other end a disc is fixed, which normally tends to close the inlet to the heater. The small screw O is adjusted to prevent the disc closing the aperture entirely. As the heater warms up, the strip bends away from the opening, owing to the brass expanding at a greater rate than the special alloy.

The effect of the thermostat is to check the amount of air in the mixture when the lamp is cold, by putting in a resistance which is automatically reduced as the lamp heats up. The object of this is two-fold—first, to ensure the lamp lighting up quietly, and thus preventing damage to the mantle; secondly, to simplify the making of the mantle on the burner itself from the soft state. The action of the thermostat is simple and positive, and when once properly adjusted cannot get out of order. In the lamps as sent out, the thermostat is



Sectional Elevation.



Sectional Plan.

adjusted for giving a very poor mixture when first lighted up, so that for a minute or so after first lighting there is little or no light. If it is desirable that the lamp should light up quickly, the thermostat can readily be adjusted by means of the small screw O already referred to. If this is screwed inward slightly, it will increase the opening when the lamp is cold. It is necessary to remove the heater from the lamp to adjust the screw O.

High-Pressure Parade Lighting in the Main Thoroughfare at Wood Green (Keith Lamps).

LIGHTERS.

As will be seen from the illustration, the apparatus consists mainly of a valve body A and a cover B, between which is held a thin metallic diaphragm C. This diaphragm C is made of pure silver, which has been found the most satisfactory material for the purpose, as it does not readily corrode, and does not flake with heat. The valve-seat D is formed in the body A; so that the centre of the diaphragm bears upon it. The diaphragm is held normally on to the seat D by a plunger E, which is actuated by a spiral spring. The gas enters the annular space between the diaphragm and the valve-seat by the passage F, and so long as the gas pressure is insufficient to overcome the resistance of the plunger E, no gas will pass to the outlet. When the high pressure comes on, however, the diaphragm and plunger are forced back to the position shown in plan, allowing the gas to flow through the valve-seat D to the outlet. When the pressure is reduced again, the diaphragm closes by the action of the plunger, and the gas is again cut off.

It will be obvious that the pilot light, which it is necessary to use with such an apparatus, must be controlled, as otherwise, if adjusted to a reasonable size under the low pressure, it will increase to an abnormal size when the lamp is alight, which, apart altogether from the waste of gas, is objectionable. The movement of the diaphragm is used to counteract this increase, and at the same time to make use of it to give a temporary flash at the moment of lighting. A small port G is formed, leading from the annular space, which is always open to the gas supply. This port is connected to a corresponding passage, which leads to the back of the cap into the space H. On the end of the plunger E is fixed a small valve K, which shuts against its seat when the diaphragm is in the open position. When the diaphragm is closed, a passage is left through this seat into the interior of the cap B, and thence to the union L, to which the bye-pass is connected.

The regulating screw M is so adjusted as to allow the correct amount of gas to pass under low pressure through the port to the bye-pass. It will be seen that, when the pressure begins to increase, the amount of gas which will pass the regulating screw M is also increased, so that the pilot flame begins to increase. This goes on until the diaphragm opens sufficiently far to press the valve K on to its seat, which cuts off entirely the supply to the bye-pass from this source. In order to allow of the small pilot light being kept burning while the lamp is alight, to avoid the pilot tube becoming filled with air, and to ensure the pilot being alight when the lamp is turned off, a second adjusting screw N is provided which controls a small port O leading directly into the cap B. This is so adjusted that the amount of gas which will pass through the port O at high pressure is just sufficient to give a small light on the pilot. In order to ensure that the diaphragm C finds its seat accurately on the valve-seat D, a circular depression is made on the face of the plunger E of larger diameter than that of the valve-seat, so that the metal of the diaphragm can accommodate itself to the seat.

In order to be able to shut off the lamp entirely without requiring a separate stop cock, a screw-down valve P is fitted, which is adapted to close the opening F. This works through a stuffing box packed with asbestos cord, and is turned by means of a T handle, so that it can be easily opened or shut by hand. This arrangement enables the cap C to be removed and the diaphragm examined at any time while the pressure is on, without interfering with the remainder of the installation. The gauze Q is fitted on the inlet to prevent any dust or dirt getting into the valve-seat.

RAISON D'ETRE FOR THE HIGHER PRESSURES.

Before passing from the description of the lamp, it is worth considering what are the conditions which require that the gas should be compressed to so great an extent. The explanation is that sufficient force is required to carry the gas and the fullest possible proportion of air through the various parts of the mixing-tube, heater, and burner, and to produce an ideal flame on the mantle. The ideal flame is one that burns fervently but still gently—that is to say, with no undue pressure in itself against the frail mantle. Another condition, in addition to the friction of the parts which the mixture has to overcome, is the tendency of heated air and gas to rise instead of descend as it is required to do, and, further, to provide the velocity at which the mixture must travel to prevent the flame from lighting-back, all of which call for a power greater than could be supplied by low pressure. This power is supplied by the velocity at which the comparatively small quantity of gas is injected through its small nipple into the bunsen chamber by the high pressure behind it. But by the time all its work is performed, there is no unnecessary pressure remaining likely to injure the mantle.

CAST-IRON PIPES FOR HIGH-PRESSURE GAS.

The main pipes used on all our high-pressure installations are cast iron, laid almost entirely under the footways. The supplies for each block of shops are run up at the street corners, and carried on top of the facia boards.

PROGRESS OF THE SHOP LIGHTING BUSINESS.

The number of lamps erected at Harringay progressed, in the four quarters of 1909, 52, 61, 61, 71 respectively; and the cost for gas (at full retail price), labour, upkeep, and interest, amounted to £66 7s. 10d., £50 9s. 9d., £54 10s. 7d., and £74 2s. 8d. in the respective quarters. Dividing the cost in each quarter by its number of lamps shows an average of 25s. 6d., 16s. 7d., 17s. 10d., and 20s. for the various periods, or a total of £3 19s. 11d. for the whole year. The first quarter's expenses were high on account of the extra expenses due to initial difficulties.

We had been so encouraged by our success at Harringay, that when another important group of shops about a mile away in the same road (namely, at Southern Wood Green) were prepared to consider a similar system, we only asked for a minimum of thirty lamps, which was soon obtained. Different hours were required in this case; and six nights per week instead of five. This made an average of seven hours extra consumption per week, representing nearly 4000 cubic feet more per lamp per annum. But as other costs amount to about three-quarters of the whole, the gas itself is comparatively unimportant; so that an additional charge of only 2s. per quarter was made. Even on early closing

A View of the Same Thoroughfare from the Opposite Direction to that on page 482.

nights, the continuation of the lights forms a good advertisement where the trade or business of the shop is conspicuously painted on the shutter.

This installation was started in July, 1909, and was rapidly followed in November by the northern part of Wood Green, where only twenty guaranteed orders were asked; and by Middle Wood Green, and a branch road (Myddleton Road), in December. In the two latter cases, we asked no guarantee as to numbers, as our past experience showed that orders were easy to obtain as soon as the supply was available. A good illustration of this is in what is known as "Costers' Market," where twenty lamps are subscribed for by the stall-holders. It is worth mentioning here that the freer from stringent conditions the offers are made, the more readily they are accepted. The Tottenham Company only ask for a year certain, and afterwards a month's notice.

Central Compressing Station.

Having now five separate centres in about 2½ miles of practically the same road, with only small spaces between, it was decided to join all up and work from a central station. This was done in August this year; and the compressing is now done entirely at the Company's Wood Green depôt, which is centrally placed. For compressors, two 25,000 feet per hour Donkin's exhausters, which the Company had among its spare plant, were used, and driven by a "M." type 8 H.P. gas-engines. The gas is drawn through a 10,000 cubic feet per hour station meter, which also came from the stock of spare plant. In order to avoid any pulsation on the high-pressure main, the gas is discharged into the upper part of a 36-inch vertical pipe, 6 feet high, with closed top and bottom; the bottom being connected by a 4-inch pipe to another 36-inch vertical pipe, 12 feet high, with closed bottom and open top. The two pipes are filled 5 ft. 6 in. deep with water. As the pressure accumulates after starting the plant, the water flows through the 4-inch connection until it balances the pressure, and thus not only forms a cushioning surface, but also a slight reservoir of compressed gas.

With central working, provision had to be made for varying times at different centres; but this was in this case easy, as the short-time districts—Harringay and Myddleton Road—are at the two extremes. Valves were introduced for shutting off these districts when required; and in order to maintain the bye-passes when the valve is shut, a 1-inch connection with a back-pressure valve is made to the low-pressure main on the outlet side of the valve. This admits low-pressure gas for the bye-passes when the main valve is shut.

This combination has been applied in another form. Some public lamps are on high pressure; but as the compressors stop at ten o'clock on the first four days of the week, at eleven o'clock on Fridays, and at twelve o'clock on Saturdays, a light is still required in the public lamps for the remainder of the night. The columns are therefore fitted with a high-pressure lamp and a low-pressure lamp; the latter being fitted with a Rostin self-lighter. The high-pressure plant is invariably started before the time for lighting the public lamps, and therefore before the Rostin lighter tries to operate. When it does try, it finds itself held down by a high-pressure diaphragm, and it is only able to act when high pressure goes off at shutting-down time. It then lights the low-pressure lamp, and in the morning extinguishes it with the others, as there is then no high pressure to interfere with its functions.

Financial Points.

As nearly as possible our costs at the central station, as ascertained so far, promise to come out—taken on the number of lamps at present (558)—at about £1750, and our revenue at £2250, leaving a margin of £500 for depreciation. As regards depreciation, the lamps are so well constructed that they may be confidently expected to last ten years. We are so satisfied with the result, and the system is so popular, that we have started new centres without asking for any guaranteed number as follows: West Green Road, Bruce Grove area, Criterion Buildings (near our Central Office), Lordship Lane, and The Broadway, Winchmore Hill. Other busy centres will soon be dealt with, until in practically all main roads we shall shortly have high-pressure supplies throughout their entire length.

Light for light, with gas taken at a general average of 3s. per 1000 cubic feet, and electricity at the low price of 3d. per unit, the cost for 10,000 candles maintained one hour is:

Keith inverted gas-lamps	0s.	6d.
Low voltage osram electric	2	6
Electric flame arcs	0	11

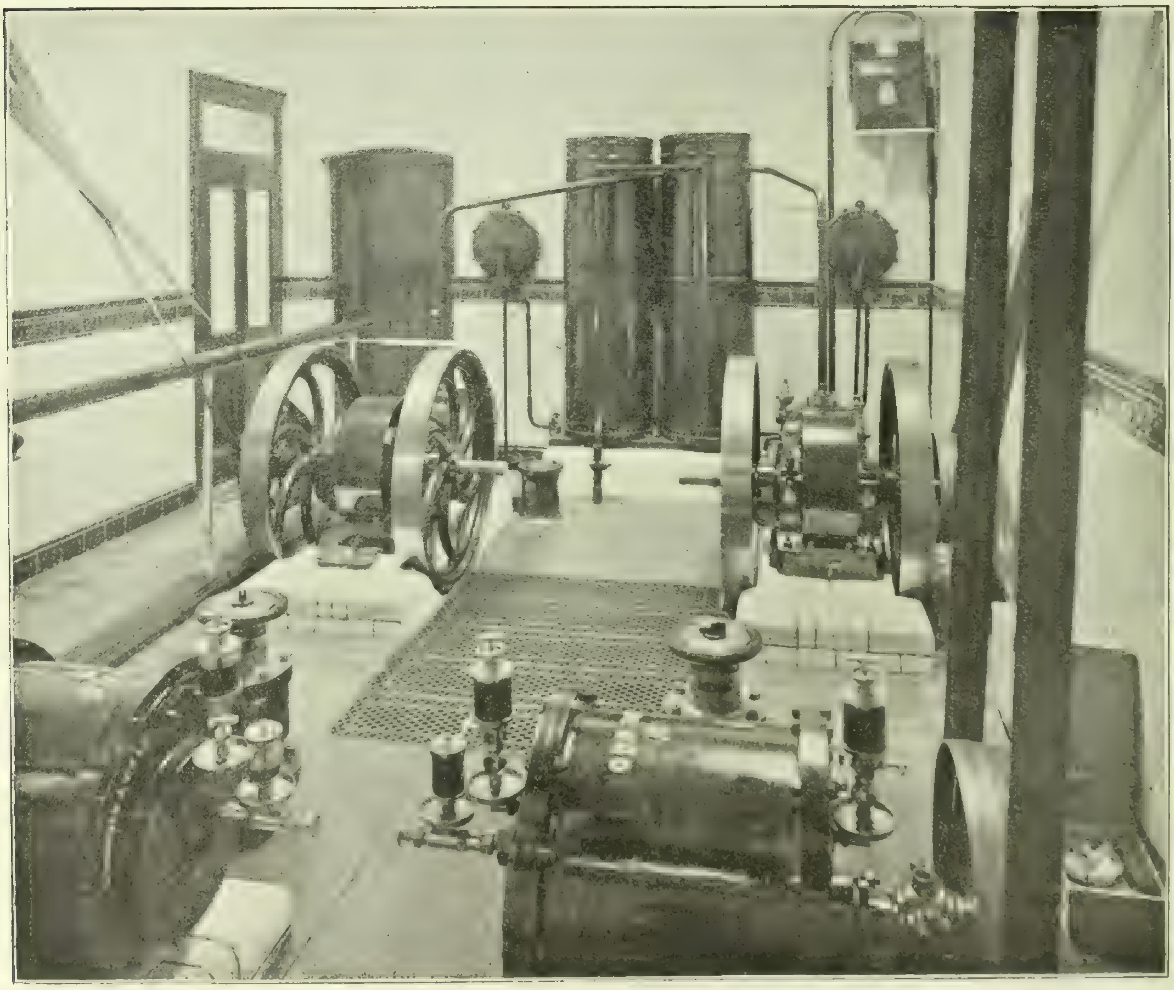
This is for gas and current only. Maintenance is all in favour of the high-pressure gas system; while the steadiness and brilliance of the light, and its superior diffusive power, appeal to all who have used it.

Other Installations, and the Question of Ignition.

On the Tottenham district there are several fine instances of high-pressure factory installations, skating rinks, market halls, &c.; but these it is not proposed to describe. The installation at the Alexandra Palace, however, is of a public nature, and is worthy of particular notice.* The most novel feature is the very neat switch-board, by which various halls and sections of the buildings and grounds can be operated separately by merely turning an extremely small high-pressure gas-cock for each section. The method of operating is as follows: Beneath the floor of the compressor station there is a diaphragm governor for each

* The Alexandra Palace installation was described and illustrated in the "JOURNAL" for Nov. 16 last year, pp. 462-4.—Ed. J.G.L.

A Brilliant Example of Hotel Lighting in the Tottenham Company's District (Sugg Burners).



The Central Gas-Compressing Station at Wood Green.

section, whose function is to cut down the high pressure on sections which are for the time being shut out; so that the valve of the distance lighter (already described in connection with each lamp) is closed, and only the bye-pass open to the reduced pressure. Behind the switch-board there is a ⅜-inch supply of high pressure when the compressors are running; and from this supply a ⅛-inch cock and tube connect with the space above the diaphragm of each section governor.

When the ⅛-inch cock is opened, high pressure (but comparatively no volume) passes to the top of the diaphragm, equalizing the high pressure below it, and thus throwing it out of action as a governor. It consequently admits gas at full high pressure to that section. This operates the automatic lighter on each lamp of the section, and cuts down the bye-pass; and all the lamps are thus lighted. In order to extinguish them, all that is needed is to shut off the switch cock, which, in shutting off, vents the small quantity of high-pressure gas that is contained above the diaphragm of the section governor, and allows it to become operative again in reducing pressure on the section; thus shutting the automatic lighters and reopening the bye-passes.

On the subject of bye-passes, these are undoubtedly expensive in such a building as the Alexandra Palace, where some sections are only lighted for a few hours per week, with the result that the bye-passes use more gas in the aggregate than the burners themselves.

This difficulty can be overcome by electric ignition. And here comes in a peculiar position for our energetic rival electricity. It is but another proof that expensive things can often be beneficially used in a small way; and in this case it is indeed in a very small way, as it only needs some small dry-cell batteries.

There are two systems which might be used; one is the Keith-Blackman system, by which from a set of central batteries wires can be run to the lamps in the various sections, and instead of the automatic lighter already described, a momentary current opens an electric control valve on each lamp, and at the same time ignites the gas. This necessitates a considerable amount of wiring; but as it has not been adopted, it need not be described in detail.

The other system is an invention of Dr. Rostin; and as the Trustees of the Alexandra Palace have ordered 121 of these lighters, a description may be found of interest. By taking a supply of gas from above the lamp to an ingenious apparatus connected with the self-lighter already described, Dr. Rostin causes a diaphragm to rise synchronologically with the opening of the self-lighter, admitting gas to the burner. The rise of this diaphragm opens a cock on the ordinary bye-pass tube, and at the same time gives an electric contact to a platinum igniter placed at the bye-pass orifice from a small dry-cell battery placed in any convenient position. The action of the diaphragm is retarded, not only as regards the admission of gas under it, but also as regards the escape of air above it, by adjusting screws. The high-pressure gas is thus allowed to issue from the bye-pass for about 15 to 20 seconds, and is ignited by the platinum wire that is heated by the electric current passing while the contact remains. The bye-pass flame shoots right across the mantle, and ensures safe lighting. At the finish of the retarded action of the diaphragm, the bye-pass cock (which is the ratchet type usually favoured by Dr. Rostin) closes by travelling on beyond the port, and the contact also is broken. The dry-cell battery, which costs only 10d., lasts six months, and the igniter, which lasts a year, can be renewed for 6d. By this apparatus, the waste of the bye-pass is quite obviated.

Enterprise the Developing Factor.

This paper has become somewhat lengthy; but as it deals with one of the important changes through which our industry is passing, the author hopes it may prove useful. The lesson to be learnt is that, notwithstanding the great progress already made, gas still has an immense reserve of potentiality untouched by scientific practice. In the past, there has been in our industry too much easy reliance on our developed strength, and too much hesitancy in doing our best with possible improvements, which only require enterprise to attain marked success.

MIDLAND JUNIOR GAS ASSOCIATION.

The November Meeting of the Midland Junior Gas Engineering Association was held at Birmingham on Saturday, under the presidency of Mr. R. S. Ramsden, of Burton-on-Trent.

The Hon. Secretary (Mr. G. C. Pearson, Nechells) read letters from Mr. Vincent Hughes, of Smethwick, and Mr. B. W. Smith, of Walsall; and also one from Mr. C. G. Langford, of Coventry, resigning his position on the Council, owing to his having obtained an appointment in South America.

Mr. W. H. Johns, of Saltley, read a comprehensive paper entitled "Ammonia Recovery, with Special Reference to Apparatus employed therein," which was illustrated by a number of models and tracings. The paper appears on p. 489 of this issue; but the report of the long and interesting discussion to which it gave rise has been crowded out, and will be given next week.

At the conclusion of the business meeting, the first of a series of "Coffee Meetings," was held at the Metropole Café; and this proved a highly successful innovation for the Association.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Brentford Gas-Works.

On Saturday, between forty and fifty members of the London and Southern District Junior Gas Association visited the Brentford Gas-Works. The members were met at the entrance to the works by Mr. A. A. Johnston, the Engineer and Manager of the Company, and Mr. R. Goodman, the Assistant-Engineer, who, with Messrs. T. Antrobus, C. Bedford, D. Sugg, N. Willsmer, W. Lewis, P. Parry, T. Parry, L. J. Croxford, and E. Waterfield (members of the staff), divided the party into groups, and conducted them over the works and through the various shops—the latter being kept running and fully staffed for the occasion.

BRENTFORD GAS-WORKS.

The Brentford Gas Company were incorporated by Act of Parliament in 1821; and further powers were granted in 1858, 1868, 1876, and 1881. The Company have two works—viz., at Brentford and Southall; the distance between them being 5½ miles. The district supplied by the Company comprises about 50 square miles, and includes the parishes of Brentford, Chiswick, Hammersmith, Acton, Ealing, Hanwell, Greenford, Southall-Norwood, Heston, Isleworth, part of Twickenham, Hayes, Harlington, Cranford, East Bedfont, Kew, Mortlake, Barnes, and part of Putney. During the past ten years the output of gas has increased from 1807 million cubic feet to 2898 millions per annum; being equal to an increase of 60 per cent. The Brentford works are situated on the River Thames about one-third of a mile above Kew Bridge. There is no railway connection with the works; all coal, oil, &c., being brought by water. The site being exceedingly restricted, every available corner is used to its utmost capacity. The total area of the works is 5·5 acres; the area available for manufacturing purposes being but 1·9 acres.

The coal-stores have a total capacity of about 7200 tons; and provision is made for storing 171,000 gallons of oil.

The carbonizing plant, capable of producing 2,800,000 cubic feet of gas per diem, consists of three retort-houses—two containing one bench of eight settings each, and one house containing sixteen settings in one bench; making a total of 32 sets, or 192 retorts in all. All the retorts are inclines, 20 feet long of ◘ section, 24½ in. by 14 in., set at an angle of 31°, six retorts in a setting, heated by regenerator furnaces.

The coal is brought alongside the works in barges, whence it is raised by grabs to the coal-breakers, from which it passes to the boots of elevators, which raise it to conveyors running over the storage hoppers which are fixed along the entire length of each retort-house. The coal then passes to measuring chambers, from which it is conducted into the retorts by movable shoots—one shoot for each tier of retorts. Over the coal-breaker of No. 2 house is fixed a totalizing hopper-weigher machine.

On leaving the retorts, the gas passes by way of the hydraulic mains to long cooling mains, along the walls of the retort-houses, and thence to two sets of Clapham's "Eclipse" reversible water-tube condensers of 1½ million cubic feet per diem capacity each.

The exhauster-house contains three exhausters—two of 125,000 cubic feet per hour capacity, of Messrs. Gwynnes' make, and one by the Bryan Donkin Company, driven by countershaft and belting from two horizontal jet-condensing steam-engines of 15 H.P. each. The gas passes from the exhausters through a series of four tower scrubbers.

The purifiers for coal gas consist of seven boxes—four 20 ft. by 40 ft. by 6 ft. deep, and three 30 ft. by 30 ft. by 7 feet deep—and two catches, each 40 ft. by 19 ft. by 6 ft. deep. Oxide of iron only is used in them.

From the purifiers, the gas passes to the station-meter, to be described later.

The carburetted water-gas plant, supplied by Messrs. Humphreys and Glasgow, consists of two sections of a million cubic feet per diem each and one section of 700,000 cubic feet per diem capacity. No. 1 set, which has lately been remodelled, is fitted with steam meters and electric pyrometer; and all the sets are provided with Humphreys and Glasgow's dust interceptors on the stacks of the superheaters.

The engine-room contains three Sturtevant No. 8 blowers; two being driven by means of countershafts and belting from Marshall high-speed horizontal non-condensing steam-engines, and one coupled direct to a De Laval non-condensing steam-turbine of 55 H.P. There are also two exhausters of 40,000 cubic feet per hour capacity each, coupled direct to horizontal steam-engines of Gwynnes' make. The various pumps for oil, circulating water, &c., are by the Worthington Pump Company. Before going to the purifiers, the gas passes through a "Cyclone" tar-extractor, and thence to the relief holder, which is of 60,000 cubic feet capacity.

The purifiers consist of four boxes, 29 ft. by 16 ft. by 6 ft. deep; oxide of iron being used in them. The gas is then measured by a station meter of 80,000 cubic feet per hour capacity, and afterwards mixes with the coal gas on its way to the holders.

Steam is supplied to the various engines and pumps, &c., on the works and to the carburetted water-gas plant by a battery of four Lancashire boilers, 6 ft. 6 in. by 26 ft., fitted with forced

View of the Brentford Gas-Works from the River Thames.

draught furnaces and regularly working at a pressure of 110 lbs. per square inch.

The remaining portion of the works is situated on the north side of the High Street.

The valve and governor house, a spacious building 110 ft. in length and 32 ft. wide, has but recently been completed. It is constructed of hollow concrete blocks made of coke breeze and portland cement. It consists of two floors, on the lower one being the various connections, ranging from 18 inches to 40 inches in diameter. The upper floor is of cast-iron perforated plates on cast-iron columns and steel framework. The building contains the coal-gas station meter, district governors, turbo-booster and holder valves. The station meter was made by Messrs. W. & B. Cowan, of 100,000 cubic feet per hour capacity. The district governors, of which there are four (three being 18-inch and one 24-inch) are of Braddock's water-loaded type. There is

Upper Floor of the Valve and Governor House.

also a 24-inch safety governor of the same make. The booster used consists of a Sturtevant gas-pressure raiser coupled to a De Laval steam-turbine of 55 H.P., and is for forcing the gas from one holder into another, or straight on to the district if required. The connections for the three holders are brought into the basement of the house; the inlet and outlet valves of holders being inside the building.

There is a 30-inch main connecting the Southall works with Brentford; and this main is brought into the valve-house and connected to the inlet and outlet of holders, district, and to the booster.

There are three gasholders, of 876,000, 522,000, and 304,000 cubic feet capacity respectively.

Opposite to the valve-house are the gas-stove repairing shops, which are completely fitted up for the cleaning and repairing of cookers, fires, &c. There is a furnace to hold 22 cookers for burning-off, after which the stoves are cleaned by a sand-blast apparatus. The main repairing shop contains drilling machines, emery grinders, buffing wheels, shearing machines, &c., driven by a gas-engine; also tools and machines for making the various tins, flue-pipes, &c., required. An average of about 220 stoves are turned out weekly.

The Company do not at present repair meters; but all meters are tested at the works, for which purpose four test holders are installed, which deal with about 240 meters weekly.

The various workshops, some of which are at present being reconstructed, comprise smithy, with four hearths and pneumatic power hammer, carpenters' shop, fitting and machine shops, coppersmiths' shop, and lamp-repairing shop.

The general offices and stores are on the Brentford works.

At the conclusion of the inspection, the company assembled in the governor-house, where tea was provided. After tea,

The President (Mr. L. F. Tooth) expressed the appreciation the Association felt for the privilege of the visit that day, and called upon Mr. T. F. Canning (Senior Vice-President) to move a vote of thanks.

Mr. Canning said that he had much pleasure in proposing a vote of thanks to the Board of Directors of the Brentford Gas Company, and to Mr. Johnston, Mr. Goodman, and the other members of the staff, for their kindness in having the members at the works that afternoon and for their generous hospitality. They had been greatly interested in all they had seen, and were particularly struck with the arrangements at the Brentford works, where there was an output of 5½ million cubic feet per diem, on a manufacturing area of under 2 acres; it was an experience of practical work and improvements in unfortunate surroundings. Mr. Johnston had proved himself equal to the occasion; and he hoped in years to come to renew the acquaintance of Brentford by making another visit. Special thanks were due to the Engineer for keeping the stove cleaning and repairing shops in operation that afternoon. They had evidently seen the last word in stove work.

Mr. D. J. Winslow, in seconding the vote, said the afternoon had been a good educational visit. They had seen how disadvantages could be turned to advantages, and obtained hints which would prove most useful.

The vote having been carried,

Mr. A. A. Johnston thanked the members for their vote. He said that the visit had been a great pleasure to him. His first experience of Junior Associations was when he visited the Junior Gas Engineering Society, held under the Welsh Chapel in the City Road, some twelve or fourteen years ago. Of this Society he was then a member; and he believed it was the pioneer of the Junior Associations in the kingdom. At that time there was none other existing. Another reason why the visit had given him pleasure was because visits of this sort were not only interesting, but they must tend to the good of the industry. Brentford was not a show works, owing to the difficulties that had been alluded to by a previous speaker.

The late Mr. John Birch Paddon, whose death was recorded in the "Journal" for the 18th ult., left estate of the value of £43,597, with net personalty sworn at £35,564. Probate of the will, dated Nov. 27, 1903, has been granted to his son, Mr. Arthur Matthews Paddon, of the Middle Temple, Barrister-at-Law, who is one of the Directors of the Brentford Gas Company. Among the bequests are £50 each to Mr. E. L. Burton and Mr. Joseph Cash, the Secretary and General Manager respectively of the Brighton and Hove Gas Company, with which the testator was connected for so many years; and £25 to Mr. A. W. Cooper, of the Malta and Mediterranean Gas Company. The Trustees under the will are directed to have constructed on some safe part of his estate a furnace wherein they shall cause to be consumed all his letters, letter-books, specifications, engineering drawings, &c., except such as they shall consider it desirable to preserve.

MEETING OF THE AMERICAN GAS INSTITUTE.

Extracts from the Presidential Address of Mr. W. H. Bradley.

In the brief notice of the recent annual meeting of the American Gas Institute which appeared in the "JOURNAL" last week, it was mentioned that the President—Mr. W. H. Bradley, the Chief Engineer of the Consolidated Gas Company of New York—devoted his address mainly to the question of maturing and spreading the interests of the Institute. The following is a general outline of the address.

INTRODUCTORY.

After extending to his colleagues a hearty welcome to the Empire City of the Empire State, the President expressed his pleasure at having in the full attendance of members many who had journeyed far from distant cities to take part and assist in the work of the organization. The usual presidential address which was expected on these occasions would, he said, be necessarily brief, as the Technical Committee had prepared a programme of unusual length and variety that would require all the time at their disposal to complete. He would, therefore, only touch on such matters as appeared to be important as concerning the Institute and its work, and one or two subjects of general interest to the members, and not attempt to discuss matters of published record so readily available to all in the columns of the Technical Press. It had been suggested that he should discuss the present policy of the Institute, and outline a future one. It was not, however, within the province of the individual, except through the medium of the Directors, to indicate what should be its future policy. But it might not be amiss to consider for a few moments the general situation, after four years of life of the Institute, and see if any information could be gained, or any conclusions drawn that had a bearing on present conditions as they might seem to exist; and, if improvement was desirable or possible in the tone or work of the Institute, how this could be made.

THE INSTITUTE AND ITS MEMBERS' DUTIES.

Referring first to the consolidation of the American, Western, and Ohio Associations into the Institute, the President said it was evident that the one thought in the minds of those who brought forward the proposal was that in union there was strength, and that one organization under favourable conditions, and loyally supported by all its members, could, and would, do better and more efficient work than could be expected from many small organizations, each working independently of the other. That this was correct in theory was beyond dispute; but it did not seem to have fully worked out in practice. Many new State and District Associations had since been formed, and others were contemplated; so that there were now many more than at the time of the formation of the Institute. In addition to these, there were the Illuminating Engineering Society and the National Commercial Gas Association, both comparatively new organizations. It was an undeniable fact that the work of these two Societies ran in parallel lines to that of the Institute. This was recognized last year in Detroit; and at the meeting a resolution was passed having for its purpose some form of amalgamation with the latter organization. This became impossible at the time, because of the decision of the Gas Association that it would not be to its advantage to make any arrangement of the kind at present. It was, however, possible, and even probable, that the question might be brought up again during the coming year.

With regard to the success of the Institute as now constituted, the President pointed out that it depended not alone on the efficiency and work of its officers and Committees, but also largely on the cordial support and assistance given them by the individual membership. "If," said Mr. Bradley, "we believe that we fill the measure of our responsibility to ourselves, to the companies we represent, or to the Institute, by simply paying our annual dues, attending the annual meetings, and returning to our respective homes, giving no further thought to the Institute and its work until the occurrence of the next annual meeting, then there is grave danger that the control of the Institute and its affairs will pass into the hands of the few, or working members, instead of remaining in the hands of the many, as it should for the benefit of all concerned."

THE PREPARATION OF PAPERS.

Passing on to consider the technical work of the meeting, the President remarked that there was only one paper that could be called a voluntary contribution; and he pointed out that the great majority of them were from members connected with the larger companies. This fact had, he said, been commented upon before; and he thought it should be corrected. On this subject, he made the following remarks: We have young men, managers and engineers of the smaller installations, who have both the ability and opportunity to prepare papers that would prove valuable and instructive; and it is eminently desirable, for the benefit of the Institute and the entire membership, that they should come to the front, and take an active part in this work and also in the management of the Institute. They should not hesitate because of a feeling of youth and inexperience; quite as much, and perhaps more, consideration will be shown them by the Institute because of this fact. The older and more experienced members are fully aware that they are not yet the custodians of all the knowledge to be obtained in the gas industry, and are all willing to gain more knowledge, even from the young members. It is neither necessary nor desirable that all papers should be severely technical. Popular papers, if I may so term them, relating to methods of operation or construction; records and results of experiments carried on with a definite purpose; notes on new, or changes made in old, distribution systems; on the uses of gas; and papers on business methods—these are but a few of the topics that would be always welcomed with the technical papers. Even records of failures are valuable. I assume there are but few of us who have not, at times, made failures; and while it is all-important that we should know what to do, it is equally important to know just what not to do. Again, the managers or engineers of the smaller installations are able to observe and attend to matters of detail—so desirable in preparing papers—to an extent that is not possible with the managers or engineers of the larger installations, who must, of necessity, delegate much of the detail work to others.

THE EDUCATIONAL WORK OF THE INSTITUTE.

Dealing next with the educational branch of the Institute's work, the President said few, except those who had been brought into contact with it, had any conception of the amount of time and labour given, freely and without stint, by the Trustees in carrying on this work. He thought the members should endeavour to assist and encourage them in every way possible—perhaps by suggesting to the financial officers of the companies not already subscribing that a subscription to the fund would be acceptable and useful, by looking over gas makers and others employed on the works, selecting those likely to become interested in the subject of a better education, suggesting the matter to them, and, if occasion presented itself, assisting them to solve the problems given out in the various classes, and thus reap their reward in the consciousness that they had done something to forward the Institute's work, and at the same time increase the self-respect, the efficiency, and the value to their company and themselves of some of their co-workers. He added that he had been prompted to make these observations solely with the sincere wish and hope that the result might be the awakening of more of the members to a fuller appreciation of their duties and their privileges in the Institute, and in this way initiate an era of progress and of interest that would result in placing it in the position to which it rightfully belonged—viz., in the front rank among the technical societies of the world.

THE PROPOSED ADOPTION OF A CALORIFIC STANDARD.

Coming to subjects of more general interest to the gas industry, the President said the suggested change in the standard of value as applied to the use of gas—the adoption of a calorific standard in place of the photometric one—was perhaps the most important. The proposed standard had, he pointed out, been already adopted in some States of America, and was being seriously considered in New York, as well as elsewhere. It had also been adopted to some extent in certain places in Europe. The advocates of the change argued that, as gas is so largely used for obtaining heat and power and for lighting purposes with the incandescent mantle burner, the thermal value is of more importance to the consumer than is the illuminating value. If this was conceded, it logically followed that in every case where the thermal standard is adopted the illuminating standard should be eliminated. So far as information was obtainable on this subject, no definite or constant relation had been established as between candle power and thermal value. Considerable variation might occur in either one without corresponding or even relative variation in the other. Any attempt, therefore, to enforce compliance with two standards of manufacture, in the present state of affairs, would simply result in gas suppliers being penalized for non-compliance with one, while entirely in compliance with the other. This in itself was a sufficient argument for a single standard.

THE INSTITUTE'S INVESTIGATIONS ON CALORIMETRY.

Reference to the proposed adoption of a new standard for gas naturally led the President to the subject of the work of the Institute in connection with calorimetry. He reminded the members that for some time past the Institute had had Committees on this subject who had done much valuable work, and had from time to time made reports. Up to the present, in accordance with their instructions, the work had been confined chiefly to the examination of the several types of calorimeters on the market, the comparative results to be obtained by their use, and to formulating rules for the proper method of installing calorimeters and conducting tests. The President said he believed the time had arrived for the members to consider the propriety of enlarging the scope of these Committees by giving them instructions to take further steps, until, by research and experiment, they were able to make a report to the Institute as to what should be the logical standard of thermal value for the gases manufactured in different localities, considered from the standpoint of a gas useful for the purposes required, as well as its economy in manufacture. A report of this character, well considered and matured, and having the endorsement of the Institute, would, he said, have much weight with those who are investigating the subject with a view to making a change of standard, as coming from a body well qualified to give expert advice on the matter. The present Committees were in possession of much useful information upon the subject; and he thought they should be continued.

GOVERNMENT BY COMMISSION.

The next subject taken up was that of "Government by Commission." This idea was conceived some years ago, when the

National Government placed on the Statute-books laws having for their object the regulation and supervision of corporations, especially those classed as "public utility corporations," in which class, among others, gas companies are included. The lead of the Federal Government was followed by the legislative bodies of the several States, with the result that many laws were enacted, more or less drastic in character, according to the temper of the legislative bodies at the time and the demands of so-called "public opinion." Public Service Commissions were evolved from among these laws; and they are now exercising their functions in several States. In some localities, and under some laws, these functions are extended to a point dangerously near to control of operation. The President made the following remarks on this subject: A Public Service Commission *per se* is not necessarily harmful or objectionable to corporations. A commission whose members are broad-minded, experienced in business methods, and who will take the time to acquaint themselves with the business of the corporations before attempting to supervise or regulate them, who will recognize the fact that the interests of the corporations and the public are identical, that disputes or misunderstandings should be amicably settled, and that both have their rights—among them being the right of the corporation to exist and do business and earn a fair return on the capital invested—will be beneficial to both corporations and the public. If, on the other hand, a commission be composed of those who are unaccustomed to handling large enterprises, men of narrow minds, or politicians appointed by reason of service rendered to party or person, whose whole conception of the duty of a commission is to make a reason for its existence and continuance, and who, therefore, promote strife as a means of gaining notoriety and consequent personal or political advantage, or both, then the result is distinctly bad, not only for the corporation, but also for the customer and the public.

MANUFACTURE OF PUBLIC OPINION.

With regard to "demand by public opinion," the President characterized it as the "shibboleth" always used by those interested in procuring legislation favourable to their own interests. His views on this subject he expressed as follows: If we look into the matter, we find "public opinion," so called, is strictly and wholly a manufactured article—manufactured by politicians and others interested in furthering their own or their party schemes, which are ofttimes actually detrimental to public policy and the general welfare of the community. The general public, not having the requisite knowledge to enable them to form definite opinions, are always ready to accept measures that seem on their face advantageous to their interests. This being the case, why should we not endeavour to mould public opinion, and by this means counteract, as far as possible, the effects of false, misleading, and garbled statements that are so freely used to our disadvantage. Such a method of procedure is entirely feasible, and can be accomplished by inaugurating a scheme of publicity of the details of our business to such an extent as will satisfy all reasonable people that we are dealing, in every way, fairly and honestly with them.

Let us give out periodical statements or reports in any way or form best suited to reach the public, according to existing conditions in any given locality—in other words, take the public into our confidence, and by this means create public opinion that is if favourable to our interests, in place of an antagonistic feeling, if it exists. An immediate change will not take place; but this course persisted in for a time will, without question, bring favourable results. If a Public Service Commission law is enacted and becomes operative in any State, then publicity of every detail of our business will be obligatory. Public opinion will be more in our favour if we do this voluntarily than if it is done under compulsion. It is fair to assume that a system of publicity, inaugurated and carried out in good faith with the public, will be of advantage to any company, by preventing, to a great extent, litigation, with its attendant expense and trouble, and make investigations and the enactment of laws prejudicial to the best interests of our industry much less popular. Another step in the same direction is to insist that all employees of the company who in any capacity come in personal contact with the public shall be courteous, and avoid giving offence or cause for complaint. Unpleasant relations that are entirely unnecessary between the company and its patrons are readily caused by a disagreeable manner and incivility on the part of clerks and other employees. This is not a matter to be overlooked. Discourtesy on the part of a company's employees will easily nullify any efforts of its officers to bring about friendly relations with the public.

POSITION AND RESPONSIBILITIES OF THE GAS INDUSTRY.

The President next referred to the excellent position of the gas industry in America, as shown by the substantial increase which has taken place in the sale of gas over the entire country; and he said he thought there was every reason for believing that similar conditions would obtain in the future. He pointed out that contracts were being made for the erection of new plants in many localities, and for alterations and extensions of existing plants. This was evidence of the healthy condition of the business, notwithstanding the attacks that had been made upon it in the past, and the further fact that the business of their neighbours who are engaged in generating and distributing electric current was also rapidly increasing. The President's further remarks on this subject were as follows: In the early days of gas manufacture, gas was considered to be a luxury; later, when electricity came into the field, that also was a luxury. That time has passed. Both are now necessities, indispensable to the comfort and welfare of our people. Each has its place, its work, and its use. Each will take and hold its place; and the use of each will be constantly on the increase. They will both become more necessary and more indispensable to the entire community as the years roll round. There can be no ground for fearing that either one will or can interfere with the other in its place, work, or use, to any appreciable extent or for any appreciable length of time. The public require and demand more light, and more convenient methods of obtaining light, than in former days. Gas is being more freely used; and its field of use extended in directions and to an extent never dreamed of in days that are easily within the memory of many of us. But we must not be content with this, and so cease our efforts to acquire new, and increase our present, business over and beyond the natural increase. We must get in touch with our customers. If any are still using the old open-flame burner, now practically discarded and obsolete, see that they are shown the advantage to them in the use of the incandescent mantle burner; see that they are supplied with cooking and heating appliances of new and approved pattern and design, at a nominal rental, or at a nominal cost price if purchased; see that all appliances are properly installed and adjusted, and that full instruction is given as to their care and use; advertise freely in the local papers, and a large volume of business now lying dormant will be brought into active life. No company is too large or too small to inaugurate a business campaign in this direction.

Many gas companies are already in the field, and in every case with most satisfactory results. Most consumers are pleased with the attention shown them; and every pleased consumer helps, aids, and assists by a certain amount of gratuitous advertising among friends and neighbours. Our electric friends have their own methods of gaining business. Their methods are not necessarily competitive, except in the one field of lighting. There we must endeavour, as far as possible, to hold our own through the greater volume of light obtained per unit by the use of the incandescent mantle, if it comes to competition. Another advantage to be gained from a general use of gas for purposes other than lighting is that the consumption is spread more uniformly over the 24 hours of the day. In some cases, where there is a considerable increase in the use of gas for cooking and heating, the daylight output is gaining rapidly, and approximates fairly well with the output during the hours when darkness prevails. This also has a beneficial effect on manufacturing and storage conditions. The National Commercial Gas Association are our active allies along these lines. It is their business to introduce appliances; ours to provide use for them.

POSITION OF THE INSTITUTE.

The President closed his address with some remarks on the position of the Institute, and a reference to the members who had passed away during the year. He said the report of the Treasurer showed an improved financial position—there being a substantial surplus, with no outstanding liabilities of any consequence. The report of the Secretary showed a net gain in membership of 16; making a total to date of 1348 members. During the year, 87 new members had been elected, and 71 were lost through resignation, death, and by being dropped from the roll. The work of the several standing Committees had been well and faithfully performed, so far as it was within their power to perform it—notably the Committee on Standardizing Cast-Iron Pipe, which had been held over for several years. The Technical Committee had done an immense amount of work. Eleven members had been removed by death. One of them was Mr. Thomas J. Hayward, the President of the well-known Bartlett-Hayward Company, of Baltimore, whose decease shortly after the meeting of the Institute last year was referred to by the President as "a distinct loss to the whole profession." Being always "helpful and resourceful in business, never refusing to aid with advice and substantial assistance when appealed to, he would," said the President, "long be remembered by many who were so fortunate as to be numbered among his intimate acquaintances."

Photometric Work at the Reichsanstalt in 1909.

The report on the work of the Physical Technical Imperial Institute (Reichsanstalt) at Charlottenburg for 1909 states that many tests have been made as to the durability of metallic filament electric lamps. These lamps at first consumed 1·1 watts per hefner mean illuminating power measured at right angles to the axis of the lamp, which is equivalent to 1·2 watts per candle. After prolonged use, the light of these lamps had fallen off by 20 per cent., though in other cases the lamps were burnt out before the falling off in light reached this proportion. Tests of inverted gas-lamps showed that in the best examples the consumption of gas was 1·2 litres per hefner mean spherical illuminating power (21·1 candles per cubic foot of gas consumed). Incandescent burners for acetylene, in the most favourable cases, showed a consumption of 0·2 litre of acetylene per hefner mean horizontal illuminating power (127 candles per cubic foot of acetylene consumed). The report also mentions that the Institute has been occupied in the testing of all kinds of mantles and lamps for assessing them for the new tax on illuminating agents in Germany. It has also been conducting negotiations with similar bodies in other countries with a view to the establishment of an "International Unit of Light."

AMMONIA RECOVERY, WITH SPECIAL REFERENCE TO THE APPARATUS EMPLOYED THEREIN.

By W. H. Johns, Superintendent of the Saltley Gas-Works, Birmingham.

[A Paper read before the Midland Junior Gas Engineering Association, Saturday, Nov. 12.]

The absence from our "Transactions" of any paper dealing with the subject of ammonia recovery, as well as the scarcity of such papers read before other Associations, has led me to comply with the President's request to submit to your notice a paper which I trust may be of some service to members. At the same time, I realize the impossibility of dealing completely with so important a subject within the limits of an ordinary paper.

Ammonia may be obtained from sewage, bones, horn, leather, coal, and other substances; it is produced in coke-ovens, producer-gas and blast-furnace plants. But it is the recovery of the ammonia that is liberated from the coal in the manufacture of coal gas with which we are particularly interested, and to which I will therefore confine my attention.

Ammonia is produced in the destructive distillation of coal by the union of the nitrogen with the hydrogen—$N + H_3 = NH_3$. The average amount evolved may be taken as $1\frac{1}{2}$ per cent. by volume, or about 480 grains per 100 cubic feet of gas; and by the time the gas has reached the outlet of the condensers, it will contain about 0·70 per cent. by volume or 220 grains per 100 cubic feet of gas—the difference being accounted for by its elimination in the hydraulic main and its absorption in the condensers and cooling mains, by the deposited aqueous vapour previously held in suspension in the hotter gases.

It will therefore be seen that the removal of ammonia commences as soon as the crude gas enters the hydraulic main from the retort, where it comes in contact with the liquor forming the seal. Owing to the temperature at this point being fairly high—from 140° to 150° Fahr.—not so much ammonia is arrested as would be the case if the liquor could be maintained at a lower temperature. But by the time the gas enters the washers and scrubbers, one-third to half the total ammonia it previously contained will have been deposited. Mr. Charles Hunt gives the following results as work done by the various apparatus:—

Ammonia removed by condensation	42·7 per cent.
,, ,, in first scrubber	43·3 ,,
,, ,, in second scrubber . . .	14·0 ,,

The removal of the ammonia from coal gas depends upon the solubility of ammonia in water, which, at 60° Fahr. and 30 inches barometer, is capable of absorbing 783 times its own volume of ammonia gas—the amount of absorption increasing as the temperature of the water is lowered, and *vice versâ*. But temperatures lower than 50° Fahr. should not be worked; otherwise the candle power of the gas will be seriously affected. It should, however, be noted that the quantity of ammonia which water will absorb is not entirely dependent upon the temperature of the water, as the solubility takes place directly in proportion to the pressure of the ammonia gas.

If we were dealing with ammonia uncombined with other gases, the whole would be absorbed at normal atmospheric temperature and pressure, to the extent of over 700 times the volume of water employed. But since the gas, as previously pointed out, only contains 0·70 per cent. by volume of ammonia at the inlet to the washers and scrubbers, very little ammonia is dissolved per volume of water, due to the small pressure exerted by the ammonia, though when taken up by the former it is retained owing to the water being at atmospheric pressure. It will now be seen that time-contact between the ammonia and water plays a very important part in the process of ammonia recovery, and should be taken into account when new plant is being designed.

Advantage should be taken of the affinity which ammonia has for combining with, and neutralizing, the carbon dioxide (CO_2) and sulphuretted hydrogen (SH_2) in the crude gas to form carbonate and sulphide of ammonia respectively; the latter in turn being capable of absorbing some of the carbon bisulphide (CS_2), all of which operations are to be desired, as the cost of dry purification is thereby reduced in proportion to the amount of the impurities (CO_2, SH_2, and CS_2) removed in the scrubbers—more especially the CO_2 and the SH_2, for CS_2 at the majority of gas-works is not now specially eliminated beyond what is taken out in the washers and scrubbers, although it is very desirable to keep it below 40 grains per 100 cubic feet.

The following reactions occur when carbon dioxide and sulphuretted hydrogen combine with ammonia in washers and scrubbers.

$$(1)\ 2NH_4HO + H_2CO_3 = (NH_4)2CO_3 + 2H_2O$$
$$(2)\ NH_4HO + H_2CO_3 = NH_4HCO_3 + H_2O$$
$$(3)\ 2NH_4HO + SH_2 = (NH_4)2S + 2H_2O$$
$$(4)\ NH_4HO + SH_2 = NH_4HS + H_2O$$

There is a limit to the amount of work which can be done through the agency of the ammonia, since, as already stated, it is only present in the gas to the extent of 1·5 per cent. by volume. About one-fourth is "fixed" or combined in the ammoniacal liquor as ammonium sulphate, ferrocyanide, chloride, thiocyanate, and thiosulphate, which is useless as a purifying agent for CO_2 and SH_2. Therefore only 1·2 per cent. of NH_3 by volume is left to combine with these two impurities, which are present in the gas to the extent of from 0·9 to 1·5 per cent. of sulphuretted hydrogen and from 1 to 2 per cent. of carbon dioxide—quantities greatly in excess of the amount the ammonia will neutralize.

In order to eliminate from the gas as much as possible of these acid impurities by means of ammoniacal liquor, it is necessary that the gas should be brought into intimate contact with a strong solution of the same; and this can be efficiently carried out in one of the various forms of washers—such as the Livesey, Cockey, "Standard," or Walker washer, in which apparatus the gas is caused to pass through a strong solution of ammoniacal liquor by means of a number of seals, the depth of which may be adjusted according to the make or volume of gas which is to be treated, so that the back-pressure at any time does not exceed 3 inches. In the washer, the gas is divided up into small streams. The contained liquid is consequently agitated by the pressure, and the gas is thereby brought into intimate contact with the same. The washer was one of the earliest forms of apparatus employed for removing ammonia; but owing to ignorance of the principles upon which it should work, it was discarded—partly due to the great amount of back-pressure thrown in some of the older types, and also to the disastrous effect it had upon the candle power of the gas, owing to the latter having to force its way through a tar-seal.

In modern works, all tar should be eliminated in the condensers or in tar-extracting plants—such as the Pelouze and Audouin, the "Cyclone," or other type of extractor—before it enters the ammonia washers, thus leaving the latter free to deal with the ammonia, and consequently increase their efficiency.

An Early Type of Washer.

An early type of washer consisted of a cast-iron rectangular vessel about 3 ft. 6 in. in depth (the length and breadth of which varied according to the required capacity per 24 hours), divided into two sections by means of a plate forming a division or false bottom, fixed about 6 inches from the cover, and drilled with holes about 1 inch diameter, and spaced 3 or 4 inches apart. Into these holes short pieces of gas tubing were fixed, the lower ends of which were sealed in liquor contained in the lower portion of the washer; the depth of seal being regulated by means of a suitable weir-valve. The gas entered the upper division, passed down the 1-inch tubes and through the liquor, agitated the same, and then bubbled to the surface. From this point, it travelled under the division-plate to the outlet, thus coming in contact with the foam that was formed by the gas when bubbling through the liquor-seal.

Anderson's Washer.

This consisted of a cast-iron rectangular outer vessel containing a number of trays, having on their lower side a series of serrated bars arranged at right angles to the flow of gas, and which were sealed in liquor. The gas, having to pass through the serrated bars, was divided up into very fine streams; and being constantly made to dip under the same, it was brought into intimate contact with the liquor. This was a very efficient apparatus; but it has given place to newer and cheaper, though not less efficient, forms of washers.

Young's Washer.

The above washer was designed by the late Mr. Hugh Young, and is still doing good work at the Saltley station of the Birmingham Corporation Gas Department. At these works, the washer consists of three cast-iron rectangular vessels filled with wooden boards, through which the gas is made to pass. Ammoniacal liquor is pumped over the top of each vessel, through which it descends and then overflows to the liquor-well. These washers give no trouble in working, and never get blocked with naphthalene, which is no doubt due to the method of liquor supply adopted, by which system any deposit is readily and quickly washed down to the bottom. They are, however, costly to instal, owing to their great height, and occupy more ground space than modern types of washers designed for dealing with the same quantity of gas.

The Livesey Washer.

This washer was designed by the late Sir George Livesey, and consists of a rectangular cast-iron outer case, the upper portion of which forms the inlet-chamber, and is fitted with one or two outlets according to its capacity—usually two for washers if designed to deal with upwards of 750,000 cubic feet of gas per 24 hours. To the lower portion of the inlet-chamber, specially shaped wrought-iron tubes, having holes 1-20th of an inch in diameter, are fixed; the interior of the tubes being in free communication at the ends with the outlet-chamber. But the spaces between the tubes at the ends are securely closed up. The gas has free access from the inlet-chamber to the intermediate spaces, passing down, and depressing the liquor until the gas escapes through the inclined portion of the perforated plate into the first space, which is filled with liquor, up through which it bubbles, until it comes in contact with the horizontal part of the perforated plate, carrying some of the liquor with it to the upper surface of the same. The bubbles of

gas pass through this liquor into the tube space above, and convert the surface into foam, which flows along with the gas into the outlet-chamber. The washer is provided with suitable overflow pipes, by which the liquor level can be easily adjusted. The inlet liquor-supply pipe is fixed in the lower part of the washer. Glass windows are fitted in the side plates, to enable the bubbling and washing of the gas to be observed. This washer works most effectively when it has nearly an inch of liquor above the perforated plate, which gives about 3 inches of pressure. Special provision is made in the lowest part of the washer for collecting tar, which is separated, and falls by gravity to the bottom; being drawn off independently of the liquor once or twice daily.

This washer has found much favour in gas-works, on account of its great efficiency. Its chief advantages may briefly be stated thus: The minute subdivision of the gas, twice in contact with the liquor. The entire removal of all the tar. The removal of large quantities of carbon dioxide and sulphuretted hydrogen. Facilities for working up the strength of weak liquor. The small amount of attention required. The small ground area occupied. The small cost of foundations. It requires no steam or pumps. It is automatic.

The following are the sizes of Livesey washers to deal efficiently with various quantities of gas per 24 hours.

Quantity of Gas per 24 Hours.	Length.	Breadth.	Depth.
Cubic Feet.	ft. in.	ft. in.	ft. in.
100,000	1 3	3 8	2 6
250,000	2 11	4 0	2 6
500,000	3 6	5 0	2 6
750,000	4 0	6 0	3 0
1,000,000	5 0	7 6	3 6
2,000,000	10 0	7 6	3 6
3,000,000	15 0	7 6	3 6
4,000,000	20 0	7 6	3 6

Cathels' Washer.

This arrangement consisted of a series of washers, each complete in itself, placed one above another, the liquor overflowing from the top washer to the second one, and so on in rotation; strong liquor meeting the incoming gas at the lower chamber, and clean water flowing in at the top.

Cockey's Washer.

Cockey's washer in its recent form consists of an upright rectangular cast-iron vessel horizontally partitioned off into three or more chambers. The gas enters the apparatus at the bottom, and travels upward through a vertical pipe, having a cast-iron hood fixed to a horizontal plate over the top. The gas comes in contact with the hood, and then travels downward, and passes through the liquor, after flowing through the four openings in the horizontal plate referred to. Before the gas can free itself from the liquor, it is brought into contact with four or five serrated edged plates forming part of the horizontal plate, the lower ends of which are sealed in liquor. After passing the outer serrated plates, the gas bubbles to the surface of the liquor and passes to the chamber above, where the same washing process is repeated, until at the last chamber the gas leaves the washer by means of an outlet-pipe fixed at the top. The chambers are arranged and constructed so that, after the ammonia is taken up, the liquor is retained in them for a considerable time, and flows downward from chamber to chamber. The free or uncombined ammonia is thus utilized for arresting the carbon dioxide and sulphuretted hydrogen.

By the adoption of the patent overflows, the seals can be regulated in each separate chamber from $\frac{1}{4}$ inch to $2\frac{3}{4}$ inches; and when once set they remain constant until it is found necessary to increase or to decrease the seal. The liquor from each upper chamber overflows into the next lower one, and so on from top to bottom of the apparatus. There are also a series of draw-off taps, by which any upper chamber can be entirely emptied into any lower one, or drawn away from the apparatus without interfering with the passage of the gas. This washer occupies little space, requires no motive power, is continuous, reliable in action, and will work with a minimum of pressure.

Walker's Washer.

This washer is constructed in a similar manner to the Livesey, except in one or two details. It is built up of cast-iron plates, usually made rectangular in form, fitted with the usual tar and liquor overflows and seal regulating valves. The gas-inlet pipe is brought through the bottom plate of the washer, and the gas enters an inlet chamber, from which branch off a number of longitudinal passages or inverted troughs, closed at the far end, but open at the bottom. The lower ends of the inverted troughs are slotted with peculiarly shaped slots, which extend from end to end; and these are sealed in liquor when the washer is at work. The gas passes into the top portion of the troughs above the liquor, forces its way through the slots after displacing the liquor, and bubbles in small streams to the surface and passes away to the outlet.

Kirkham's "Standard" Washer.

The patent "Standard" washer, as manufactured by Messrs. Kirkham, Hulett, and Chandler, consists of a cast-iron vessel fitted with horizontal and vertical division plates, and contains a number of sheet-iron tubes, having their lower ends fitted with perforated inner and outer screens, and their upper ends fitted with machined cast-iron rings and wrought-iron lifting handles; the latter being provided to facilitate the withdrawal of the tubes. The tubes are dropped through faced circular holes, cast in the horizontal divisional plate, and secured to the latter by studs. The lower ends of the tubes are sealed in ammoniacal liquor; and the gas is admitted above the division plate, passes down the tubes and through the perforations in the inner screen, impinges on the outer screen, then passes through the perforations, bubbles through the liquor, and passes away to the outlet. This washer has been found to do its work very well; and although the perforations in the sealed tubes are very small, they are kept perfectly free from choking by the bubbling action which takes place. (See fig. 1.)

Improved "Multiple" Ammonia Washer.

Reference should be made to what is known as the improved "Multiple" ammonia washer recently introduced, and manufactured by the Western Gas Construction Company, of Fort Wayne, U.S.A. (whose English agents are Messrs. W. C. Holmes and Co.). This type of washer is very similar to the Livesey; the main difference being in the position of the "breaking up" or washing perforations in the sealed portion of the horizontal tubes or ducts. The washer consists of a cast-iron rectangular outer case,

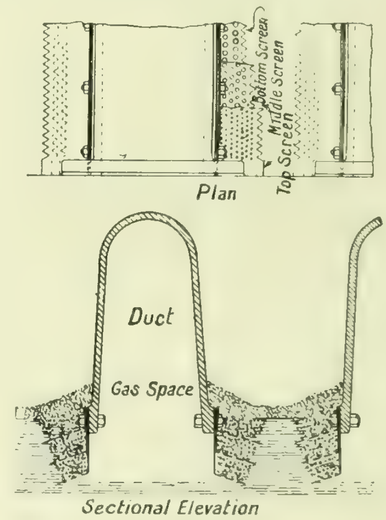


Fig. 2.

to the end plates of which are fixed inverted U tubes, running horizontally. To the lower ends of these tubes three perforated plates are attached, one above the other. Each plate projects a little beyond the one below; but all are bent to the same angle and secured at intervals by bolts to the enlarged ends of the inverted U tubes previously referred to. The perforations in the plates decrease in size and increase in number from the bottom plate upwards; the edges of the plates being serrated from end to end. (See fig. 2.)

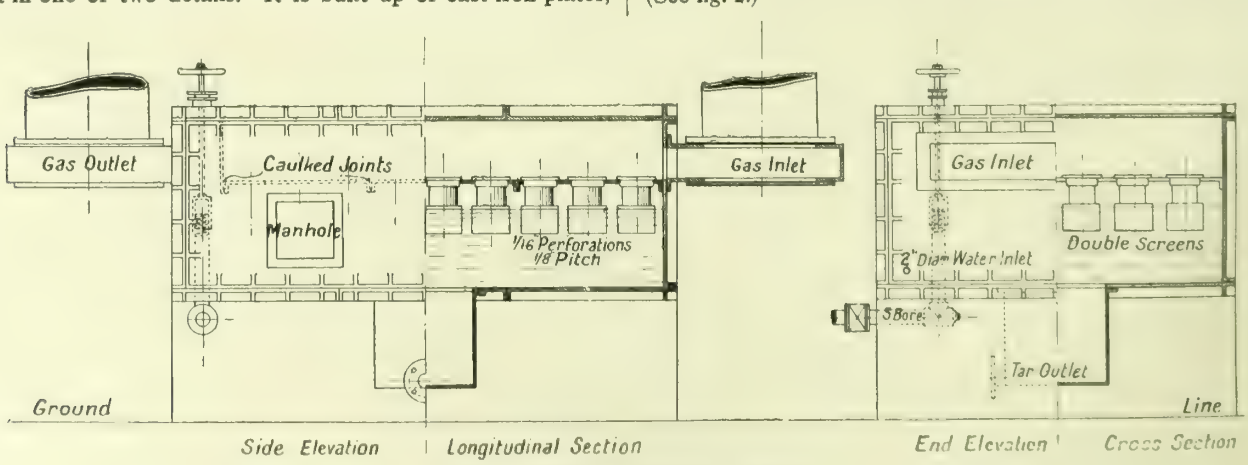


Fig. 1.—Patent "Standard" Washer.

This appears to be a very cheap washer to construct, since no special shaping of the washing plates is necessary, beyond bending them to the angle shown in sketch. Without further particulars as to the working of this form of washer, it would appear that when passing the maximum quantity of gas, all would not find its way through the perforated holes, but take the easier course and pass through the liquor beyond the serrated edges of the plates.

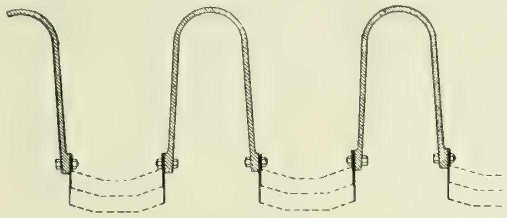


Fig. 3.

From this it would seem to be a better plan to arrange the plates as shown in fig. 3; thus ensuring all the gas being thoroughly subdivided and brought into intimate contact with the washing medium.

Other Types of Washers.

There have been many other types of washers used from time to time, including Charles Hunt's, Good's, Saville's, Dempster's, Whimster's washer and exhauster, &c. Sufficient have been taken, however, to show that the aim in all is to divide the gas into small streams while in contact with ammoniacal liquor; and their efficiency depends entirely upon this, having due regard to the amount of back-pressure which such apparatus will throw.

Scrubbers.

The tower scrubber consists of a cast-iron vessel of considerable height—the usual relationship between the height and diameter being as 7 is to 1—either rectangular or circular in form (the latter shape being preferable), built up in sections and divided into bays. At the bottom of each bay a grid or iron shelf is fixed to suitable brackets cast on the side plates. The shelves support the washing medium, such as coke, drain pipes, wooden blocks, brushwood, or boards which are arranged in the scrubber, and over which liquor is allowed to flow in a downward direction against the upward flow of gas. The object of employing such material for filling is to subject the gas to as large an area of wetted surface as possible. The most efficient scrubber filling undoubtedly consists of wooden boards, about 11 inches in depth, $\frac{3}{8}$-inch to $\frac{5}{8}$-inch thick, spaced from $\frac{1}{2}$-inch to $\frac{3}{4}$-inch apart by distance pieces; the whole being made up in the form of a sieve with the boards set on edge, and the tiers arranged so that each is set crosswise to that immediately below, by which means the gas is very finely divided. At the top of the scrubber, an apparatus is arranged which distributes liquor or water over the scrubbing material. The boards are kept in a very clean condition; scrubbers so filled easily working twice the time any coke-filled scrubber could be expected to work.

The relative areas of wetted surfaces presented to the gas with different fillings are given below; the late Sir George Livesey being the authority for the same:—

Coke.	8½	square feet per cubic foot.
3-inch diameter drain pipes . .	17	,, ,,
2-inch ,, ,, ,, . .	21	,, ,,
Boards	31	,, ,,

It will thus be seen that board filling presents practically four times the area of coke filling, though its first cost is naturally higher. But since it can be used over and over again, in the long run it is the cheaper, besides being a more efficient material for scrubbing purposes.

Tower scrubbers are usually worked in pairs; the gas passing through both in succession. The first scrubber is supplied with ammoniacal liquor, and the second, or finishing scrubber with clean water. In small works where only one scrubber is employed, arrangements are sometimes made for the top half to be supplied with water and the lower half with liquor; the gas being brought in contact with strong liquor at the bottom and clean water at the outlet or top portion—thus combining, as far as may be possible, the benefit of a pair of scrubbers.

Scrubber Capacities.

According to the various authorities given below, the capacity of tower scrubbers should be:—

1.—W. R. Chester (1892), Nottingham: Scrubbers and washers, 4·1 cubic feet per 1000 cubic feet maximum make per day. Time contact, 6 minutes.
2.—W. R. Herring (1892), Huddersfield: 9 cubic feet per 1000 cubic feet maximum make per day.
3.—T. Newbigging (1898). 9 cubic feet per 1000 cubic feet maximum make per day.
4.—H. O'Connor (1897). 120 cubic feet per ton of coal carbonized per day (maximum).
5.—V. Wyatt (1887), London: 100 cubic feet per ton of coal carbonized per day (maximum). Time contact, 15 minutes.

The tower scrubber possesses the advantage of being of simple construction (though its great height adds to its cost); and it requires very little motive power, and this only for the water distributors, which should be described before passing along to the apparatus which is better adapted for removing the last traces of ammonia—namely, the rotary washer-scrubber.

Water and Liquor Distributors.

In order to ensure thorough distribution over the whole area of a scrubber, a good distributor must be arranged. One method of supplying a scrubber with liquor or water is that known as Gurney's jet, which consists of a jet under great pressure impinging on a small plate or disc, which causes the water to spread out in a very fine spray.

Barker's mill consists of a pipe which passes through the top of the scrubber, from which radiating pipes pierced with small holes are suspended, and caused to revolve simply by the action of the water pressure—similar to an ordinary lawn sprinkler.

Another arrangement is the well-known tumbler method, which consists of a tumbler constructed to hold a certain quantity of water or liquor which is supplied from an overhead tank. The tumbler is mounted in such a manner that, when filled with the liquor, it overbalances and empties its contents through a sealed pipe, and then returns to its original position. In some tumbler arrangements gear wheels and an index are fixed which register the quantity of water used, and also rotate several radial arms by means of a pawl and ratchet attachment fixed to the tumbler spindle.

In the Mann and Walker type, as made by Messrs. C. & W. Walker, of Donnington, a brushwood wheel is fixed in the top of the scrubber, which is caused to revolve by means of bevel wheels worked from a vertical shaft attached by means of brackets to the outside of the plates forming the scrubber, and worked by a small steam-engine fixed at the scrubber base. Water or liquor from an overhead tank is supplied through funnels and down-pipes and sprayed over the brushwood wheel by means of revolving distributors, which work eccentrically, travelling rapidly when nearing the centre and slowly when traversing the outer circumference, consequently causing the liquor or water to be dashed or sprayed all over the brushwood. Such an arrangement is at work on the 15 feet and 20 feet diameter scrubbers at the Saltley works, and, beyond daily regulation of the water flow, require very little attention.

Three distributors are fixed in each of the appliances referred to. The liquor overflows at the bottom of the scrubbers through the ordinary seal-pot arrangement. If liquor is employed, care should be taken to have the overhead liquor tanks perfectly air-tight, to prevent loss of ammonia through evaporation and agitation. The temperatures should be controlled and maintained as near as possible at 60° Fahr. Where deep well water is available, it is an advantage to use this in the summer months, as its temperature will, in all probability, be found to be lower than that of the town supply (this has been my experience). At the Saltley works, well water is employed in the summer on the finishing scrubber, and town water in the winter months. Well water would be used all the year round for economical reasons. But trouble has been experienced with incrustation or precipitation owing to the softening action of the ammonia; hence the reason for not employing it for longer periods. There is, however, a decided advantage in using it in summer, on account of its greater power for absorbing ammonia, due to its low temperature.

Rotary Washer-Scrubbers.

A very simple and efficient mechanical washer-scrubber was that known as the Anderson scrubber, which consisted of a vertical tower, divided into separate compartments, in each of which a drum of whalebone fibre was fitted and revolved by suitable gearing. The drums exactly fitted the spaces allotted to them, and, when revolved, dipped into the liquor contained in the several compartments of the scrubbers, while the gas passed through the wetted fibres and escaped from a lower to a higher compartment through an uptake fitted to the side plates, where it met another brush which revolved in the opposite direction to the one in the compartment below. This scrubber was fitted with a washer at the base. It was a very simple arrangement, and was improved upon by a Mr. Creeke, of Messrs. Henry Balfour and Co., of Leven, Fife.

Creeke's Annular Brush Scrubber.

When first put on the market Creeke's brush scrubber consisted of two or more steel cylinders with closed ends, placed horizontally and arranged one above the other. Each was provided with a gas-inlet port at the centre and one end, while, at a lower level, and on either side of the inlet, were provided two outlet ports. These outlets in the lower cylinder communicated, by means of suitable connecting pipes, with the inlet of the cylinder immediately above. In each of the cylinders a compound or annular brush was fitted, formed with a cast-iron ring at either end and secured to a central shaft carried on suitable bearings at the end. The rings had two ledges—one at the outer circumference, the other at a suitable distance towards the centre—to which wooden staves were secured, and which, in turn, carried the fibrous scrubbing material; thus forming two cylindrical brushes, one inside the other. The annular space between the brushes was in direct communication with the inlet port at the end of the containing cylinder. The other end of the annular space was left open; but both ends of the drum on which the inner brush was fixed were closed gas-tight.

The apparatus operated as follows: From the inlet, the gas

passed along through the inner annular space, escaping at the end, whence it returned along the surface of the outer brush, through the annular space, and down to the outlet-ports, and so was conducted to the inlet of the brush immediately above it, where it passed along the annular space, and so on over the outer brush to the outlets, as before, until finally leaving the scrubber at the main outlet. Each cylinder was filled with liquor up to the level of the inlet-mouths of the inner brushes, which acted as overflows, allowing it to run in rotation from the top to the bottom brush. The brushes revolved in the liquor, and were constantly presenting wetted surfaces to the gas. The foul gas entered the bottom of the first cylinder, was met with the strongest liquor and brought in contact with clean water at the top cylinder. In the early type described, the brushes were revolved by means of Ley's patent chain gearing; and the lower brush made two revolutions to each revolution of the upper brushes. Since its early days, this scrubber has been considerably modified; and in those made to-day, the gas passes up a casing at one end of the vessel, instead of through pipes leading from the outlet-ports previously referred to, and bevel-gearing has taken the place of the chain-drive. I have entered into a rather full description of this apparatus, since it is really a modern adaptation of the first rotary washer-scrubber as introduced by Mr. George Anderson, and which is still capable of doing good work.

The following shows the results of several tests on a brush-scrubber of this description, dealing with 800,000 cubic feet of gas per 24 hours, from which it will be seen that strong liquor can be produced and the gas entirely freed from ammonia.

Gallons of Water per Ton of Coal Carbonized.

Division.	12 Galls. Oz.	11 Galls. Oz.	10 Galls. Oz.	
In washer.	13·8	16·0	18·0	Percentage efficiency for ammonia, sulphuretted hydrogen, and carbon dioxide not tested; but clean tests with litmus and turmeric papers were obtained.
1st brush	11·8	14·0	15·2	
2nd ,,	4·3	5·4	7·4	
3rd ,,	1·1	2·2	3·0	
4th ,,	·3	·4	·8	
5th ,,	—	—	·1	

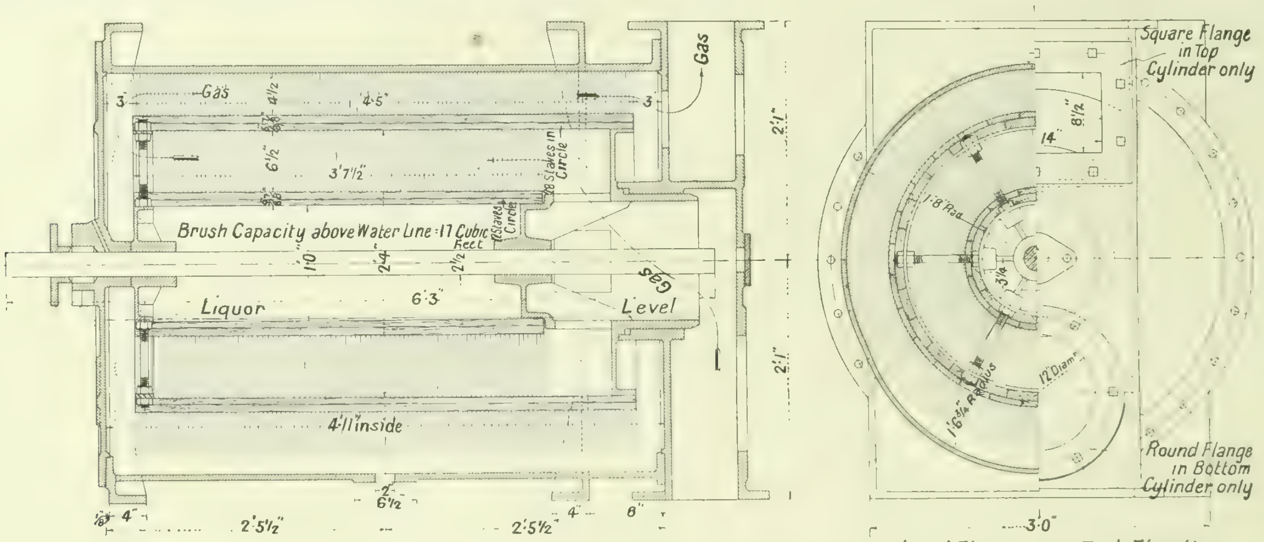
Fig. 4 shows one complete cylinder, from which it will be noticed that additional cylinders may be easily added when required.

LAYCOCK AND CLAPHAM'S "ECLIPSE" WASHER-SCRUBBER.

This washer-scrubber is of the horizontal rotary type; the previous mechanical washer-scrubbers described being vertical. The "Eclipse" washer-scrubber is made by Messrs. Clapham Bros., of Keighley, and consists of a cast-iron vessel with semi-circular top, built up in segments; the bottom portion of the vessel being divided into internal chambers by cast-iron plates, in which cylinders keyed to a steel shaft running from end to end of the apparatus revolve. The shaft is carried on bearings fixed on each end plate, and by other bearings fixed to the division-plates forming the chambers. The outer edges of the cylinders are faced and run against similar facings inside the case, which prevents slip of gas from one chamber to another, and compels the gas to pass through the cylinders, which are filled with wood balls about $1\frac{1}{4}$ to 2 inches diameter (depending upon the capacity of the machine), bored with a $\frac{1}{2}$-inch hole in the centre.

These balls are continually wetted with liquor, which is picked up from the bottom part of the washer by perforated buckets fixed to the peripheries of the revolving chambers in one make of washer, while in another type the liquor passes through openings in the side plate of the revolving drums, thus ensuring a constant wetted washing area being presented to the gas. The weak part about washers of this description is the liability of slip of gas taking place; and the makers of the "Eclipse" got over this difficulty by fitting a tail-pin to keep the facings of the revolving cylinders in contact with the case. The washer may be driven in any ordinary way—belt driven or direct driven—but in machines of recent make worm-gearing enclosed in a cast-iron box is fitted, being direct driven by a specially designed small engine, mounted on the same bedplate. I am informed that an "Eclipse" machine has been in constant work since the year 1891, and has not cost a penny for repairs, which speaks well for the quality of material and workmanship employed.

I might mention at this point, and to save repetition, that it is usual in the rotary types of washer-scrubbers to supply them with clean water at the gas-outlet end, which, after entering the washer, overflows from chamber to chamber, gradually getting stronger and stronger, and overflows at the end where the gas enters the apparatus. These washer-scrubbers are also fitted



Sectional Side Elevation Sectional End Elevation End Elevation

Fig. 4.—Creeke's Washer-Scrubber.

with "draw-off" or sludge cocks, and in some cases with hydrometers under glass cases to enable the strength of the overflow liquor to be noted.

HOLMES AND CO.'S "NEW" WASHER-SCRUBBER.

This is another type of horizontal rotary washer-scrubber, and consists of a cylindrical outer case composed of cast-iron plates, divided into separate chambers, as in the "Eclipse" washer-scrubber, by means of vertical cast-iron plates; each chamber containing ammoniacal liquor as before. Inside, a number of $\frac{1}{4}$ inch wrought-iron plates are ranged, fixed alternately between the flanges of the cylinders and to the driving shaft running from end to end of the apparatus. This shaft is supported on brackets carrying bearings outside each end plate, and by another in the centre of the washer-scrubber carried on a cast-iron standard in the older types. But in recent machines an outside bearing is arranged, the washer being made in two halves and connected together with a gas connecting-piece. The advantage of the outside bearings will be obvious. To the iron plates attached to the shaft, and referred to above, circular brushes are fixed, which dip into the liquor in the lower portion of the washer and revolve with the shaft, and constantly supply freshly wetted surfaces to the gas, through which brushwood the gas has to pass before it reaches the outlet. These brushes contain an enormous area of washing surface, and occupy a very small space. The cost of the brushes for renewal is, however, somewhat heavy; but this is of small account with so efficient an apparatus (99 per cent. efficiency). The method adopted in this washer-scrubber to prevent "slip" is to set the brushes to give a $\frac{1}{4}$-inch thrust on each of the division-plates. Between the washing-chambers, in some of the designs of this washer-scrubber, are annular spaces, which the makers say enable the liquid to be worked up to a greater strength. These spaces are known as "still" chambers.

Messrs. Holmes also make a vertical rotary scrubber-washer for works where ground space is a consideration. This is very similar to the Anderson type, and need not take up any more of our time.

WALKER'S PURIFYING MACHINE.

This machine as made by Messrs. C. & W. Walker, Limited, of Donnington, differs entirely from all other ammonia washing plants. It consists of a rectangular cast-iron vessel and in some cases is fitted with a washer of Walker's design in the lower part. This washer has previously been described.

After leaving the washer, the gas enters the "purifying machine" proper, which is built up of six chambers, in which movable wooden boxes, or what the makers term "devices" are attached to vertical shafts, connected to rocking beams at the top of the machine, which are worked by an outside vertical shaft and bevel-gearing, and driven by a small horizonal steam-engine usually fixed at the ground level. The gas travels from one chamber to another between the constantly wetted boards forming the devices, which dip into the liquor at one stroke of the rocking beam, and on the return stroke are pulled up from the same to come into contact with the gas.

Clean water is admitted at the top of the machine, and flows downward from chamber to chamber, finally overflowing as a strong ammoniacal liquor. Such arrangement is adopted when

the machine is employed as a finishing washer or scrubber; but when followed by another washing or scrubbing apparatus, liquor should be used in place of the water. Such is the arrangement at Saltley, where in one section of the works a Walker purifying machine, dealing with 5 million cubic feet per day, precedes a 20 feet diameter tower scrubber, and deals with gas which has previously been treated in a Young washer.

The power required for driving the necessary gearing is small. The machine works very efficiently, and requires little attention beyond the daily running off of any tar which may have been arrested, adjusting the seals, and regulating the water or liquor used.

The whole arrangement of washing devices, gearing, &c., is thoroughly illustrated in fig. 5, and calls for no further remarks

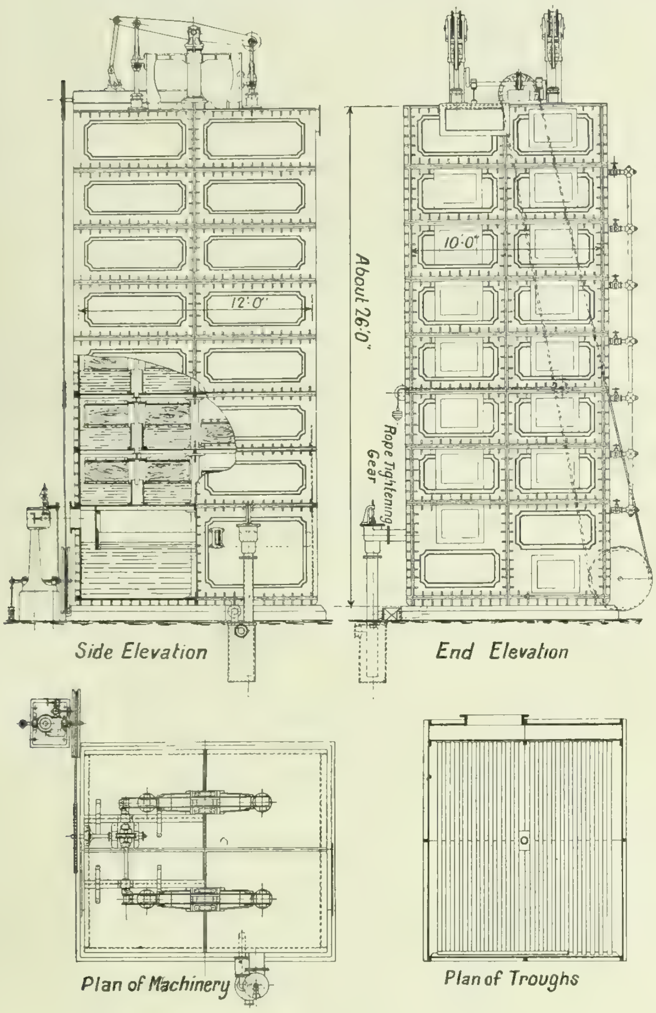


Fig. 5.—C. and W. Walker's Patent Purifying Machine.

here, beyond saying that rope-driving arrangements are shown in this case.

The Whessoe Rotary Washer-Scrubber.

This washer-scrubber consists of a cylindrical outer vessel, divided into separate chambers as described in the other rotary types, fitted with a horizontal shaft carried in suitable end plates and internal bearings; the shaft being fitted with washing devices or bundles built up in segmental clusters of sheet steel (or thin boards if preferred) and the spaces maintained by wooden washers or distance-pieces—the bundles held taut and rigid by bolts securing them to the sheet-iron side plates of the washing drum. In this washer-scrubber, the end plates are made ∩ shaped, and extend the whole length of the pier. This affords great rigidity, and prevents side rock or oscillation, and dispenses with cradles. The provision made for the connections might be specially mentioned. It consists of a cast-iron box bolted to the end plate, through which the driving shaft passes, suitably carried in a stuffing-box. The side, top, and bottom plates of the "universal connection box" referred to are cast with holes, so that the connections may be made in any of these positions; blank flanges being provided for the remaining plates. This is a great convenience and does away with bends, which are liable to become choked with naphthalene. The connections may, however, be arranged without the universal connection box.

A recent Whessoe improvement consists of a central driving arrangement of spur-gearing direct driven; all bearings being in sight, and the washer-scrubber compartments arranged on the twin method—namely, isolated, and connected with gas-way connecting pipes. The advantages claimed for this method of driving are: (1) Reduced cost of shaft—being central driven, is subjected to less tension, and therefore can be of smaller diameter. (2) Central instead of end strain. (3) Liability of breakdown reduced by 50 per cent. (4) Cost of repairs reduced by 50 per cent. (5) One half of the machine available for work while the other half is under repair, if connections are so arranged. (6) Exposed bearings.

Kirkham's "Standard" Washer-Scrubber.

The earlier make of this type of machine consisted of a ∩ shaped cast-iron tank containing several water compartments, in each of which metal discs were caused to revolve. The discs were made up to about sixty in number in each compartment, fitted together in the form of a sheaf. The surfaces of the discs were indented to a depth of an eighth of an inch, in order to present roughened surfaces to the gas and keep the discs apart, or, in other words, to act as distance-pieces. Each sheaf of discs was suspended from a central shaft supported in the usual manner, the lower portion being immersed in the liquor, the remainder of the apparatus being practically as it is known at the present time. After some little time, the metal discs were discarded and wooden bundles substituted; the efficiency of the machine being considerably increased. The chief advantages claimed for the new arrangement were: (1) The driving shaft of the washer-scrubber greatly relieved of weight. (2) Less wear and tear. (3) Smaller driving power required. (4) Washing surfaces kept cleaner and free from deposit.

The improved "Standard" washer-scrubber as manufactured to-day is much in advance of the older machine; many important improvements having recently been introduced. It consists of a cylindrical horizontal vessel divided into compartments by vertical division plates, having circular openings in the centre through which the gas passes from one compartment to another, after being washed or scrubbed by the revolving wooden bundles referred to above. The scrubbing bundles consist of wooden boards $\frac{1}{8}$-inch thick, spaced about $\frac{3}{16}$-inch apart by distance-pieces attached to a light wrought-iron frame; the whole being secured to the shaft by a key driven in a cast-iron collar.

The effectiveness of this washer-scrubber depends to a great extent upon the faced joints between the revolving collars and the division plates. The recent machines are made in two halves, connected by a gas connecting main. All bearings are arranged for easy access; and the washing bundles may be obtained in different patterns to suit all conditions of working. One arrangement, which is recommended, is in the form of corrugated wrought-iron sheets, the corrugations of alternate sheets crossing each other. This arrangement provides the maximum amount of washing surface for "bundle" washers. The gas is very thoroughly split up, it zig-zags between the corrugations, and the water is thoroughly distributed.

Another important improvement is to be found in the driving arrangement; the engine being bolted to the end plate of the washer-scrubber, directly coupled by means of a worm and worm-wheel to the washer shaft. With this method of driving, ground space and cost of engine foundations are saved; also silent running is ensured. I had experience with one of the first washer-scrubbers of this new design which was erected at Bath, where it is used as a finishing scrubber, dealing with 3 million cubic feet of gas per twenty-four hours, after it has passed through three vertical or tower scrubbers. It is worked at the "maximum make" period; the connections being so arranged as to enable the gas to be put through a Cockey washer during the "minimum make" period, and so allow first one and then the other to be let-down for cleaning, which process enables all washers, scrubbers, or washer-scrubbers to be maintained in a thoroughly efficient manner. This is of the utmost importance if every advantage is to be taken in the recovery of ammonia to swell the revenue account by this bye-product. A study of the workings of the various gas undertakings shows a very considerable difference in the returns for ammonia in the form of ammoniacal liquor, concentrated ammoniacal liquor, or sulphate of ammonia—the three principal forms into which the ammonia is converted in gas-works.

Some undertakings only receive $\frac{3}{4}$d. and even less for ammonia products per 1000 cubic feet of gas sold, while others obtain nearly 4d., showing the necessity for some levelling-up. There are, of course, matters which enter into the great difference in the returns shown—such as the amount of ammonia evolved from various kinds of coal carbonized, wages paid for labour in the different districts (which varies considerably), and also the strength to which the liquor is worked up. It should here be stated that the receipts from ammonia products, as well as those for other residuals, in undertakings manufacturing water gas are obviously lower per 1000 cubic feet of gas sold than in those manufacturing coal gas only, and are therefore not comparable; but the figures quoted above apply to works manufacturing coal gas only.

Chandler's Double-Action Rotary Washer-Scrubber.

Another, and recently patented, apparatus is that known as S. B. Chandler's double-action rotary washer-scrubber. This is very similar to other rotary machines. The principal difference is in the washing bundles, which, in this case, consist of several thin iron plates punched all over with small holes; the edges being left in a ragged condition. The plates are bolted together with distance-pieces between them in the usual manner. The holes are punched in the plates on the "hit-and-miss" principle; alternate plates having the perforations in the same position. By this means, the gas is made to pass through the bundles in a more or less zig-zag course, and is brought in contact with a very great area of wetted surface. The idea is a good one; but I am under the impression that such bundles would quickly make-up with naphthalene, and be rather difficult to clear excepting by

excessive steaming. This is to be avoided, since ammonia would be liberated and driven forward.

I have now dealt with all the well-known and tried types of washers, scrubbers, and washer-scrubbers; but this paper would not be complete if reference were not made to new appliances from which much is expected in the future, both as regards first cost and working efficiency.

Centrifugal and Other Types of Washers and Scrubbers.

There yet remain four other washers or scrubbers to which reference must be made—namely, the Feld vertical centrifugal, the Kirkham vertical centrifugal, the Liversedge centrifugal, and Burstall's gas-washer, which will be taken in the order named.

Feld's Centrifugal Washer.

This washer is different in every respect from those previously described, and is the invention of a German chemist—Dr. Feld. It is manufactured by Messrs. R. & J. Dempster, Limited.

The details of the design and arrangement of the apparatus are shown in the drawing,* from which it will be seen that it is of the vertical type, made up of a number of cast-iron chambers or sections of similar construction, cylindrical in form, each fixed one above the other, the number of chambers varying according to the required washing capacity. A central shaft is fitted vertically, working in roller bearings, and supported at the bottom of the washer by suitable cast-iron brackets, driven by bevel wheels keyed to the lower end and to a horizontal driving shaft, as shown, or by fast-and-loose pulleys. In fact, any ordinary arrangement of drive may be employed. The power required for driving is very small—a washer capable of dealing with 1 million cubic feet of gas per 24 hours only requiring a 2-H.P. engine. To the central shaft sets of cones are keyed, each set consisting of six to twelve plates placed one inside the other—one set to each chamber or section. The lower ends of the cones dip into the dish-shaped casting containing the washing fluid-water or ammoniacal liquor. In the latest design, only four cones make up a set; the outer one being slotted and somewhat deeper than the others, by which a better spray is obtained. Four or more openings are arranged in the dish-shaped liquor containers, through which the gas may pass upward from chamber to chamber against the downward flow of excess liquor on its way to the outlet.

When the washer is in action, the central shaft, with the attached sets of cones, driven at the rate of 120 revolutions per minute, causes the liquor to be drawn up on the inside of the cones from the liquor containers, and thrown off at a tangent at the upper edges with great velocity across the gas-ways and against the chamber walls in the form of a thin spray or sheet of liquor; and it is through this that the gas has to pass, and by this it is washed. It will be seen that the gas and water are brought into contact with each other in such a way that very thorough washing is ensured, not merely by bringing the gas in contact with wetted areas as in the horizontal rotary type of washer, but by actually passing the gas through a thin sheet of water or liquor; and this is done without an increase of back-pressure—certainly not more than ½-inch. A baffle or screening plate is fixed in the top of the washer to prevent the spray being carried over; thus allowing the gas to pass away in a dry state.

The advantages claimed for this new washer are set out by the patentee as follows: (1) Most intimate mixture of gas and washing liquid. (2) Highest possible efficiency, owing to exceedingly fine diffusion of washing liquid due to centrifugal force. (3) Throws practically no back-pressure. (4) Lowest volume of washing medium required. (5) Concentrated liquors are obtained. (6) No clogging, even when working with muddy solutions. (7) Simple operation. (8) Small power required to drive. (9) Small space required. (10) Can be constructed of practically any capacity. It is very compact. Therefore its first cost is low compared with other forms of scrubbers.

The dimensions of a washer designed to deal with 7 million cubic feet of gas per twenty-four hours in six chambers are only 26 ft. 1½ in. high by 6 ft. 3 in. diameter. Such a washer is in use at Saltley, and has been running for two years; the cost of repairs being *nil*. The washer is employed for the extraction of cyanogen; but tests have been made to obtain its efficiency for ammonia extraction, which comes out at 99 per cent., making a 6 oz. liquor. No doubt much better results could have been obtained if arrangements had existed for pumping the liquor over and over in the lower divisions, and admitting fresh water to the top or finishing position, or if two washers had been worked in series to produce a stronger liquor. This, however, was not possible. But I think the tests will prove the efficiency of the washer, which no doubt has a great future before it, and may possibly revolutionize the existing methods of gas purification and bye-products recovery. In fact, a plant on the Feld principle has already been put to work at the East Hull Gas-Works for the extraction of sulphuretted hydrogen from coal gas; the active agent employed in the washers being zinc thiosulphate solution, which is made in the first instance by the action of sulphur dioxide on zinc sulphide formed from zinc oxide and sulphuretted hydrogen. Two Feld washers are used in this system, and the reactions which take place are as follows :—

$$2ZnS + 3\,SO_2 = 2ZnS_2\,O_3 + S$$
$$2ZnS_2\,O_3 + 6H_2S = 2ZnS + 6H_2O + 8S.$$

Even further advance is proposed; Dr. Feld being at present engaged in perfecting a process by which ammonia is to be removed from gases and converted into ammonium sulphate simultaneously with the removal of sulphuretted hydrogen. If this is found to be an efficient system, the days of the dry purifier will be short. Ammonia and sulphuretted hydrogen, the only impurities (not including naphthalene) which have to be eliminated (since the disappearance of the sulphur clauses), will then be dealt with in the same plant, the advantages of which will be obvious. These matters have been mentioned to show the possibilities of the Feld washer; but further cannot be said at present as no working results are available.

Kirkham's "Standard" Centrifugal Washer.

This machine is very similar in its action to the Feld washer described above. It consists of a vertical cylindrical cast-iron vessel divided into a number of chambers, fitted with a central vertical shaft to which are attached spraying devices for lifting and spraying the ammoniacal liquor or water used as a washing medium; bringing it into intimate contact with the gas. The

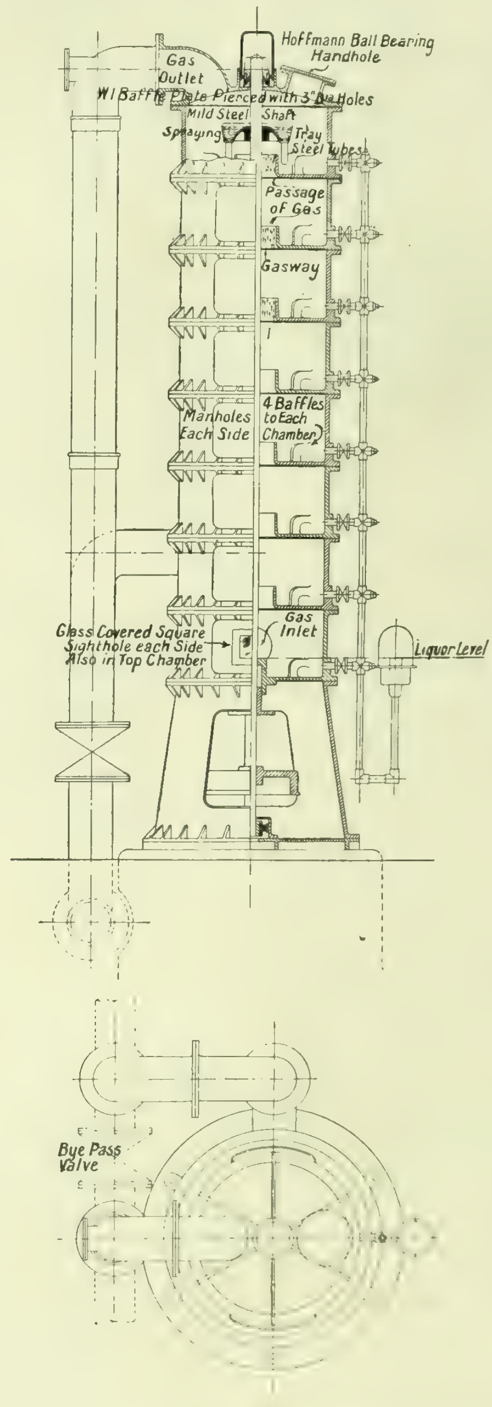


Fig. 6.—Patent "Standard" Centrifugal Washer.

devices consist of specially-designed trays having perforated rims and bent tubes (usually four in number) depending from their undersides. The trays are made in halves to facilitate taking apart for cleaning if found necessary (see fig. 6).

The shaft and trays are revolved at a speed of 100 to 150 revolutions per minute, according to the diameter of the apparatus. As the devices revolve, the liquor is picked up by the bent tubes. carried into the trays and through the perforated rims, across the gas space to the plates forming the shell of the washer, rebounding and falling to the liquor container, from which it overflows finally leaving the apparatus at the bottom chamber. The gas enters at

* This is similar to those given in the "JOURNAL" in 1908—see numbers for July 21, p. 161, and July 28, p. 228.

the base and flows upwards from chamber to chamber through the central openings and through the spray, finally leaving at the top. The liquor is admitted at the top and flows downward through the central openings.

It is a very simple washer, requires little or no attention, the driving power necessary is small, its first cost is low compared with ordinary scrubbers, and a great saving in ground space can be effected by its adoption. A washer designed to deal with 500,000 cubic feet of gas per twenty-four hours, working at the Hitchin Gas-Works, is only 3 feet in diameter by 17 feet high over all.

Burstall's Washer.

This apparatus, which is a recent invention of Professor Burstall, of the Birmingham University, and which I was recently kindly allowed to inspect, is of very simple construction, very compact, and surprisingly small for dealing with any given quantity of gas per hour. The washer is mechanical, and consists of a cylindrical outer case fitted with a horizontal central driving shaft to which perforated plates are attached, and which are revolved at about fifty revolutions per minute. The end plates are fitted with the usual inlet and outlet pipes for gas and liquor. The perforations in alternate plates are arranged at the centre and at the periphery respectively, and about ⅛-inch clearance is allowed between the edges of the plates and the casing of the washer. The seal is secured by the centrifugal action of the revolving plates on the liquor contained in the washer; and slip of gas is rendered impossible. From the inlet the gas is made to pass through the washer in zig-zag fashion, flowing through a central perforation in one plate, then rising to the top portion to pass through another opening in the next plate, to again descend and rise between the plates until the outlet is reached—being brought into contact with wetted surfaces and consequently cooled and washed.

Professor Burstall explains that, when washing ammonia from coal gas, it would be advisable to employ two such washers in series, and utilize them not only for washing but also for condensing purposes. The gas at the outlet of the first washer would probably be reduced to about 80° Fahr., and to 60° Fahr. in the second one. The liquor leaving No. 2 washer would flow into a bosh, from which it would be pumped and circulated through No. 1 washer, and the hot liquor from No. 1 pumped into an atmospheric condenser, from which it would flow to No. 2 washer, until it attained any predetermined strength, when it would be run off to the storage well and a supply of clean water admitted to take its place.

A washer to deal with 30,000 cubic feet of gas per hour would have the following dimensions: 3 ft. 6 in. diameter by 3 ft. 6 in. long, or about 5 feet long including bearings and supporting standards.

Burstall's "Static" Washer (Non-Mechanical).

Professor Burstall has now invented a non-mechanical washer, designed in the first case to cool the gas and recover the tar. With some slight modification, this has been recently installed in a gas-works to recover ammonia. The washer consists of a rectangular steel tank, fitted with a dished bottom and supported upon a light framework, as shown in fig. 7. The gas inlet and outlet connections are arranged in the end plates, and the overflow liquor taken from the deeper end of the washer. The washer is 3 ft. 4 in. deep at one end and 3 ft. 7 in. deep at the other, to which end the tar flows, and from which it is drawn off. Under the top cover plate, and spanning across the washer, a number of $\frac{13}{16}$-inch by $\frac{13}{16}$-inch inverted steel channels are supported by the side plates, as shown in the enlarged cross section. Into the channels wires are cast (the wires are placed into position in the channels before the latter are fixed and molten lead run in) and the channels closed in between the wires, as shown in dotted lines on the drawing. The number of wires in each channel or section number 58 and 59 alternately, and are arranged in the sections so that those in one section come opposite spaces in the next section (see detail). The number of sections in the washer shown, which has been designed to deal with 50,000 cubic feet per hour, is 117.

Around the top of the washer water-supply pipes are fitted, whence several branches are taken and carried internally across the washer. Holes, $\frac{1}{16}$ inch in diameter by $\frac{1}{4}$ inch pitch, are pierced in the cross water-tubes in the positions shown; and as the water is supplied at a fair pressure, jets of water are caused to impinge upon the wires, and form thin sheets, through which the gas is made to pass, and is also brought into contact with the large number of wetted wires (about 6780) contained in the washer. When used for ammonia recovery, the apparatus is divided into a number of separate compartments connected by gas-passages, and the liquor is caused to pass from one to the other, by means of a small pump, becoming stronger in ammonia as it passes through the washer.

I have no figures as to the efficiency of this apparatus; but by the time this paper is read, perhaps Professor Burstall may be able to supply the same. The advantages claimed for this washer are: (1) It has no moving parts. (2) It is very compact. (3) It does not clog with tar.

The illustration shows a washer designed to extract tar; but it will serve to show the general arrangement of the ammonia washer.

Burkheiser's Washing Process.

I would like to draw your attention to a recently patented process which appears to me to have a great future before it. I refer to Burkheiser's process for purifying and washing gases, in which it is intended to (1) absorb sulphuretted hydrogen by means of ferric hydrate; (2) revivify the fouled material and form sulphur dioxide; (3) form ammonium bisulphite from the sulphur dioxide and a solution of ammonium sulphite; (4) form ammonium sulphite by the taking up of ammonia by the solution of ammonium bisulphite; (5) the oxidation of the ammonium sulphite to ammonium sulphate. Further particulars cannot be given here; but a full description of this important process may be found in a recent issue of the "Journal of Gas Lighting," to which I would draw your attention.*

Weekly tests on the outlet of the finishing scrubbers should be taken for the amount of ammonia passing in grains per 100 cubic feet of gas, and the amount calculated as so much 10-oz. liquor lost, to enable comparisons to be made of the working over any extended period. This method is to be preferred to that which simply shows the ammonia which is not eliminated; for this does not take into account the quantity of gas dealt with, and therefore the quantity of ammonia lost for comparative purposes.

The calculation is made as follows:

$$\frac{\text{Make of gas for week}}{100} \times \text{loss of } NH_3 \text{ in grains} = \text{total grains of } NH_3 \text{ lost.}$$

$$\therefore \frac{\text{Total grains of } NH_3 \text{ lost}}{1522 \text{ (grains } NH_3 \text{ in 1 gallon of 10 oz. liquor)}} = \text{quantity of 10-oz. liquor lost in gallons.}$$

The recovery of ammonia and its conversion into ammonium sulphate in the same apparatus appears to me to be the next

* See "Journal" for Oct. 4, 1910 (p. 23).

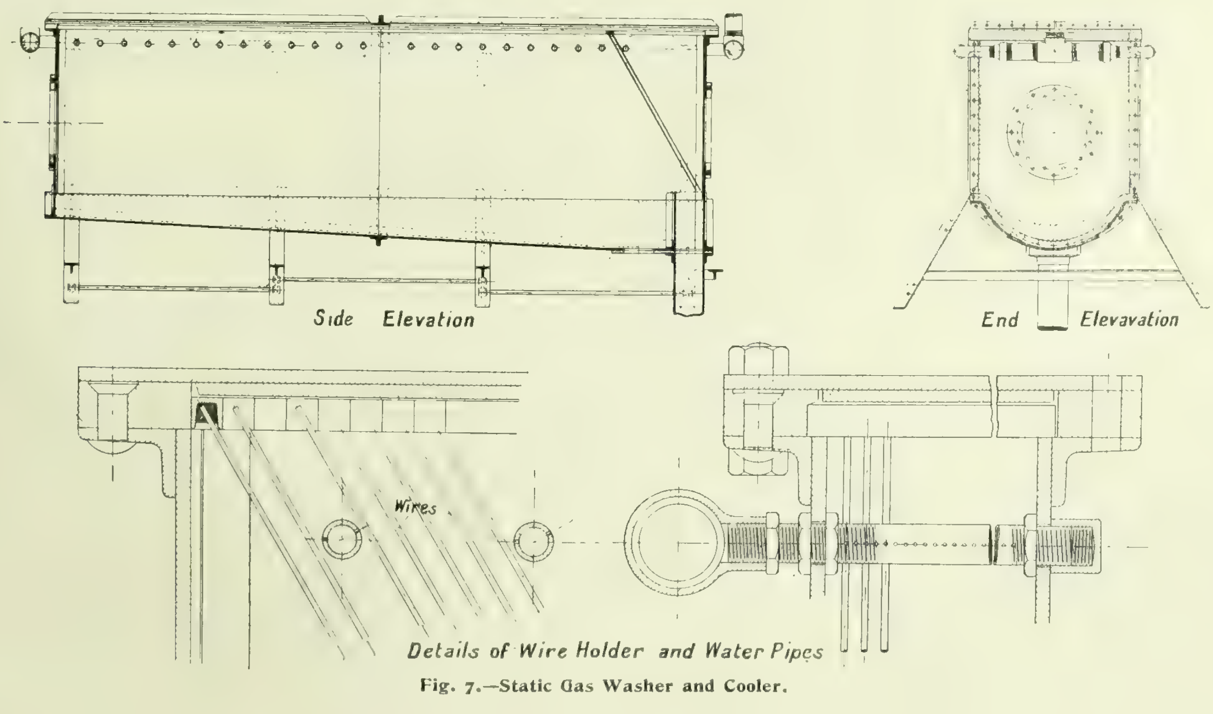


Fig. 7.—Static Gas Washer and Cooler.

advance in gas-works economies, by which a saving of as much as £2 per ton of sulphate made should be obtained, thus—

Fuel	£0	10	0
Manufacturing wages	0	6	0
Stores (manufacture)	0	0	3
Stores (repairs)	0	12	0
Wages (repairs)	0	7	0
	£1	15	3

To this must be added the saving in interest and redemption on the lower capital expenditure on plant; making roughly a saving of £2 per ton of sulphate produced. This is practically a 50 per cent. lower producing cost than is obtained with the most efficient sulphate plants at the present time.

BRICK, CONCRETE, AND STEEL TANKS FOR GASHOLDERS.

By Herbert W. Alrich.

[A Paper presented to the American Gas Institute, October, 1910.]

(*Concluded from p.* 403.)

It is interesting to observe that the investigators have confined their attention to the security of the tank against being overturned bodily. As a matter of fact, this does not concern us at all, and is impossible under operating conditions. The actual task is to build a water-tight tank, and no peril of collapse confronts us. Retaining walls of the usual proportions, resting upon earth, are generally found to lean outward in attaining their maximum stability. With other than very firm soil formations, this leaning must occur if the wall is to develop its maximum resistance. Hence if a tank be assumed to consist of a series of retaining walls, it is evident that the elements could lean outward and be stable, but the tank would not be tight. As long as the tensional resistance in the masonry bond between the elements prevents leaning, there can be no retaining wall action. When this tensional resistance has been overcome, the elements will be stable, but the useful career of the tank has ended.

In providing external assistance for the masonry, the first resort is naturally to the surrounding earth. The particular assistance required is that which will prevent the wall from cracking. The extent to which such assistance may be derived from the backing is obviously dependent upon the character of the formation. All geological formations lie between two extremes of condition—fluid and monolithic. The vertical pressure against a horizontal plane at a given depth below the surface of a column of fluid is equal to the weight of the fluid above that plane. The horizontal pressure against a vertical plane of unit area at the same depth as before is likewise equal to the weight of fluid above. If the position of the vertical plane remains unchanged, the pressure against it will also remain unchanged. This is the condition of passive pressure. If the plane recedes, the fluid will follow; and pressure against the plane will continue. This property of following a yielding resistance is active pressure. If the plane be advanced towards the fluid, the pressure against it will still continue—this being the condition of bearing pressure.

The vertical pressure against a horizontal plane at a given depth below the top of a mass of rock is equal to the weight of the rock above; but because of the relative incompressibility and inelasticity of stone, there is neither active nor passive pressure against a vertical plane. Hence, the only pressure rock can exert against a vertical plane is the bearing pressure developed by advancing the plane against the rock.

The behaviour of all earth formations lies between that of fluids and that of rock. While the behaviour of any particular ground cannot be foretold with much accuracy, it is somewhat consistent with the extent to which the physical condition approaches one limit or the other. If a masonry tank be surrounded by earth in a plastic condition, the internal hydrostatic pressure will be largely balanced by the active external pressure; and the expansion of the tank's diameter will be reduced below that where cracking would occur. If the tank be built in an excavation in rock, the backfill may be so puddled as to transmit the internal hydrostatic pressure directly to the rock. In this case, also, no cracking would be apprehended. If, however, the earth surrounding the tank be somewhat firm in character or consist of damp sand or an elastic clay, it will probably be capable of exerting little passive pressure and no active pressure. With such formations, it will not avail to build up a thrust by compacting the backfill around the tank, as any such pressure in excess of that of which the earth behind the backfill is inherently capable, is artificial and cannot continue to exist.

It is doubtless a fact that active pressure exists in some of these formations before they are disturbed; but during the work of excavating, the equilibrium that had existed in the mass of earth behind the face of the excavation is destroyed by the loss of those components contributed by the earth that has been removed. If the face of the excavation then comes to a condition of repose at a slope inclined but little from the vertical, or requiring little assistance to remain so, the forces that had composed the active pressure have become adjusted to a new condition of equilibrium in which the earth does not tend to push outward and exert a thrust against the tank wall when built.

With such formations, then, the extent to which they can assist the tank is measured by the amount of horizontally applied pressure the earth is able to withstand without compressing enough to permit the tank to expand up to the cracking point. Further, if the tank surrounded by earth incapable of exerting active pressure be other than truly cylindrical when filled with water, the wall will be drawn away from the earth at the ends of the greater diameter, and thereby cracking will be induced at the ends of the lesser diameter.

It thus appears that some formations sufficiently firm to be conveniently excavated are very unsuitable for enclosing a brick tank. The best site for such a tank is doubtless one where the formation consists of either hardpan or stiff clay. The expense of excavating eliminates rock from consideration. While saturated ground is capable of greatly assisting the masonry, the excavation is expensive, and the gelatinous condition of the soil makes probable the transmission of distant shocks.

It commonly occurs that brick tanks are cracked by the driving of piles near by; but the writer has direct knowledge of two having been damaged by the use of explosives in removing an obstruction from a river two blocks away.

It is now material to discover, in exact terms, just what assistance the tank wall shown in fig. 4 (*ante*, p. 402) requires of the earth. The ring tension S at a depth of 30 feet has been computed as 14,450 lbs. If the unit stress in the brickwork be limited to 70 lbs., there will be a factor of safety against cracking (the only form of failure that concerns us) of about 3. The proportion of the internal pressure thus resisted by the masonry P may be deduced from the following equation:

$$P_b = \frac{70}{\frac{S}{12T}} = \frac{840T}{S} = \frac{5{,}880}{14{,}450} = 40{\cdot}7 \text{ per cent.}$$

The increment of increase in the radius of the tank d_1, due to the circumferential stretching of the wall under a unit stress of 70 lbs., is $d_1 = \dfrac{12\,(D+T)\,\frac{U}{E}}{2} = \dfrac{12 \times 192 \times 80}{2E} = \dfrac{80{,}640}{E}$.

As has been stated, investigation has failed to determine any satisfactory value for E—the modulus of elasticity of brickwork. However, it is logical to assume this modulus as not varying materially from that of the cement mortar, which modulus has been found to lie between the limits of 500,000 lbs. and 1,500,000 lbs. If we assume the average of these values, and solve the equation $d_1 = \dfrac{80{,}640}{E}$ there results 0·0806 inch as the amount the brick wall at a depth of 30 feet advances outward in performing its share of the work.

The outward pressure of the water on one square foot of wall at a depth of 30 feet is $30 \times 62{\cdot}5 = 1875$ lbs., of which $100 - 40{\cdot}7$, or 59·3 per cent., must be resisted by the earth. Hence, we may conclude that, in the absence of either active or passive pressures, the tank will be secure against cracking if the earth-backing be capable of developing a resistance of $0{\cdot}593 \times 1875 = 1110$ lbs. per square foot while compressing not more than 5-64th inch. It is difficult to believe that such a condition has been frequently realized. The practice of reinforcing brick tanks by steel bands would indicate that the builders of tanks have not found the earth backing a very dependable assistance.

Of the six masonry tanks approximating 185 feet in diameter observed by the writer, three are reinforced with steel bands. These bands are all ⅝ inch thick and about 5 feet wide. In apparent compliance with Arson's theory, these bands were placed just below the second offset from the top of the wall. It is a fact of much significance that, though these tanks rest on bed rock and are surrounded by very firm ground, one of them has cracked below the band.

In designing these tanks, it was doubtless assumed that there would be imposed upon the band a tension approaching the maximum safe stress on the metal. As a matter of fact, such a result could only be attained by cracking the masonry. Assuming the unit tension in the brickwork to be limited to 70 lbs., and the modulus of elasticity to be 1,000,000 lbs., the maximum stress possible in the steel may be deduced from the relation of the modulus of elasticity of brickwork to that of steel. The accepted value of E for steel is 29,000,000 lbs. Applying these values, the unit tension developed in the steel under the conditions assumed would be $\dfrac{29{,}000{,}000}{1{,}000{,}000} \times 70 = 2030$ lbs. With the brick stressed-up to the breaking point, the unit tension in the steel would be only about 6000 lbs.

With average unit stresses of 2030 lbs. in the steel and 70 lbs. in the brickwork, the band will co-operate with a ring of masonry 7 ft. 1 in. in height in resisting the hydrostatic pressure included between the planes coinciding with the top and bottom of the masonry ring, as shown by fig. 8; the highly-stressed lower courses of brickwork receiving no assistance whatever from the band. The total tension in the ring and band developed by the internal pressure is 400,000 lbs. With a joint efficiency of 80 per cent., the band would be capable of resisting the entire tension while under a unit stress of only 13,500 lbs.

Though we assume any other possible stress for the masonry, and any other probable elastic relation between it and the steel,

or any other vertical position for the band, similar results will follow, and we shall find that whatever tensile resistance can be developed by the combination of brick and steel can be secured from the steel alone. Hence, if the brick tank here discussed were reinforced with steel bands properly proportioned to keep the unit stress in the masonry below 100 lbs., it would require as much metal as a steel tank.

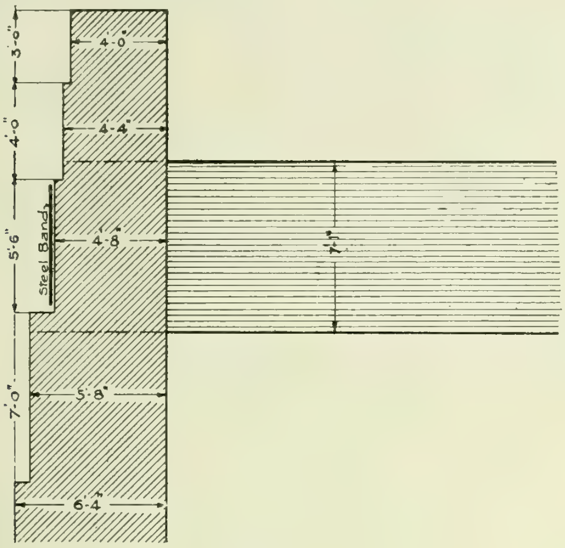


Fig. 8.

An established feature of modern engineering is the preference, in planning large structures, for those designs and types in which the expectation of security is based upon faith rather than hope. This may also be stated by saying that engineers avoid those designs in which the stress conditions resulting from the system of loading governing the design are either materially uncertain or not susceptible of determination. The most frequent occasion in gas engineering for applying this criterion is in the designing of holders. If the criterion should be applied even in moderation to tank design, but few brick tanks would ever be built.

The writer has observed lay formations of such stability that they could not be excavated by ordinary methods. These deposits were being quarried for use in the ceramic arts. If such a formation should be found upon a site selected for a gasholder, a strong and inexpensive tank could be constructed by merely lining a circular excavation with a thin brick wall constructed with suitable piers for supporting the guide-framing. The cost of the tank would be largely defrayed by the sale of the clay. Such were the circumstances at Manchester; the clay having been made into a high-class brick at the site. In view of the facts, it is strange that the designers exerted themselves to devise a fictitious resistance for a wall palpably incapable of taking even a fifth part of the internal pressure.

The writer has knowledge of an engineering work where the test borings disclosed a subsoil of hardpan possessing such stability that the contractors bidding on the work were advised to estimate the excavation as being in rock. If such a formation as this should be encountered in locating a holder, a tank economical and strong could be built as before, by merely lining the excavation and providing piers for supporting the guide-framing.

For a tank to be so constructed, it would be necessary that the formation of clay or hardpan should extend considerably beyond the tank area; and evidently any disturbance of the adjacent ground would be a serious matter.

The idea seems to be prevalent that the first cost of brick tanks is in general less than that of steel tanks. It is the writer's belief that a brick tank can cost less than a steel tank only when the work begins with favourable conditions, and is accompanied by them as it proceeds. If the conditions require much sheet-piling and pumping, the cost of a steel tank is certain to be exceeded.

While plain concrete tanks were built more than thirty years ago, reinforced concrete tanks have only appeared in the last decade. These reinforced tanks represent three different types of construction—

1. Tanks with plain annular walls; the concrete being assumed to participate in the work of resistance.
2. Tanks with relatively thin walls, provided with outstanding piers for supporting the guide-framing; the steel reinforcement being assumed to take all the tension.
3. Tanks similar to No. 2, but with relatively thinner walls belted with hoops of reinforced concrete; the steel being assumed to take all of the tension, as before.

There are two other types for which the writer has seen designs, but has no information as to their having been built. One of these types is designed with a wall similar to the familiar retaining wall with counterforts. In the other type, the wall consisted of a ring of arches in a vertical plane, sprung between buttresses that were assumed to receive the outward thrust of the arches and hold them in together against the hydrostatic pressure. In neither case was the wall as designed capable of offering much resistance to tension. Hence, unless a tank built from either design rested upon solid rock or was surrounded by a very firm earth formation, it would certainly crack; for absence of circumferential tension would require the counterforts or buttresses to be absolutely unyielding. If they were not thus rigid, their outward movement would be necessarily accompanied by an increase in circumference; and any such increase means tension. If the wall were surrounded by a formation of firm clay or hardpan, the backing would probably be capable of withstanding the entire outward pressure with less compression than would cause the concrete to crack; but the buttresses or counterforts would be useless, and would contribute nothing whatever to the strength of the tank.

At the time the two 300-feet tanks at Astoria were being designed, Mr. Bradley and Mr. Bruce made an exhaustive investigation into the question of concrete tank construction. The writer was employed upon the work as draughtsman and computer. There being practically no precedent to consider, various types of construction were devised, then analyzed and compared. The conclusion was finally reached that the concrete tank most easily and quickly constructed, at the least cost, and in service the most reliable, was the type already described as No. 1. The experience accrued during the construction of the two tanks at Astoria and the tank 189 feet in diameter built for the Central Union Gas Company fully justifies the conclusion that this type No. 1 is preferable to any other design of concrete tank.

The disadvantages common to both types Nos. 2 and 3 are too obvious to require much discussion. If all the tension is to be taken by the reinforcement, then evidently the quantity of steel in the hoops and vertical bars will exceed that sufficient for the shell of an ordinary steel tank. To whatever extent reinforcement in place may cost less than the equivalent plate work, the economy is more than offset by the cost of the concrete. The writer believes it has been fully demonstrated that, while the cost of any type of concrete tank must exceed the cost of an equivalent steel tank, the cost of types Nos. 2 and 3 is prohibitive.

The structural objections to types Nos. 2 and 3 are, first, the care required to properly locate the reinforcement and secure it against displacement; and, second, the great difficulty of reducing the concrete to a compact mass when its flow is obstructed by the mesh of the reinforcement. Yet whatever strength such a tank can possess is measured directly by the extent to which both these requirements have been accomplished. The design of a tank of type No. 3, which was built in 1908, called for a circumferential reinforcement of $\frac{5}{8}$ inch bars spaced $2\frac{1}{2}$ inches centre to centre and $\frac{1}{2}$ inch vertical bars spaced $11\frac{1}{2}$ inches apart. It is alleged that the work was executed in accordance with the plans. Hence, unless the builders resorted to a process resembling dentistry, we are expected to believe that the concrete, when tamped, flowed through a space $1\frac{5}{8}$ inches wide by $11\frac{1}{2}$ inches long and became thoroughly compacted around the bars. Fortunately, this tank is surrounded by saturated ground.

Within the last few years the Board of Public Works of New South Wales built four water-tanks differing in design from type No. 2 only in the omission of piers. In 1909, one of these reservoirs totally collapsed. Though designed for a head of 40 feet, it contained at the moment of failure only 32 feet of water. The engineers who investigated the collapse reported the two principal causes of failure as being: First, the concrete had not been thoroughly bedded around the bars, under which condition the tensile resistance of the steel could not be developed; and second, the filling of the tank began "only 98 days after its completion."

The engineers did not state what in their opinion should have been the age of the tank before filling; but it is possibly indicated by a series of tests they had made, in which specimens 98 days of age were compared with others six months old. If a concrete tank requires any such period of seasoning, then the significance of the necessity is best realized by considering the fact that large holders with steel tanks can be erected in six months.

The analysis of stresses for a concrete tank of type No. 1 is substantially the same as that which has been applied to brick tanks. In this case also the secondary stress resulting from ellipticity may be a serious matter. With great care and much supervision during construction, any considerable ellipticity may doubtless be avoided. However, the writer believes that there is sufficient probability of a tank being other than truly circular to justify an assumption that *d* (the increment of ellipticity) has a value of $\frac{1}{2}$ inch per 100 feet of tank diameter.

In the discussion of brick tanks, there was considered the restraint exerted by the foundation upon the lower part of the wall. In a concrete tank of type No. 1, this restraint may be safely assumed to be effective for a distance above the tank bottom equal to 1·75 times the thickness of the wall. Hence, the maximum wall thickness and the depth to the plane of maximum tension are reciprocally dependent. A preliminary computation of the wall thickness may be made, assuming the plane of maximum tension to be 0·8 of the depth below the top of the tank.

Evidently the consequence of this restraint upon the wall is a shearing stress in the plane of attachment to the foundation. The responsibility of resisting this stress should be imposed upon vertical bars imbedded in the foundation and carried up 5 feet into the wall.

The proper unit stresses for concrete gasholder tanks is still an open question. There has as yet been neither sufficient experience nor investigation to justify any very positive conclusions. In a tank of type No. 1, the stress in the steel is dependent upon

the elastic relation of the steel to the concrete. The modulus of elasticity of concrete is an indeterminate quantity. Numberless tests have been made, giving values of from 1,500,000 lbs. to 5,000,000 lbs. The Building Department of New York City assumes the ratio of the modulus of elasticity of concrete to that of steel as being 12; but 15 is the ratio most frequently assumed by engineers when not restricted by ordinances.

The unit stress that may be safely assumed for the concrete is somewhat dependent upon the character of the surrounding earth. For instance, if the tank be located in saturated ground, we may, with considerable accuracy, compute the minimum value of the active pressure that will act inward against the wall. Hence, if the unit tension in the concrete were assumed at 90 lbs., we might expect, with reasonable certainty, that this stress would never be exceeded. If, however, the tank be surrounded by damp sand, it would be hazardous to assume such a stress as 90 lbs., unless the sand be regarded as incapable of either active or passive pressure.

With the earth pressure assumed in designing the Astoria tanks, the maximum tension in the concrete would be 83 lbs.; but from the character of the formation, as disclosed by the excavation, the writer would conclude that it does not exceed 25 lbs.

In the case of tanks of type No. 1 under 175 feet in diameter, the wall thickness will generally be determined by the width at the top necessary to accommodate the base of the guide-framing standards. This thickness, if continued down to the bottom, may sometimes be in excess of that necessary to resist the maximum tension. Hence, it may be suggested as an economy that the wall thickness be reduced and piers added to the outside of the wall for supporting the guide-framing. It can be shown, however, that such a modification may result in increasing the cost of the work. Tanks of type No. 1 are usually constructed by moulding the concrete between two concentric rings, each consisting of segmental forms about 6 feet high. As the work proceeds, these forms are slid upward in vertical guides. It is apparent that outstanding piers will interfere seriously with the continuity and facility of this process, and offset the economy in concrete. Also, from a frequent experience with buttressed retaining walls, we may conclude that the corners formed between the wall and piers favour the development of cracks. The design of type No. 1 is based upon a theory, supported by experience, that it is cheaper to put in more concrete and avoid complicated form-work and tangles of reinforcement.

In proportioning the reinforcement for type No. 1, it is not advisable to exceed 2½ per cent. in any unit-height of the vertical section. If this amount be materially exceeded, the bars will be spaced too closely to permit the best results in placing the concrete; and the additional steel, not being economically employed, will increase the cost very perceptibly.

The concrete in the upper half of the wall will rarely require the assistance of reinforcement in resisting the ring-tension; but one-half of one per cent. of steel in that part of the wall will do much to prevent shrinkage or temperature cracks.

Except in the unusual case of a tank having earth formations radically different in behaviour acting against opposite arcs of its circumference, any computation of the tank's resistance to externally applied pressure is unnecessary. Though we should assume an external fluid pressure from a saturated earth weighing 110 lbs. per cubic foot, the maximum unit compression in the concrete would not exceed 600 lbs.

Only very small tanks of types Nos. 2 and 3 have as yet been built. These tanks have most of their depth above the surface of the ground. As has been stated, these types of construction are expensive. Hence, for economy, it has been the practice to employ the steel at stresses as high as 25,000 lbs. When the stress in the steel reaches 5000 lbs., every vestige of the tensile resistance of the concrete has been destroyed. It is not this fact in itself that concerns us, however, but the attendant condition of the concrete. It has been established by experiment that when concrete is thus strained, there is developed a countless number of cracks which, though invisible, are not less real. In this condition the concrete is not impervious to water; and it has been found that a mere seepage through the wall will eventually become a flow. Furthermore, the alternate freezing and thawing of the water in the cracks results in a gradual splitting of the concrete.

In 1907, the Board of Water Supply of New York City made extensive tests with a reinforced concrete cylinder 11 feet in diameter and 210 feet long. The walls of the cylinder were 8 inches thick, and contained 5 per cent. of reinforcement. The high grade of the concrete was shown by the average ultimate tensile resistance of 330 lbs. developed by specimens seven months old—that being the age of the cylinder when first subjected to pressure. Under a head of 28 feet, the leakage from the cylinder was over 900 gallons per hour. After the interior surface of the concrete had been grouted twice and coated with cement mortar, the leakage was reduced to about 45 gallons per hour under a head of 34 feet. Under this last condition, the steel was under a unit tension of only 1100 lbs. The writer does not know what conclusions were formed from these tests; but he assumes them to be reflected in the practice of the Board of Water Supply, of limiting the unit stress in the reinforcement of water-retaining structures to 8000 lbs.

The existing gasholder tanks and reservoirs conforming substantially to types Nos. 2 and 3 in design have maximum wall thicknesses of 18 inches for No. 2 and 10 inches for No. 3. A considerable increase in this wall thickness would doubtless prevent seepage; but this would lead us in the direction of type No. 1.

Tanks of these types cannot be made tight by waterproofing, for the reason that such coatings, to be effective, must be applied to the inner surface while the wall is under tension. If applied to the outside, it will be useless. Such tanks have been made tight by charging the water in them with cement; but there is no certainty of this process being successful unless all the water in the tank be converted into grout.

In some very important particulars, concrete tanks of any type are less desirable than those of brick. For, while brickwork has been discussed as an uncertain material for resisting tension, concrete is even less dependable when thus employed. The structural principles of concrete and brick-masonry are essentially the same; but the latter represents the systematic assemblage of the elements. This process permits complete inspection as the work proceeds. Brick-masonry does not require the exercise of any peculiar skill, nor that momentary vigilance so necessary in concrete work. Hence good results are more easily secured. Concrete work may turn out unintentionally bad; but it will never be accidentally good.

Brickwork is not liable to the serious cracks that develop so frequently in concrete as a result of the inherent shrinkage stresses. Furthermore, it is a simple matter to repair the wall of a brick tank and obtain the original strength. With concrete, repairing is difficult, and the results doubtful.

In the event of a destructive storm during the building of a masonry tank, any damage sustained by brickwork would be palpable, while impaired concrete might escape observation.

When a more extended use of concrete began (about ten years ago), it was believed that structures built of sand, cement, and broken stone were practically immortal. They were said to become a part of geology. Doubtless the experience accrued in the last ten years has convinced engineers that concrete structures are not more enduring than the other works of man.

In no other field of human industry have science and skill been so extensively and successfully applied as in the production of structural steel. Manufactured from the most important of the metallic elements, the original granular formation is really transformed into an elastic fibrous structure. Structural steel is manufactured in several grades, each differing from the other in physical properties. The desired properties of tenacity and ductility are developed by mechanical processes, and by varying the proportion of certain chemical constituents. The custom of specifying these chemical properties in "hundredths per cent.," indicates the perfection that the art has reached. The certainty and uniformity with which any specified grade or quality of steel may be produced is in marked contrast to the random results from the manufacture of other structural materials.

An ideal stress condition may be described as the condition which is developed in a material of definite and uniform elastic properties by a completely known force. Such ideal conditions are never more nearly attained in practice than when steel is employed to resist fluid pressure.

The usual specification for steel plates for gasholder tanks permits a variation of 10,000 lbs. in the ultimate tensile strength, and requires the elastic limit to be not less than one-half the ultimate. The ultimate strength of tank plates is generally assumed at 60,000 lbs.; and records available to the writer of tests made upon thousands of tons of such material show rare instances where the variation from this figure was 5 per cent. Hence, it may be said that while steel tanks are designed upon an average resistance which varies 10 per cent., masonry tanks are proportioned upon the basis of the poorest material that human frailty may permit to enter the structure. Someone has defined a factor of safety as the "factor of ignorance." In the case of masonry tanks, it would be very properly defined as the "factor of our helplessness;" for we are helpless to either influence or control the tensile resistance of masonry within 100 per cent.

Fig. 9.

The shell of a steel tank, like the wall of a masonry tank, receives material assistance from the bottom, though this fact is not usually considered in designing. Fig. 9 is an exaggerated representation of the elastic deformation of a steel tank. The thickness of the plates at the top of the shell is governed by practical considerations, and is always much more than the stress conditions would require. This excess of metal, assisted by the circular girder, reduces the diametral expansion at the top of the tank to a very small amount. At the bottom of the shell, the diametral expansion is reduced to an almost imperceptible increment by the restraint of the bottom. The amount of this restraint is best realized by conceiving a large tank to be cut into two parts by a vertical diametral plate. Then if the coefficient of the static friction between the bottom and the foundation equals 0·3, the friction would exceed the whole bursting pressure tending to spread the two halves of the tank apart. Or, ignoring the friction and assuming a joint efficiency of 50 per cent. for the bottom seams, the bottom plates would be capable of resisting the entire hydrostatic pressure acting on the lowest 10 feet of the tank shell. The flexibility of the plates will, however, prevent the restraint from being materially effective above the first rim.

The assistance contributed by the bottom of the tank to the lowest rim of side plates is much more effective when the curb angle is placed on the outside of the tank. If, with such a condition, the thickness of the lowest rim be proportioned to a stress computed from the condition of an unrestrained ring under hydrostatic pressure, an analysis of the elastic behaviour of the rim in connection with the curb angle and tank bottom will show that the actual unit stress at the bottom of the rim does not exceed 10 per cent. of that assumed in designing. If the rim approximates 4 feet in height, the unit stress at its upper edge will not exceed 90 per cent. of that assumed in the design. From this it will be seen that, having determined the unit stress permissible in the plates, this stress will be more nearly approached if the thickness of each rim is proportioned to the tension at the centre of the rim. The frequent practice of proportioning the plate thickness to the tension at the bottom of the rim is inaccurate, and results in an unnecessary amount of metal. It is certainly neither rational nor intelligent designing to accept one unit stress as permissible, and then assume fictitious conditions that produce some other stress.

Though gasholder tanks of steel have been in use for more than twenty years, there is still a lingering distrust of their security. Those who entertain this distrust seek to justify it not by the failures but by the lack of them. The idea seems to be that a failure is more or less equivalent to a test to destruction; and hence, if more steel gasholder tanks had collapsed, their behaviour under pressure would be better understood. There is doubtless some logic in this argument; but from the fact that of all the many large steel gasholder tanks that have been constructed during the last twenty odd years there is a record of but one failure, we may safely conclude that a more exact knowledge of the true stresses in the tank shell would result in less metal and rivets than are employed in the practice at present.

In connection with the recent design and construction of two large steel gasholder tanks, tests of prepared riveted specimen joints were made by the builder. The tests indicate:

1. That the strength of a double butt-riveted joint is not less than the total strength of the elements of which it is composed, taken separately.
2. That the ultimate resistance of a tank plate is less than the stress which would be necessary to break down the friction in the joint.
3. That the frictional grip in such joint is so great that, within the limits of working stresses, there is neither shear in the rivets nor bearing stress against the shank.

Fig. 10 is a partial cross-section of the spherical type of tank of which several have recently been built in Europe. With this design, the thickness of the plating is independent of the diameter. The profile of the tank on a radial line is an equilibrium curve known as the hydrostatic chord. The tension at any point in the walls of any vessel having a curved perimeter under fluid pressure in equilibrium is equal to the product of the unit pressure and the radius of curvature. Hence, as the internal pressure is met by the tensional resistance in a meridional plane without developing any serious circumferential tension, it is evident that this design permits the plating to be very thin. To make the nearest approach to ideal stress conditions requires that the shell of this tank shall be uniform, elastic, and unrestrained.

The advocates of this new type of tank are asserting its alleged advantages with an immoderation that may remind us of the enthusiasm with which the suspension bunker was first introduced. The suspension bunker has been in the field now for some twenty years. It has its merits, and is extensively used; but it has absolutely failed to eliminate those standard types of bin construction that were in use before it appeared. If a spherical tank is to eliminate the usual cylindrical form, the design must be

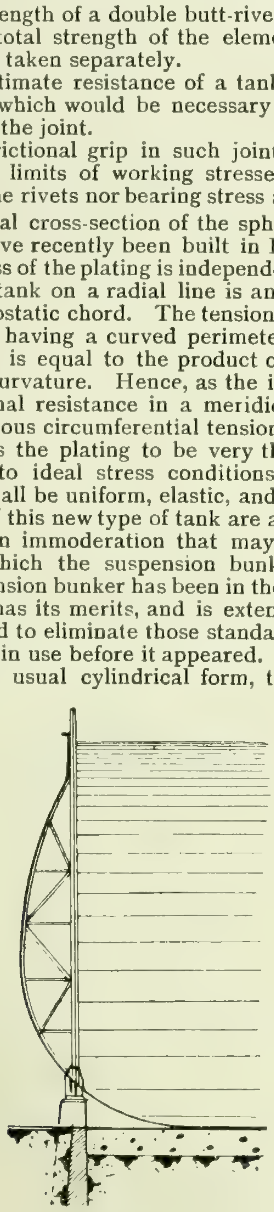


Fig. 10.

demonstrated as possessing more considerable advantages than have yet been shown.

In the "Journal of Gas Lighting" of July 5, 1910, there appeared a discussion of steel gasholder tanks by M. Edouard Bonnet. The paper is an argument for the new type of tank, and consists in comparing the alleged disadvantages of the cylindrical construction with the supposed advantages of the spherical tank. Nothing is stated by the author about the disadvantages of the spherical tank. M. Bonnet begins his condemnation of cylindrical tanks by acknowledging the bottom plates as being necessary to retain the water. In the next sentence, he states that the bottom contains an "amount of metal . . . . which has no really useful place in the construction." If this statement be true, it follows that the shell of the tank is also unnecessary, as likewise its only purpose is to retain the water.

The thickness and behaviour of the tank shell is next discussed by M. Bonnet. He takes a serious view of the difficulty and labour involved in assembling the heavy plates required for the cylindrical tank. The fact that the entire first rim of the 10 million cubic feet holder at Newtown was assembled and riveted in eleven working days without extraordinary effort, would suggest that M. Bonnet is not without prejudice. He then states that, "while the interior pressure increases the diameter of the tank, the bottom of the lower ring of plates, strengthened by the angle iron and held by the bottom plates, cannot take part in the general tension of the circumference, and causes partial strains which are dangerous and lead to bursts." Can M. Bonnet explain why the condition of the lower ring of plates is dangerous when it is "strengthened by the angle iron and held by the bottom plates"? Also, why are "partial strains" more serious than the entire strain?

His next statement is that the circular girder at the top of the tank does nothing. "Its only effect is to insure the circular form of the tank, and it adds nothing to its strength." From this we may assume that a tank is not strengthened by insuring its circular form. It would also greatly enlarge our knowledge if the "certain parts" of a cylindrical tank in which the metal "exerts itself badly" were definitely stated.

A fair comparison of the two types of tank will show that the reduction in plate thickness which the spherical tank permits is its sole advantage. The spherical tank, as constructed, makes no closer approach to the ideal stress conditions upon which the design is based than does the cylindrical tank. A mechanical analysis of the hydrostatic chord assumes the element to be unrestrained at any point between the termini. The spherical tank is not, and cannot be, so constructed. The tank described by M. Bonnet has a number of radial vertical girders attached to the outer shell; there being apparently one girder under each guide-framing standard and two in the space between. The bases of these girders are supported by pedestals outside of the shell resting upon the annular foundation. Each vertical element of the tank coinciding with one of these girders is subjected to considerable restraint; while an element midway between is free except to the extent to which the rigidity of the plating may transmit the restraint of the girders around the circumference. Will some advocate of the spherical tank enlighten us as to the extent to which the ideal stress conditions are disturbed by this restraint, or as to the nature and amount of the stress thus induced? Further, M. Bonnet, referring to the stress induced in a cylindrical tank by the guide-framing, states "such a tank . . . . has thus added to it considerable strains, varying in position and intensity, which it is almost impossible to ascertain." In view of this statement, it is somewhat remarkable that he omits any discussion of the corresponding stresses in a spherical tank.

M. Bonnet discusses tank foundations in utter disregard of the fact that the shell of a cylindrical tank represents a circular girder of great depth and stiffness. The writer has seen a cylindrical tank of large size, the foundation of which has been undermined by adjacent excavation without serious results. A spherical tank is a relatively flabby construction, and is absolutely dependent for its security upon an unyielding foundation. If one arc of the annular foundation were to subside, is the structure of the spherical tank adapted to bridging across the depression? An unequal settlement of cylindrical tanks has occurred with sufficient frequency to demonstrate the inherent strength of its form as a circular girder. The author also states, referring to spherical tanks, "even the bottom only supports the weight of water." What else does he assume the bottom of a cylindrical tank to be carrying? He then says that "calculation has shown that an important depression in this part of the foundations would require only a slight increase in the work done by the plates." The author might observe, in this connection, that calculation has shown that an important depression in this part of the foundation under a cylindrical tank would reduce the work done by the plates in the shell; and actual experience has demonstrated that no harm results. An unmistakable advantage of the cylindrical tank is its security when supported upon an annular foundation. The Consolidated Gas Company of New York have a holder the steel tank of which is 193 ft. 2 in. in diameter and 41 ft. 9 in. deep; the tank being supported by an annular pile foundation. The site was originally under water, and was filled in upon black river mud of a considerable depth. The foundation has now carried the load for twenty-two years without settlement.

All innovations should receive a fair hearing and full consideration; but, on the other hand, the claims of merit should be candidly and honestly presented. The writer does not believe that much can be accomplished for an alleged improvement by subjecting existing practice to unfair and truthless criticism.

Though steel tanks have been built in large numbers, there seems to have been little investigation into the behaviour of the

inner surface of the plating where exposed to the action of the water in the tank. Hence the question has been frequently raised as to what might be the effect of the water upon the inner surface of the shell. During the present year, the writer had opportunity to examine a large steel tank which was built at a time when the manufacture of open-hearth steel plates was in its infancy. The material in this tank has been shown to be of very inferior quality; but notwithstanding this fact, after nearly twenty years exposure to the action of the water, the interior surface of the shell could be described as being in perfect condition.

The Consolidated Gas Company have usually placed their large steel tanks with some part of their depth below the level of the surrounding ground. It has been their practice to protect the shell below the ground level with a thin concrete wall. A recent examination of the tanks so located showed that the concrete remained in absolute contact with the surface of the plates, and that no corrosion had occurred.

Among the distinct advantages of steel tanks, when compared with those of masonry, are:

1. Less cost.
2. Shorter period required for construction.
3. The ease with which the quality of the work may be controlled during construction.
4. The high state of development in fabrication and erection.
5. Greater reliability under stress.
6. Accessibility for inspection.
7. Tank may be placed at any elevation with relation to the ground line that may be desired.
8. No liability to damage by storm during construction.
9. No internal stresses from shrinkage or temperature that are serious.
10. Possibility of rectifying an unequal settlement.
11. No liability to cracking from undetermined causes.
12. The ease of making repairs and obtaining the original strength.

The writer may be charged with entertaining a strong prejudice against masonry tanks. He will admit that he is opposed to any type of tank, 25 to 40 per cent. of the cost of which may go into digging a hole in the ground, instead of putting quality into the structure.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

A Quarterly Meeting of the Eastern District Division of this Association was held on Saturday in the Masonic Hall, Kirkcaldy —Mr. W. Dunlop (Kirkcaldy), the President, in the chair.

The President welcomed the members, of whom more than thirty were present, and introduced Mr. W. Ewing, of Lochgelly, who, he said, though making his first appearance among them, was by no means unknown. As a matter of fact, his personal abilities were recognized far and near.

ADDRESS BY MR. W. EWING.

Mr. William Ewing (Lochgelly) gave what he described as a homely address. After a few preliminary remarks, he proceeded: We meet at times with men whose names are destined to live in the history of the gas profession after death. Their excellent work remains behind them in a material form, in the shape of apparatus, discoveries, Acts of Parliament, &c., to which they have devoted their whole lives and energies for the benefit of the profession. To live in the hearts and thoughts of those left behind is the finest memorial a public benefactor can have. It was my privilege, over three decades ago, to serve the late Mr. William Young during his experiments with tar and other hydrocarbons before and after the erection of the Young and Aitken analyzer. As a young lad, what struck me most about this scientist and experimentalist was the calm, kindly, and magnetic demeanour and wonderful patience and enthusiasm he showed over experiments, which left a lasting impression upon the mind. He was endowed with an active mind, and privately spent large sums on experiments the results of which the gas profession find invaluable to-day.

The late Sir George Livesey will ever be remembered as the greatest personality the gas profession has seen. We are indebted to him for much that made for progress during his wonderful lifetime, and for the successful results that followed in the train of many a hard-fought battle. He was the Napoleon on whom we relied in the hour of need; and he never failed us. When you met him, you were struck by his courtesy and his knowledge of what you were doing. Nothing was too trivial to escape his notice so long as it contained a gas problem.

There is another gentleman to whom I feel greatly indebted (whose experiments with retort-settings I was privileged to see and watch over two decades ago, and learned what to avoid)— Mr. George Anderson, a native of this county. Though now feeble in health, he is happily still with us. His inventions of last century are in use in nearly every gas-works to-day. His career has been a great and useful one to the profession which he adorned before retiring. It is men such as these that give to the young men the necessary impetus to be up and doing, and leave behind them, when departing, "footprints on the sands of time."

When one assumes the management of a gas-works, he either finds the plant requiring much attention, or in good order. I am pleased to say that the Lochgelly Gas-Works, where I succeeded one of your members, was in the latter condition. What first appealed to me was the tidy and fresh appearance of the works and plant, and, secondly, the extraordinary amount of work accomplished in about four years by my predecessor Mr. J. D. Keillor. The first condition reflects the nature of the man in charge, and the second the ability and energy with which he is endowed. When I tell you the make of gas has quadrupled in five years, five miles of main pipe and twenty miles of new services laid, not to mention fully 1000 houses gas-fitted by our own men, including about 1600 stoves and nearly 2000 new consumers, you can form an idea of the amount of energy expended. The whole works were remodelled and enlarged to meet the demand for gas, and the first high-pressure system in Scotland introduced; also a sulphate of ammonia plant added.

This is certainly a record for any young man to be proud of. Mr. Keillor was most fortunate in having a Board of Directors who gave him a free hand. In many places, where a manager is "cribbed, cabined, and confined" by restrictions, &c., opportunities are lost for doing the best work; but this never happens with an enterprising gas company. These are places where one may have to endeavour to put a quart into a pint measure, and make the best of existing circumstances. Ones duty is to make the loss as small as possible, and hope for better and larger plant. An old or small plant is a great source of worry to the gas manager; but remember the sweetest music is played on old fiddles. The best results I ever had were obtained by making the best of old condemned plant, and that nearly two decades ago. The most of these results, if not all, stand as a record, at least so far as Scotland is concerned, even to-day. Gas of 25-candle power was sold at 2s. 1d. per 1000 cubic feet, or 1d. per candle. When the price of coal was about 15s. per ton, no change was made in the price of gas. The sale of coke reached 10 cwt. per ton from cannel coal and shale, which was solely used. The cost of carbonizing ranged from 1s. 6d. to 1s. 9d. per ton. The wages bill was the smallest by a long way of any other gas-works of the same size, and yet the rate of wages was the highest paid in Scotland. Many people asked me how it was done; and my reply was "elbow grease, and every man a full and efficient unit of work." I had a staff and workmen who knew their duty, and did it.

If anyone is doing good work, it will show itself by a reduction in the price of gas or an increased dividend. You sometimes meet a man who claims, after a reconstruction, that he is saving 1s. 6d. per ton in carbonizing wages; and yet his gas is no cheaper. His former costs are compared with his own previous bad working, which might be 3s. 6d. per ton; and the 1s. 6d. of supposed saving is sometimes absorbed in extra interest, sinking fund, &c., on some elaborate and unnecessary plant. Often when the best is made of a plant, and some elbow grease used, the 1s. 6d. is a true gain, *plus* the interest and sinking fund and increased make of gas per ton of coal. Never increase your capital expenditure unless your best working is done at a loss. It has all to be paid out of profits, and saddles you with a further capital for about thirty years.

One thing I should like from one of your members, and that is a good paper dealing with the illuminating power of gas in Scotland, past and present, and its relation to present prices charged per 1000 cubic feet—giving, of course, the present and former prices of coal. It would be most instructive.

At the close of the address,

The President said the members had listened with pleasure to Mr. Ewing's remarks, and he was sure they would agree with him when he said they were indebted to him for the words of advice he had given them. He had put before them many of the difficulties they were likely to meet when they launched out on their own account, and had imbued them with a spirit to overcome the difficulties as they cropped up. Much had been said in the Technical Press and at Association meetings regarding the course of training most suitable for a young man entering the gas profession; but, as Mr. Ewing had pointed out, success did not necessarily follow any particular course. To succeed, there must be the right man in the right place. That a knowledge of the applied sciences and a few years spent in an engineering shop were beneficial to the budding engineer, could not be gainsaid; and in these days of commercialism, the value of a commercial training was becoming more apparent every day. But with all this, much of the course advocated in the address must be pursued. He asked the members to express their indebtedness to Mr. Ewing by according him a hearty vote of thanks.

Mr. Ewing thanked the meeting for the courteous reception they had given him. He was starting life afresh, and like, or rather unlike, the young man, he knew what to do. A young man entering upon life found many snares; and the most successful man was he who did his duty and never faltered—who went on the right course, and went on to success. He would impress upon them that when they came into the managership of gas-works the working unit was the first consideration. His experience was that the man who attained a knowledge of the greatest number of trades—he himself had worked as journeyman at six—found it very easy to specify when he came to the engineering part of a work. Such a man never had extras. He would advise them that their first duty on entering a gas-works was to see nothing for a month or two, and by that time they would have got the details of everything they wanted.

MR. ARTHUR HUTCHINSON ON PURIFIERS.

The PRESIDENT said the next item on their programme was a paper by Mr. Arthur Hutchinson, of Granton, on "Purifiers." He had known Mr. Hutchinson intimately for a number of years, and knew that he was well qualified to deal with the subject he had taken for his paper.

Mr. ARTHUR HUTCHINSON (Granton) read the following paper.

It is a difficult matter to find a subject to put before you which has not been previously given at one or other of the Gas Association meetings; and I hope this paper, which deals with gas-purifiers, with special reference to the luteless type, will be of interest.

WATER-LUTE PURIFIERS.

In the first place, we shall take the old-established and generally recognized water-lute purifier, which, as you know, has ribs cast on the side plates for supporting the old form of wood grid, which was, and still is, generally used in most gas-works throughout the country for gas purification.

These water-lute purifiers are made up of plain cast-iron bottom plates, with flanges bracketed, and faced with special side plates, having the lute made as part of the plate itself or as a separate casting—the former being preferred, both for economy in making and cost of erection. There is also required at each corner of the purifier another special lute-plate, having return corners and internal and external flanges, which are very costly in pattern making, moulding, and machining before they are ready to be put together. Besides, ribs have to be cast on some, and pockets or lugs on others, for receiving the steel T bearers and wood grids. In designing a purifier, care must be taken to see that the depth of the lutes is enough to allow for the greatest pressure likely to come, without blowing water out of them, and allowing gas to escape.

The covers for this kind of purifier are of various forms. In the case of square purifiers, they generally have a slight rise in the centre, with a strong centre-plate and the main bars radiating to each corner, and a truss cup to receive the tie-rods; also a strong forged lifting-eye for connecting to the lifting apparatus. In the case of large covers (say, 30 or 40 feet long), they are usually made curved across the width, and continued along the whole length. This size of cover requires strong curbs and main bars, on account of the large area to be covered and pressure to be resisted. The arrangement of truss cups and tie-rods not being applicable, strong welded lifting-eyes and straps are riveted to the sides and bottom curbs at four different points, which ensures a firm and steady lift.

The holding-down catches used are common to both of these forms of purifier cover. They consist of strong steel bars bolted to the inside of the lute plates with "C. S. K." bolts at reasonable distances, and having a forged eye at the top, and steel lugs riveted to the curb of the covers, with a recess in the centre to allow the forged eye to pass between when the cover is lowered into position previous to the purifier being put into action. A steel cotter, which is secured by a small chain, is then passed through the eye, and projects on either side of the lugs, so that when the pressure comes on the cover cannot possibly move from its position, and is securely held.

This is a general description of the water-lute purifier and its cover, a section of which is shown in fig. 1.

The horizontal wood grid or sieve has been largely replaced by various forms of vertical or hurdle grids, some of which are claimed by the makers to pass three times more gas than flat grids, to be far superior to the others, and to possess the advantage of greatly increasing the quantity of purifying material which it is possible to put into a purifier, and at the same time hold it in suspension in much smaller quantities—thereby enabling the gas to have an easy passage, and yet to eliminate efficiently the the various impurities and to greatly reduce the back-pressure often thrown by purifiers, especially when the material has been in use some considerable time.

All gas engineers and managers, however, do not favour the use of grids for the full depth of their purifiers. For instance, Mr. Herring, at the Granton works, has tried in succession the Jaeger, Cutler, and Spencer forms of wood grids, and has eventually adopted an arrangement which gives every satisfaction. It has short cast-iron grid bearer standards about 12 inches high, instead of these extending to the full height as for the old system of purification, and supporting one tier of steel T bearers. On this tier is carried a layer of wood grids or sieves of the ordinary type used for layers of oxide or lime. On top of these is then placed a much coarser grid, formed of bars $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in. about 3 inches apart, tied together by two wood battens, about 3 in. by $1\frac{1}{4}$ in., with two feet to each. This takes a great deal of the weight which otherwise would come on to the bottom grid. After this, the purifier is filled with oxide to a depth of about 3 ft. 6 in. from the bottom. I might here state that the size of the purifiers at Granton is 45 ft. by 30 ft. and 6 ft. 3 in. deep.

We have found this arrangement to give the most satisfactory working results; and the back-pressure is no more than we had under any of the before-mentioned systems. The back-pressure varies between 14-10ths and 20-10ths. By this arrangement we can empty and refill a purifier which will hold about 156 tons of oxide with twelve men in one day; but when filled with grids, it took sixteen men nearly two days. Our system of discharging is by twin elevators, discharging on to a travelling belt conveyor, which delivers into the boot of an elevator; and the material is taken up to the revivifying floor overhead.

LUTELESS PURIFIERS.

Coming to the luteless purifier, which is shown in fig. 2, when Mr. Henry Green, of Preston, introduced his now well-known type, called "Green's purifier," it was received, as new ideas often are, with a certain amount of doubt and prejudice as to its

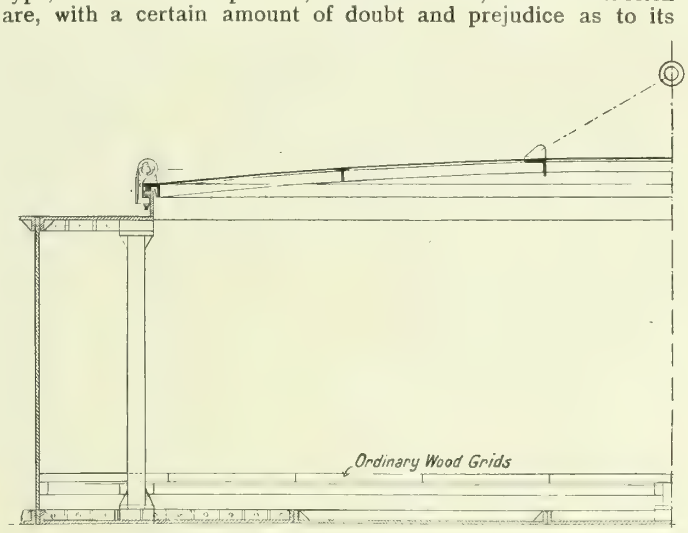


Fig. 2.—Luteless Purifier and Cover.

improvement or advantages over the water-lute type. But as time passed, many gas engineers have overcome their conservatism, and have seen the wisdom of the idea; and these purifiers have been adopted all over the country both for large and small installations. The advantages of this type of purifier are

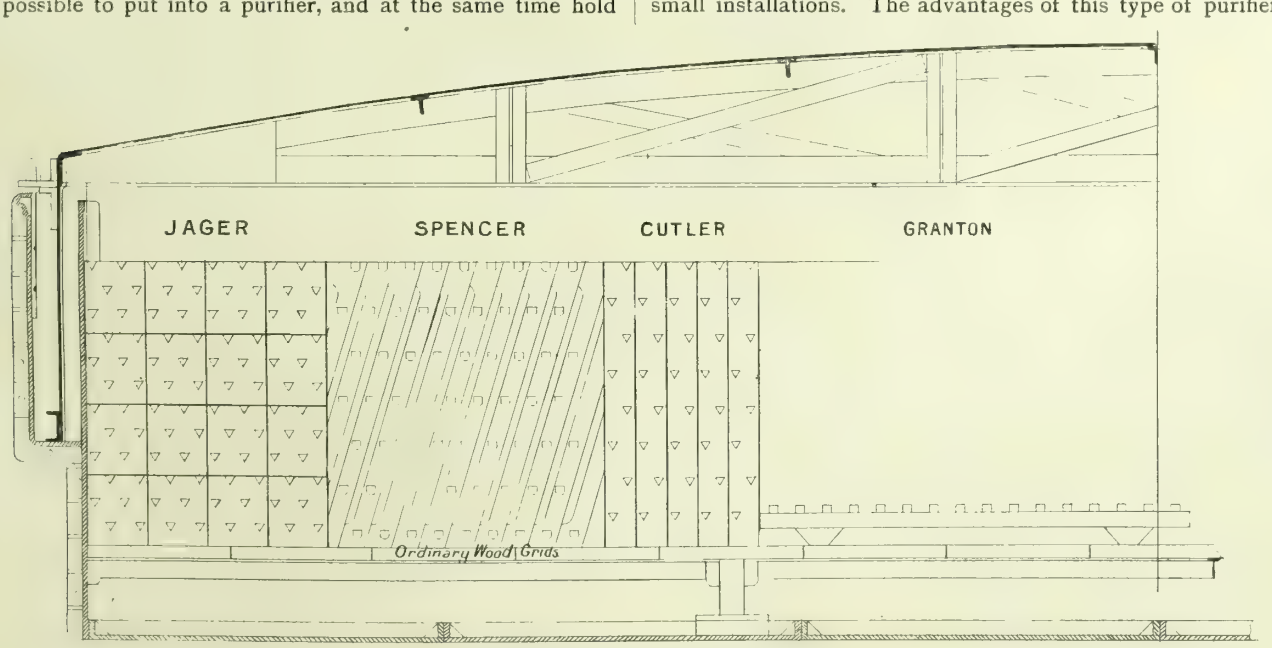


Fig. 1.—Water Lute Purifier and Cover.

that there is no trouble or risk in winter from frozen lutes; while there is a great saving in steam and water connections to the lutes and in the cost of covers. The covers, instead of being of large dimensions, are made much smaller; thereby obviating the necessity of heavy overhead girders and lifting apparatus. In fact, it is in these that the greatest advantage lies, and also in the saving in the height of the cast-iron columns.

These luteless purifiers are constructed of cast-iron bottom plates of the ordinary pattern, about 4 or 5 feet square, with faced and bracketed flanges and side plates, but without the expensive lute plates which are a prominent feature of the water-lute purifier—thereby effecting considerable saving in pattern making, moulding, and general cost to produce. But in this case, as the openings for the covers are not so large, it is necessary to have overhanging cast-iron plates to make up the difference in area. These are of convenient size, and have an upstanding flange which is to receive the covers when in position, either made as part of the plate or separate. A suitable support for these overhanging plates is obtained by a simple arrangement of extending the grid bearer standards immediately underneath them to the full height, and securing them by bolts and nuts to the plates, as shown.

The covers are of the usual construction, designed to resist the internal gas pressure without causing any undue strain on the top sheeting, and with steel angle or other form of curb and main bars. The sheet covering is provided with lugs for four chains, with a centre ring for lifting, or, in the case of small covers, a strong eyebolt only in the centre. The holding-down catches are of different forms—ordinary bolts and nuts, and eyebolts which fit into a slot in the curb of the cover, and when not in use fall down clear. But the best form is an automatic catch which can be so arranged as to release a whole cover, or at least one side of it, by twining a shaft which controls an eccentric movement, and so liberates all the catches at once. There is the "Eclipse" patent fastener, which is the production of Messrs. Clapham Brothers, and also the one known as "Milbourne's patent automatic rapid cover fastener," both of which are excellent ideas, and give every satisfaction in working. The "Eclipse" is fixed to the side of the purifier, the steel shaft running under a cast-iron raised flange; and when the cover is released, the whole of the catches fall clear of the cover towards the cast-iron plates forming the top of the purifier, and leave the cover free to be lifted. The "Milbourne" fastener is just the reverse. The cast-iron brackets holding the discs in position are firmly secured to, and form part of, the purifier cover, so that when the shaft is set in motion the catches are released, and move clear of the raised iron flange; and when the cover is lifted, this and all the fasteners are taken out of the way, so that nothing is left which is likely to impede the movements of those who are in charge.

In making up a specification for this type of purifier, it should be stipulated that each cover is to be provided with a set of approved patent automatic fasteners, with shafting, discs, brackets, and clutches complete, together with the necessary rubber pad, of good pliable quality, properly secured to the under side of the cover by ½-inch bolts of 12 pitch, in addition to being seccotined, or by other approved means. The curbs of all covers must be absolutely level when riveted up and lowered into position. The joints of the top sheets must be arranged to clear the fastener brackets and all holes for fixing; and the fasteners must be accurately put in to template. Rubber pads are preferable to hemp gasket for making joint between cover and purifier.

When this form of purifier was first brought out, one of the difficulties to be contended with was the satisfactory fixing of the rubber used for making the cover gas-tight. Various shapes and makes of rubber have been tried, and, like everything else, time and experience have solved the problem. The joint is now made by means of rubber flat on one side and round or convex on the other; and it is secured to the steel curb of the cover by T-bolts or other form of fastening, as described later.

General Remarks on Purifiers.

In designing purifiers, it is advisable, when possible, for the length and width to be multiples of 5 feet. The flanges of the top plates should be arranged inside, as this leaves the top platform and gangways clear of such obstructions. The side-plate flanges should be external, to avoid having special sieves. It is usual to have external flanges on the bottom plates when erected on a girder floor, and internal ones when erected on brick or concrete foundations. Flanges should be 2½ inches deep clear of the plate, with round bolt-holes 6 inches pitch, having brackets 6 inches apart, spaced equally between the bolt holes.

Small purifiers, up to 12 feet square, may be 4 ft. 6 in. deep; above this, and up to 700 square feet, 6 feet deep; while those above this area should not be less than 5 ft. 6 in. or 6 feet deep. Under modern conditions, only one tier of wood grids is used, supported on short standards about 12 inches high, and the purifier filled with hurdle or other grids as the engineer may decide. But perhaps it would be as well to prepare for (say) four tiers of grids, though only intended for oxide purification, as local conditions may so vary as to necessitate the use of lime or other purifying agent at some future time. Wood grids should be of a length equal to the side plates of the purifier, and not more than 2 feet wide. It is not wise to exceed these sizes, for convenience in handling when filling or emptying a purifier. The bearing-bars should be of T section, of convenient lengths for handling; the span being arranged proportionately to the depth by the introduction of intermediate standards.

Where there are no chemical restrictions enforced, good purification may be obtained by a set of four purifiers; but six make a more satisfactory arrangement. The use of a pair of catch purifiers is in some degree optional. There is, however, not only safety but considerable economy in their use, as the purifying material in the set of four can be more thoroughly worked up and exhausted.

With the luteless form of purifier, there is no need for heavy lifting apparatus. Therefore, pulley-blocks with travelling carriages running on the lower flange of rolled joist-girders, which can easily be supported from the tie-rods or beam of the roof, may be employed. When the purifiers are out in the open, and this is not possible, a light double-jib travelling crane, running on narrow-gauge rails, should be fixed on the top plates forming the centre gangway of the purifiers.

Milbourne's "Rapid" Fastener.

Milbourne's rapid fastener is automatic in its action, and it enables a complete cover to be unfastened on all four sides by one man in less time than he would take to unscrew one on an ordinary cover. As a 10 feet square cover would have twenty catches, the saving in time and labour is most pronounced. The fastener consists of a square steel rod running along each edge of the cover, and connected at the corners by mitre gearing. These rods are mounted on very simple bearings, and by means of eccentric discs actuate the fastener clutches, which are spaced about 3 feet centres. The opening or closing of the cover is effected on all four sides simultaneously by one action of a hand-lever moving through an angle of about 180°.

In order to fasten down a cover, the first portion of the stroke of the lever brings the holding-down clutches into a position immediately underneath the cast-iron flange or fender plate of the opening; and the remainder of the lever stroke imparts an upward vertical motion to the fastener clutch, which firmly grips the curbs of the purifier and cover together—thus compressing the india-rubber pad, and making a perfectly sound and gas-tight joint. By reversing the motion of the lever, the holding-down clutches are released, lowered vertically, and then slightly rotated to such a position that they clear all flanges—thus allowing the cover to be freely raised and travelled away. With this form of fastener the cast-iron flanges of the purifier around the openings are kept quite clear of all bolts or obstructions.

Clapham's "Eclipse" Fastener.

Clapham's patent "Eclipse" rubber joint and rapid automatic fasteners are also operated by a steel shaft, which is octagonal in section, and runs the full length of each side of the cast-iron raised flange or fender-plate round the openings, passing through cast-iron lugs or brackets which form stiffeners to the frame. Each bracket is bored to admit a turned collar, in which is a hexagonal hole for the shaft; and the collars revolve in the brackets. Between each pair of collars is a turned eccentric with hexagonal hole, through which the shaft passes. A swan-head catch is raised or drawn down by the eccentric, the hexagonal shaft passing the full length, raising or drawing down the series of eccentrics and catches at one and the same time—the catches falling back when liberated, to allow the cover to be lifted without hindrance. The catch is adjusted to the position required by means of a bolt which is screwed through it.

In making the cast-iron curb or raised flange separate from the overhanging plates on the top of the purifier, Messrs. Clapham claim that they strengthen the top plates thereby, and reduce the number of joints which come in contact with the rubber; and fixing the holding-down apparatus to the curb reduces the weight of the covers, which is an important item. They also place the strain of fastening on the cast-iron curb instead of on the covers. Their patent also gives them the option of gearing-up with bevel wheels; but they have not used this method, as they do not consider it of sufficient importance, and it also increases the cost. The "Eclipse" rubber joint is both substantial and novel, giving the required elasticity to overcome this difficulty.

Further General Remarks.

In the case of small purifiers, I should prefer to keep to the water-lute, unless some form of automatic fastener could be adopted, as a cover simply held down by ordinary bolts and nuts is anything but satisfactory, and likely to leak unless it is pitched very close. This means a very annoying experience and loss of temper by the manager of small works, who personally has his work cut out to attend the various duties devolving upon him throughout the day, and has not the men or the time at his command which those in charge of larger works have.

There are some works where water-lute purifiers have been converted into luteless ones. This is done by a special casting which fits into the water-lute and runs all round. The rest is quite simple; being only a repetition of previous descriptions. In these conversions, new purifier covers are always required, as the old ones cannot be made use of. Very often, on completion, the water-lutes are filled with concrete flush with the top; and this makes a first-class job.

The "New Century" purifier cover has the advantage that it gives rigidity and protection to the rubber when the covers are removed, and also reduces the waste-gas space in the opening.

Different Forms of Grids.

In addition to the details of purifiers and covers in fig. 1, you will notice that it also shows various forms of wood grids. The

old style of wood grid, with its hardwood frame and bars spaced about ½ inch apart and distance-pieces between, all tightened up with ⅜-inch bolts and nuts, is now used as a support for the latest ideas in grids. The Jäger grid is composed of wood bars triangular in shape, spaced as shown, each grid containing six bars with end-pieces about 12 in. by 10 in. to hold them together in suitable lengths. The Cutler grid is very similar in construction, except that, instead of the grids as a whole being horizontal, they are vertical; the bars being similar to the Jäger, but fitted into upright end-pieces about 5 inches wide and of a depth to suit the purifier the grid is intended to fill. When these grids are fitted into a purifier, they split it up into a number of different sections. The Spencer grid is also upright, but when in position it reposes at a slight angle; and the bars, instead of being triangular in shape, are rounded on the under side. These grids all have a projecting piece top and bottom, which will allow various ways for the gas to pass along. There are other types of grids; and they have been tried at the Granton works by Mr. Herring, but he has replaced them by the arrangement of two grids shown on the diagram, and previously described in detail.

The Milbourne Purifiers.

In addition to the before-mentioned purifiers, there are also Milbourne's patent purifiers, in the design of which external valves can be avoided, and the passage of the gas is controlled by valves embodied in the construction of the vessels. The purifiers are of the luteless type, the gas-tight joint between the cover and the purifier being made with an india-rubber pad similar to that already described. Some of the advantages claimed for these purifiers are as follows: No external centre-valve or slide-valves required; economy in ground space; convenience of addition or extension; and connection reduced one-half; discs controlling the flow of gas worked from the top of the purifier; greater uniformity in connection; number of special pipes reduced by one-half; no connections between valves and purifiers; time in changing purifiers greatly reduced; and inlet pipes protected from falling. The purifying material as well as the main inlet and outlet can enter at any desired position along the length of the purifier—thus saving special bends and pipes.

The Changing of Purifiers.

The great variety of changes that can be made in any set of four purifiers are as follows: All four on in rotation, any purifier first; three on and one off; two consecutive purifiers on, and the other two off; and any single purifier on, and the other three off. The whole set can be bye-passed by the addition of a single slide-valve. The necessary drainage can be provided for in the pipe-lines or at the yard syphons which precede and follow the purifiers.

Purifier Inlets and Outlets.

Special inlet and outlet pipes fitted with valve-discs control the gas passage from and to the trunk mains, and from purifier to purifier. There is a lower inlet-pipe connecting with the inlet mains, and an upper inlet-pipe connecting from the upper outlet of the adjoining purifier. Between these a valve-disc is provided, with a screwed spindle passing through a stuffing-box and gland, fixed on the top plates. This spindle is raised or lowered to close either the upper or the lower inlet as desired. The outlet column is of ordinary construction, but is fitted internally with a lower outlet-pipe connecting to the outlet-main, and an upper outlet-pipe connecting to the upper inlet of an adjoining purifier. Between the upper and lower outlet the gas is controlled by a valve-disc, as described for the inlets.

It will be readily seen, from this arrangement of inlets and outlets, that the gas can be admitted from the inlet-main to any purifier which has the disc raised from the lower inlet, and the upper inlet closed. The gas passes under the inlet hood to the underside of the lower tier of sieves, where it diffuses itself over the entire area of the purifier, then through the purifying material, down the outlet column, and through the lower outlet to the outlet-main, or through the upper outlet to the inlet of the next purifier, according to the position of the valve-disc. It will thus be seen that, by adjusting the discs, the gas can be passed through any number of purifiers; and when it has arrived at the last one, it is passed through the main outlet to the station meter.

When the purifiers are arranged in a line, a return box is cast on the side plates connecting the upper outlet of the fourth or last purifier with the upper inlet of the first of the series. When they are arranged in square formation, this box is not required, as the fourth or last purifier always adjoins box No. 1.

Some Figures as to Cost.

With regard to the cost of the several purifiers, there is not much difference between the small water-lute and luteless kind; the contrast being greater in large installations.

Approximate Costs.

A set of four luteless purifiers, 12 feet square and 5 feet deep, with lifting apparatus, connection, and Clapham's patent fasteners, would come to	£664
A similar set with Milbourne's patent fasteners	660
A similar set in water-lute purifiers	671
A set of four luteless purifiers, 25 feet square and 5 feet deep, fitted with Milbourne's 18-inch valves and connections, lifting apparatus, and Milbourne's patent fastener for covers, would cost	2100
A similar set with Clapham's patent fastener	2170
A similar set in water-lute purifiers	2326
A similar set converted from water-lute to luteless, including new covers	700

In conclusion, the author read an extract from Mr. Fletcher W. Stevenson's "Modern Appliances in Gas Manufacture," with reference to Mr. Henry Green's luteless purifier, a complete installation of which on a large scale is in use at the Grimesthorpe station of the Sheffield Gas Company. It consists of six purifiers, each 70 feet long and 40 feet wide, arranged in two lines. The three in each line are joined together without a break, forming a box 210 feet long; two cast-iron division-plates being inserted to separate one purifier from another. The cost of these purifiers erected complete, including connections, valves, lifting apparatus for the covers, and the columns and girders forming the floor on which the purifiers are carried, was £14,678. The cost of purifiers of equal area with water-lutes and large covers, calculated at the same prices, would be £18,825, or an increased cost of £4147, while the house in which they were placed must have been made larger to permit of water-lutes on all sides.

[The paper was illustrated by diagrams and models; and for the loan of the latter the author expressed his indebtedness to Messrs. C. & W. Walker and Messrs. Clapham Bros.]

Discussion.

Mr. R. W. Cowie (Dalkeith) said it was not often that a paper was illustrated by models in the way the one they had just heard had been; and these had lent very considerable interest to Mr. Hutchinson's communication. They could not have understood the various methods of fastening the covers had it not been for the models and numerous drawings and illustrations. He was struck with the decision of Mr. Herring with regard to the various forms of grids in the purifiers. He (Mr. Cowie) had had no experience of these different grids; but he had seen some of them in other works, and it seemed to him that they would take a great deal of time to clean, whenever the purifiers were being emptied. The arrangement of Mr. Herring, which was found to be better than the patented grids, appeared to be a very simple one. If it overcame the difficulty of back-pressure, its not being patented, and being easily made by any intelligent workman, it might be well to adopt it. A question he would like to ask with regard to Mr. Herring's grid was whether the oxide was harder than in the Jäger grid. It seemed to him it would become hard unless the weight were taken off it. Then the purifiers in Edinburgh were 6 ft. 3 in. deep; and if there were only 3 ft. 6 in. of oxide in them, surely the purifiers were not being worked to full capacity. One thing in favour of Mr. Herring's grid was shown by the time that it took to empty a purifier. Mention was made of steam not being required in order to keep the water-lutes from freezing; but, as a matter of fact, if the purifiers were open to frost and wintry weather, they could not very well get away from the use of steam, because it was almost necessary to keep them at a constant heat of about 60° Fahr.; otherwise the oxide would not work so well, and they would have to change purifiers in the winter, when they could do without this by using steam. He had had some experience with luteless purifiers. He had occasion to put in two purifiers, 8 feet square, the covers of which were flat steel plates with T-iron edges, and the bolts were fitted as described by Mr. Hutchinson. He had no trouble, nor, he believed, had his successor, with the joint giving way. These two small purifiers were laid on a concrete foundation, and the flanges were internal. To have left them as they were would have entailed considerable trouble in clearing out the lime or oxide; and to save this the bottom was filled up with cement and gravel to the depth of the flange, so that the bottom was a thoroughly flat surface.

Mr. R. B. Waddell (Dunfermline) said that Mr. Hutchinson had spoken of a back-pressure of from 14-10ths to 20-10ths. He supposed that back-pressure was thrown by each purifier, and that, therefore, if there were (say) eight purifiers in the works, the total back-pressure due to them would be from 11·2 to 16 inches. In Dunfermline they had adopted Spencer grids. They had four purifiers; three being at work and one off, in rotation. At present they had only one set of Spencer grids at work—viz., in the last box. The back-pressure thrown by the three purifiers in rotation was: No. 1, at the inlet, 55-10ths; No. 2, 57-10ths; No. 3, 48-10ths. In Nos. 1 and 2 there were two layers of oxide, each 14 inches thick, giving 28 inches of oxide in each. In No. 3, where the Spencer grids were the depth of oxide was 3 ft. 6 in., and the back-pressure thrown by that purifier was 6-10ths, compared with 13-10ths by No. 1 and 15-10ths by No. 2. They hoped to still further reduce the back-pressure when all three purifiers were working with Spencer grids.

Mr. W. Ewing (Lochgelly) said he had listened attentively to Mr. Hutchinson's paper, and he could assure members that it was one which a young man could lay aside and refer to at any time. He would find it very useful, more especially if he was about to exercise his mind upon construction. Mr. Hutchinson took them through the whole field of purifiers, from the old to the newer systems, and showed them what was in operation at the present time in the most important, and, to his mind, the finest works in Great Britain—those in Edinburgh. Mr. Herring had introduced a method of purification which could be quite easily followed. There was no patent in it. He himself did the same thing (only he did not use an additional grid) with lime, many years ago, when he first took up duties after he came back from abroad. He put lime into the purifiers, and everybody told him it would never do. He used to fill the boxes with lime. He started with 18 inches on the lower grid, and filled up to the top; and even with Scotch lime he saved much in money and trouble.

The purifiers went three, sometimes four, times as long as they had done previously. Mr. Herring's method should be emulated by everyone. Anybody building purifiers of small size might, with advantage, add another inlet, so that he could put the gas in either at the top or bottom; and if there were a complete set of six purifiers, two catch-boxes would keep them safe. He had designed both kinds of purifiers—the water-lute and the newer system of the Green type—with very successful results. A 30 ft. by 40 ft. purifier went for eight months without cleaning; but he had only two boxes. He wanted six; but, unfortunately, circumstances did not permit of this number, and he made the best of the two. It being an innovation, he put lime in the last box; and he passed gas through up to 300 million cubic feet very successfully. Had he had a complete installation of six purifiers when he started, he believed he could have gone a year or two without opening them. In using oxide of iron, he saved upwards of £900 when compared with the old system of lime purification.

The PRESIDENT remarked that Mr. Hutchinson had brought before them many things worth storing for future use. He had dealt with purification mostly as applied to the oxide method, though those who still kept to the older plan of lime purification would not fail to have benefited by the paper. One thing which struck him during the reading of it was the minute way in which every little detail was gone into. Not only was this the case, but the reason was given for the details of construction. Mr. Hutchinson had discussed in order the different types of purifiers, their advantages and disadvantages, and, what was more important, had gone thoroughly into the cost of each type. Compared with other parts of gas-works plant, the method of purification would seem not to have marched with the times. The ordinary lute purifier had done, and still did, admirably well the work allotted to it; but he thought it was the feeling of all connected with the gas industry that they were in need of improved methods, so far as purification was concerned. The luteless form of purifier seemed to be gaining favour among engineers; and, as Mr. Hutchinson had pointed out, much could be said in its favour. He (the President) had not had any personal experience of the working of this type of purifier; but he could see that it possessed many advantages compared with the older type. One of the drawbacks to the luteless purifier, he understood, had been the way in which the rubber joints were affected by the crude gases, and the loss of elasticity through the pressure exerted on screwing down the cover. These difficulties seemed to have been overcome by a specially prepared rubber. Were he in a position to put down a new set of purifiers, he would give the claims of the luteless form serious consideration, though he would not think of converting a good serviceable set of luted purifiers into the luteless form. He understood that in some of the places where this form was in use a seal-pipe was fixed to the purifier, and was so arranged that excessive back-pressure would blow the seal, and at the same time the escaping gas was led right into the atmosphere—in this way preventing any possibility of explosion. Mr. Hutchinson had demonstrated that not only was the form of the purifier undergoing a change, but also that of the lute inside it; the newer forms having for their object the bringing into closer contact of the gas and purifying material and giving a more equal distribution of the weight. Along with other members who had spoken, he wished to express his thanks to Mr. Hutchinson for his interesting paper, and for the trouble he had taken in procuring the models and preparing the diagrams before them.

Mr. HUTCHINSON, in closing the discussion, said that at Granton the depth of the oxide was 5 ft. 6 in. from the bottom of the purifier; and that the difference in the time taken to empty the purifiers was accounted for by the number of wood grids which had previously to be taken out. It was quite true that there might be some trouble, in the case of small purifiers with rubber joints, in fastening them down; and he knew before Messrs. Clapham's fastening came out, the joints used to come off. He thanked the members for the good reception they had given his paper.

At the close of the business, the members were entertained at tea in the Crown Temperance Hotel—Mr. J. KINCAID, the Gas Engineer and Manager at Kirkcaldy, presiding.

Mr. J. R. MOYES (Edinburgh) proposed a vote of thanks to Mr. Kincaid for the kindness and hospitality he had shown towards the members.

Mr. KINCAID expressed disappointment that he could not get to the meeting till late; but he said he had had the opportunity previously of reading Mr. Ewing's address and Mr. Hutchinson's paper. Mr. Ewing had had a wider experience than most of his colleagues, and therefore his words of counsel were worth listening to. With regard to Mr. Hutchinson's paper, his opinion was that, even though the Association did nothing more this year than receive this contribution, the session would not be unprofitable. The paper would be a reference one both for seniors and juniors.

Mr. Scott's Paper on "The Repair of Gas-Meters."—In the remarks of Mr. M'Ghee on this paper, as given in the "JOURNAL" last week, it should have been stated that unless a rotary meter was passing a minimum of about 70 (not 70,000) cubic feet an hour it was unreliable. In Mr. Scott's reply on the discussion, his statement in regard to the late exhibition was that one 500-light meter (not 500 meters) stood out for a year.

GAS AND ELECTRICITY WORKS AS CROSS-COUNTRY POWER SUPPLIERS.

The October number of "Technik und Wirtschaft"—a magazine issued monthly by the Association of German Engineers, contained an article by Herr Kobbert, the Manager of the Gas-Works at Königsberg, dealing with the economic problems involved in the establishment of central works for cross-country power supplies.

Herr Kobbert first refers to the competition of the last quarter-of-a-century between the gas and electrical industries, and which competition, he says, has been restricted in places where both the gas and electrical undertakings are the property of the municipality by a peaceful apportionment between the two of spheres of activity, and agreement as to prices to consumers. Where, however, the two undertakings have been in different ownership, the competition has been keen and often bitter. The ultimate result of five-and-twenty years' competition has been to give an assured position to electricity for the distribution of power over large areas from central stations; while there is no serious rivalry with gas-works as centres for the distribution of heat. For public and private lighting, however, great competition continues. Herr Kobbert proceeds to argue that the interests of the two industries are not, however, in reality opposed, but that each can advantageously promote the development of the other. The development of electricity supply has, he thinks, resulted in the needs of the larger power consumers being already met; and an attempt is being made to extend the use of electricity to smaller applications. Gas-works, on the other hand, have already nearly exhausted demands in the direction of supplying gas to small users for cooking purposes, and are entering on a campaign for the supply of heat on a larger scale of consumption. Authorities on hygiene have furthered this use of gas by their propaganda against the smoke nuisance. The progressively increasing centralization of household work due to domestic service difficulties is entailing an extension in the supply of heat from central installations; and in this direction there is an almost illimitable field of activity for the gas industry. Economy of fuel and abatement of the smoke nuisance will be incidental advantages gained by the adoption of heating by gas.

Herr Kobbert next refers to the economic conditions which prevail in East Prussia, which obtains its supplies of coal almost exclusively from England through Baltic ports. He advocates the import of English coal as a return cargo for the timber and grain exported from those ports; and points out that if coal rather than coke, tar, pitch, or sulphate of ammonia, is imported, the industry of the country will benefit by the production of these products from the raw coal on the spot. But the coal must be consumed or utilized in such a way that gas, tar, and nitrogen are recovered from it and are not wholly or partially wasted as smoke. At present about 600,000 tons of coal are imported annually through Pillau and Königsberg; and of this, he estimates that about 100,000 tons represents the weight of volatile constituents, such as gas, tar, and nitrogen. The waste gas alone from this quantity of coal, if utilized in gas-engines, &c., would supply 40 to 50 million units of electricity; while the nitrogen would afford, if recovered as ammonia, about 1250 tons of manure for the benefit of the agriculture of the district.

At present, the capital expended on gas-works is only partially utilized, because the maximum day's production is $\frac{1}{220}$-th to $\frac{1}{200}$-th of the annual production. Thus a gas-works which carbonizes 60,000 tons of coal per annum could, without extending its plant, carbonize 100,000 tons of coal if work were uniform throughout the year. If the gas-works were regarded as a large central station for the supply of heat, and gas were produced continuously in large ovens or chambers and water-gas generators, the plant employed would be considerably simplified and less costly, extensive retort-houses would no longer be required, the distinction between gas-works and coke-works would then no longer be marked, and the central generating stations for the cross-country supply of power would become the chief consumers of the gas. In this way, the electricity and gas works would become colleagues rather than rivals. The imported coal employed on gas-works for the supply of central electricity power stations would serve to open up the resources of the interior of the country, and facilitate the industrial employment of peat and timber in districts which are at present more or less inaccessible and undeveloped.

A French patent has been taken out by Dr. Kreidl and Herr Heller for the preparation of pure thorium nitrate for use in incandescent gas lighting. An abstract of the specification in the "Journal of the Society of Chemical Industry" shows that the thorium compound is converted into the salt of an organic derivative of sulphuric acid—for example, ethyl-sulphuric acid—and this salt is purified by fractional crystallization. The differences in solubilities of the ethyl-sulphates of thorium and its impurities are greater than in the case of the sulphates. The pure ethyl-sulphate is converted into hydroxide, and finally into nitrate; and it is stated that a small admixture of the ethyl-sulphate with the nitrate is of advantage, since it gives a bulky oxide on calcination.

WATER SUPPLY TO A LARGE TOWN.

In the Philosophical Hall, Leeds, Mr. Charles G. Henzell, M.Inst.C.E., the Water-Works Engineer to the Corporation of Leeds, last Wednesday delivered his Inaugural Address as President of the Association of Yorkshire Students of the Institution of Civil Engineers. His subject was "The Work of an Engineer with Regard to the Distribution of Water to a Large Town."

After a few prefatory remarks specially addressed to the younger members of his audience, Mr. Henzell said the first great problem which faced the water-works engineer to-day, and one which had been emphasized by the dry season of 1901, was the provision of an ample reserve supply of water for times of accident or drought. This provision was made by means of large storage reservoirs, in which filtered water was reserved, generally under cover, in order that rain and the soot and dust from the town might be prevented from contaminating it. The domestic water supply had, of course, to be of the purest, and should be frequently tested, both bacteriologically and chemically. A fair proportion of carbonates was desirable, as they counteracted the risks of lead poisoning. In Leeds, the proportion of carbonates was barely sufficient; and if it were only a very little less, particular precautions would have to be taken to obviate the chance of lead salts being dissolved in the drinking water of the city.

With a town supplied by gravitation, it was often necessary to pump the water to the higher levels. It was then essential that a reserve supply should be kept in service reservoirs at a considerable height, so that if any accident happened to the pumps the high levels might still be served. The mains of a large town were always divided into sections, with valves so arranged that, in case of fault in any one section, it could be cut off without depriving the consumers on the other sections of their supply.

An efficient department for the detection and prevention of waste was a very great asset in the maintenance of an economical system of distribution. Waste was detected in two ways—the first being by means of a systematic house-to-house inspection by day, and by an organized system of testing at frequent intervals of all mains and services by night. By the former, leakage from consumers' fittings could be detected and located; with the latter, waste from the pipes could be located and immediately repaired. The second method of waste prevention was by the Deacon meter system, which meant that the town was divided up into sections, and at the quietest period of the day the quantity of water passing through each section was measured by a meter. From this amount all the known consumption was deducted; and thus the wastage was obtained. But the same system of house-to-house inspection as in the first method was also necessary. By the adoption of such measures in Leeds, a waste of 3 gallons per head, or 1½ million gallons per day, had been found and remedied.

Yorkshire Junior Gas Association.—We learn from the Hon. Secretary (Mr. Edward Garsed, of Elland) that the next meeting of the Association will take place on Saturday afternoon, in the Chemical Lecture Theatre at the Bradford Technical College, by permission of the Principal. The President (Mr. F. Scholefield, of Dewsbury) will deliver his Inaugural Address, after which a discussion on Mr. Shepherd's address given last January will be opened by Mr. P. Ward, of Frizinghall.

Chemical Industries at the Turin Exhibition.—We learn that a large number of applications have been received for space in the British Industrial Court at the forthcoming Turin Exhibition, and that there is every promise of a thoroughly representative display of the various industries of this country. The Chemical Industries Committee of the British Royal Commission are already considering how the recently organized Chemical Court, which attracted so much attention at the Brussels Exhibition, may be improved. The Committee referred to include Sir Boverton Redwood (Chairman), Dr. G. T. Beilby, F.R.S., Mr. J. F. L. Brunner, M.P., Professor Vivian B. Lewes, F.I.C., F.C.S., Mr. Thomas Tyrer, F.I.C., F.C.S., and Mr. Corbet Woodall, M.Inst.C.E. It only requires the hearty support of manufacturers to make the exhibit thoroughly representative and successful.

International Committee on Screw-Threads.—We learn from the current number of the "Journal des Usines à Gaz" that a fully attended meeting of the Committee, on which Mr. James W. Helps represents the Institution of Gas Engineers, was held in Paris on the 19th and 20th ult., under the presidency of M. Coze. The members received a hearty welcome from M. Marquisan, the President of the Société Technique du Gaz en France, and were entertained by the Society at dinner at the Grand Hotel on the evening of the first day. Mr. W. H. Lindley, of Frankfort, the Vice-President of the Association of German Gas and Water Engineers, and Mr. Helps, expressed the thanks of the foreign delegates for the cordiality of their reception. Next day, the members of the Committee of the Society were invited to take luncheon with their guests of the previous evening. Several toasts were honoured; and after a few remarks from M. Marquisan and M. Coze, the sittings for the present year were brought to a close. A report of the proceedings will shortly be sent to the delegates for submission to their respective societies, with the view of calling another meeting if necessary.

REGISTER OF PATENTS.

Gas-Meters.

Hibberd, C. E., of Victoria Street, S.W.

No. 23,551; Oct. 14, 1909.

This invention, relating to dry gas-meters, has for its object to provide means for rendering the parts of the mechanism readily accessible for purposes of inspection or repair, and for ensuring accuracy.

In dry gas-meters, it has been customary heretofore, the patentee points out, to mount the slide-valve mechanism in the casing above the measuring devices, and the plate bearing them has been fixed to, and formed part of, the meter casing. Under these conditions, the replacing of a valve-seat or any repair in such parts necessitated the unsoldering of the entire valve apparatus. It has been proposed to minimize this disadvantage by mounting the valve-seats upon a detachable base-plate made removable from the rest of the apparatus. But even under these conditions, it is necessary, in order to remove the valve gear and the plate, to uncouple the whole of the crank connecting rods and the slide valve rods from the vane rods, and then, further, to undo the screws connecting the plate to the rest of the meter. It has also been proposed heretofore to provide independent valve-seats, or make them up in one element readily detachable from the valve gallery. But in all such constructions, to remove or replace the valve-seats, it is necessary to disturb other of the operative parts of the meter.

According to the present invention, however, the valve-seats are rendered independently accessible. It is only necessary to remove the one which it is desired to repair or replace, and none of the operative parts are disturbed in such a way as to render readjustment necessary on reassembling. This is attained by mounting the valve-seats upon the plate supporting the valve mechanism so as to be readily detachable therefrom, and disposing the valves and other parts so in relation to the plate that it is at most only necessary, in order to remove the valve-seat from the meter, to slacken the guide-rail or equivalent part for positively guiding the valve (which is preferably provided) or like part, and to disconnect a simple connection. The construction of the measuring chambers forms no part of the present invention; this feature being dealt with in a copending application No. 26,425 of 1909.

Treating Coal Gas for the Removal of Cyanogen.

Williams, P. E., of Leytonstone.

No. 23,624; Oct. 15, 1909.

This invention relates to "treatment for the removal, in soluble form and practically free from iron, of cyanogen from coal or other gas of the kind wherein such gas, also containing ammonia and sulphuretted hydrogen, is, in the presence of water, brought into contact with sulphur."

Hitherto for such purposes, the patentee points out, there has been employed apparatus for treating tar-freed gas comprising a horizontal cylindrical water-containing scrubber having fixed vertical partitions with central openings; free sulphur being delivered as required to the compartments formed by such partitions, and through which there passes a shaft carrying rotary brushes for each compartment. The ammonium sulphocyanide formed is removed from time to time; treated for purposes unconnected with this invention; and as often returned to the scrubber until it is sufficiently concentrated.

The present invention has for object to entirely obviate the necessity for the use of sulphur other than that obtained in the ordinary course of coal-gas purification, as well as to dispense with any apparatus other than is ordinarily employed in gas purification and to obtain the ammonium sulphocyanide in strong solution by a single treatment.

The gas (say, coal gas) is brought, in a suitable vessel, into contact with spent oxide of iron in a moist state, whereby the ammonium sulphocyanide produced is obtained as a strong solution which drains to the bottom of the vessel containing the spent oxide, from which it can be removed and treated for the recovery of the cyanogen. The spent oxide may be formed in the vessel in which it is used, by previously passing through the vessel coal gas free from ammonia but containing sulphuretted hydrogen.

The gas as it leaves the exhauster, and after the removal from it of tar, traverses, preferably in an upward direction, a mass of spent oxide in a moist state; the mass of material being supported within a closed vessel above a perforated plate or grid arranged above the bottom of the vessel which is adapted to form a receptacle for liquid—the gas to be treated being admitted to the lower part of the vessel and the treated gas withdrawn from the top. The ammonium polysulphide formed by the action of the ammonia and sulphuretted hydrogen in the gas upon the free sulphur in the mass forms, with the moisture present in the gas and in the mass of material, a strong solution of ammonium polysulphide, which extracts the cyanogen from the gas so as to form therewith (for the most part) a solution of ammonium sulphocyanide, which drains into the receptacle in the bottom of the vessel, from which it can be withdrawn and treated for the extraction of the cyanogen therefrom, and also, it may be, for the recovery of ammonia and sulphur.

The gas treated as described may then be passed on for treatment in the ordinary washing plant and the purifying boxes containing oxide of iron, in the ordinary way, to remove therefrom the remaining ammonia and sulphuretted hydrogen, or be utilized for the preparation of strong ammoniacal liquor for the recovery of sulphur from spent oxide and like material, as described in patent No. 596 of 1909.

The patentee (who does not illustrate his specification) claims: (1) In the removal, in soluble form and practically free from iron, of cyanogen from coal gas containing ammonia and sulphuretted hydrogen by subjecting the gas to the action of water and sulphur, bringing such gas into contact with spent oxide of iron in a moist condition substantially as described.

(2) In the removal of cyanogen from coal gas according to claim 1 causing the gas under treatment to flow in an upward direction through a moist mass of spent oxide of iron, whereby there is obtained a strong solution of ammonium sulphocyanide.

Manufacture of Incandescence Mantles.

Société Francaise de Chaleur et Lumière, of Levallois-Ferret, France.

No. 5262; March 2, 1910. Date claimed under International Convention, March 5, 1909.

It is a well-known fact, the patentees remark, that "mantles made from artificial silk are more flexible and better sustain shocks and vibrations than mantles made from ramie and cotton; on the other hand, they present the inconvenience that their manufacture is delicate and difficult, that they lose rapidly their illuminating power, and that they withstand badly the operation of coating them with collodion." It is further pointed out that mantles made from ramie and cotton, if indeed, they are less resistant to shocks and vibrations than those made from artificial silk, their manufacture is much simpler, they preserve better their illuminating power, and, since they can be coated with collodion, they are better adapted for transport.

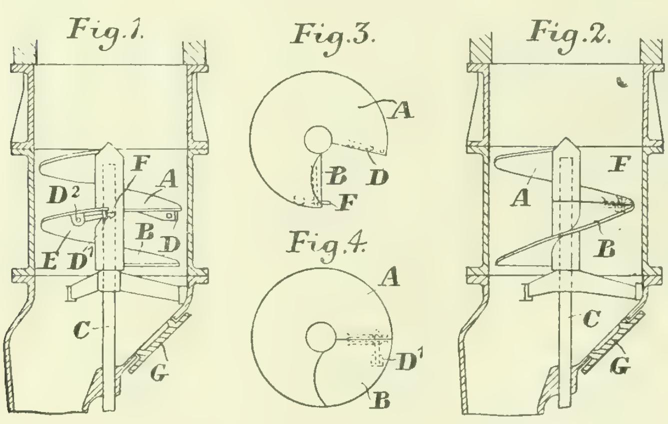
The patentees' proposal is to select artificial silk or analogous material made from cellulose and cotton or ramie as the two fibres for the manufacture of their mantles—a mantle fabric being in this way composed both of ramie and of artificial silk. In this particular case, the artificial silk is said to give the mantles the power to resist shock and vibrations, while the ramie renders them easy of manufacture, adapted to preserve their illuminating power, and to be coated with collodion. These two kinds of thread may be associated, it is pointed out, in various proportions and in various manners. They may be merely associated in the knitting or weaving of the mantle, or may be twisted together or combined to form a single thread in any other manner. The fabrics thus obtained are then impregnated, incinerated, and coated with collodion in the usual way.

Vertical Retort Discharging Apparatus.

West, J., of Southport, and Glover, S., of St. Helens.

No. 6067; March 10, 1910.

This invention relates to the construction of a helix or worm discharging apparatus applied for the purpose of discharging vertical retorts. It has for its object the construction of the worm in two sections; so that one half can be partly rotated on its axis or spindle to such an extent that a free space is made which will permit the inspection of the retort and afford ready access to the retort when it is required to be scurfed or cleared from carbon deposits—the scurfing tools being inserted through the space between the two halves of the worm. When the worm is in action for discharging the retort, the two halves are joined together and held together by a catch, which can be released in a ready manner through an inspection hole provided in the coke chamber.



West and Glover's Vertical Retort Discharging Apparatus.

Fig. 1 shows the worm divided. Fig. 2 shows the two halves of the worm coupled together by the catch. Fig. 3 is a plan of fig. 1, and shows the opening obtained by separating the two sections or halves of the worm. Fig. 4 is a plan of fig. 2.

The worm, as shown, is made in two parts A and B; the former part being free to revolve on the shaft or axis C, while the part B is secured to the shaft. The motion of the shaft, when the two parts are coupled together, causes the worm to revolve as though it was constructed in one piece. D and D^1 are lugs cast on the faces of A and B; and E is the eye-bearing for the pin D^2, which holds the catch F. G is an inspection door in the coke-receiving chamber below the worm discharging apparatus, and through which access is obtained to the worm for the purpose of releasing or fixing the catch when it is required to separate the two halves of the worm, and also to permit the inspection of the retorts and the insertion of the scurfing tools.

Manufacture of Ammonium Carbonate.

Bueb, J., and Deutsche Continental Gas Gesellschaft, of Dessau, Germany.

No. 9177; April 15, 1910.

The process, in accordance with the present invention, consists in causing gaseous ammonia, carbon dioxide, and steam to react together by heating the gases separately at temperatures above that at which ammonium carbonate can be produced; the quantity of steam employed being varied in accordance with the amount of ammonia the required salt is to contain.

The process is carried out as follows: The gaseous ammonia, carbon dioxide, and steam, in about the proportions in which they exist in sublimated ammonium carbonate, are heated separately to a temperature above that at which ammonium carbonate can be produced, and are mixed by being passed through a tube of small bore. The hot gases are led into a sublimating chamber, which is cooled from the outside, and has suspended or supported therein hollow plates or the like, which are cooled internally for the purpose of further increasing the cooling effect. The precipitation and formation of solid ammonium carbonate takes place immediately the gases enter the sublimation chamber, and become cooled to below 60° C., the ammonium carbonate then depositing in thick crusts on the walls and cooling surfaces formed by the hollow plates.

It has been found that the quantity of steam used is inversely proportional to the ammonia contents of the salt obtained. It is accordingly possible, by a corresponding regulation of the steam supply, to vary the ammonia contents of the ammonium carbonate to be prepared. The amount of carbon dioxide in the salt remains practically constant in this case—about 50 per cent.—whereas the amount of ammonia ranges between about 20 and 40 per cent. If, for instance, ammonia and carbon dioxide be subjected to the action of but very little steam, a salt is obtained which contains above 40 per cent of ammonia. By increasing the quantity of steam relatively to the amount of ammonia, it is possible to produce salts containing a proportionately less and less percentage of ammonia, so that an ammonia content of nearly as little as 20 per cent. can be obtained.

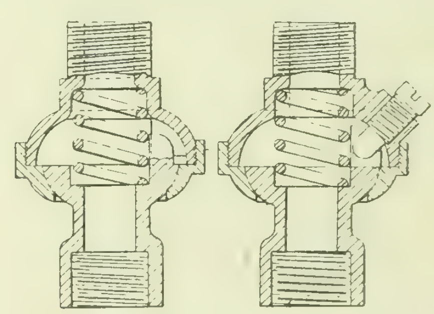
The patentees conclude their specification by stating: Special advantages of an economical nature are secured in the present process by separately isolating from the ammoniacal liquors of gas-works large amounts of ammonia, and the carbon dioxide contained therein; both bodies being thereupon caused to form ammonium carbonate by treatment in accordance with the process of this invention.

Ball-and-Socket Joints.

Falk, Stadelmann, and Co., Limited, from a communication by Andor Barella, of Berlin.

No. 12,848; May 26, 1910.

These ball-and-socket joints have each member of the joint provided with internal projections the two sets of which engage for preventing the axial rotation of one member of the joint relatively to the other member, while at the same time leaving the parts of the joints free to partake of the usual oscillatory movement.



Barella's Cup-and-Ball Joint for Gas-Fittings.

As shown, a single lug or projection (a "tongue") on one member of the joint (say, the ball member) enters between a pair of lugs or projections (a "fork") on the other member of the joint. Ample space is left in the fork, into which the tongue projects, to allow of the oscillatory movement of one member of the joint relatively to the other member, but not to permit of any rotation. The tongue may be integral with the member of the joint to which it is applied, or it may be in the form of a screw which can be fixed in position after the members of the joint have been connected. A sketch of each arrangement is given.

Manufacture of Sulphate of Ammonia from Moist Gases.

Collin, F. J., of Dortmund, Germany.

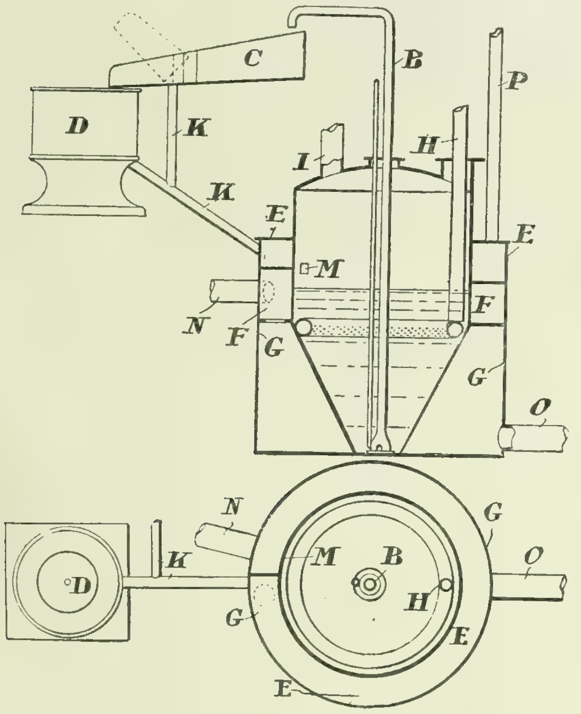
No. 16,193; July 6, 1910.

In the various direct processes for obtaining sulphate of ammonia from hot gases of carbonization by introducing these gases into sulphuric acid, there is (the patentee states in his specification) the drawback that if the temperature of the gases is kept too high the separation of the tar therefrom is made difficult, while at lower temperatures, which favour the separation of tar, there is condensation of water in the acid bath through which the gases pass, which tends to dilute this bath. Efforts have, he says, been made to keep the temperature of the gases as high as possible; and, to prevent the condensation of water in the acid bath, steam coils have been placed therein. It has, however, been found that these arrangements are unsatisfactory, inasmuch as the tar does not separate completely at the higher temperature, and certain of the lighter oils of the tar remain in the gases. These oils are removed from the gases when the latter pass through the acid bath, contaminate the bath, and are rendered less valuable. Furthermore, the heating of the bath by the steam coils is costly and difficult to carry out, because, "so far, no material has been found which will sufficiently resist the action of the hot acid," and the amount of steam used is very considerable.

By the present invention, these disadvantages are said to be avoided by heating the acid bath from the outside, and at the same time heating the mother-liquor which comes from the sulphate of ammonia when it is drained on the drip table and in the centrifugal machine, before it re-enters the saturator, and by concentrating this mother-liquor through the evaporation of part of its water.

The saturator shown is surrounded by an outer shell or jacket G,

forming a space F through which hot gases, hot vapours, or hot air are passed in order to externally heat the saturator, and which gases may be subsequently treated in the saturator. The gases are conducted in such a way that the zone of the saturator in which the separation of the ammonium sulphate takes place is heated first; and the lower portions of the saturator are afterwards heated by the same gases. For this purpose, the space F can be subdivided, horizontally or spirally, as often as may be desired, in order to obtain the greatest amount of heat from the gases. The heating gases enter through the tube N and leave at O. It is not necessary to heat the bottom of the saturator, as the steam of the steam-ejector employed gives sufficient heat for this purpose.



Collin's Sulphate Saturator.

The operation for obtaining sulphate of ammonia from the gases of carbonization is as follows: The gases are first cooled sufficiently to remove the tar as far as desired. They then enter the saturator through the tube H and leave again through the tube I, passing through sulphuric acid, or a solution of acid, on their way, and leaving behind the ammonia they contain in the form of sulphate at the bottom of the saturator, which is removed by the steam-ejector B on to the drip table C. The mother-liquor which is removed with the solid salt returns to the saturator through the tube K, together with the mother-liquor which comes from the centrifugal machine D in which the sulphate of ammonia is dried. This mother-liquor then runs into the evaporating trough E, which is heated from below by the hot gases or hot air passing through the space F around the saturator, and some of its water is evaporated—the vapours leaving through the pipe P. The mother-liquor thus concentrated re-enters the saturator through the opening M.

In this way, it is possible to allow the gases of carbonization to enter the acid bath at a comparatively low temperature, because, in the first place, there is very little condensation of the moisture contained in the gases in the acid bath, owing to the external heating, and, secondly, because the mother-liquor returning from the drip table C and the centrifugal machine D to the saturator is concentrated by passing through the trough E over the top of the heating jacket G.

APPLICATIONS FOR LETTERS PATENT.

Application for Restoration of Lapsed Patent.

C. Burnett has made application for the restoration of the patent granted to him for "Improvements in apparatus for cooling, screening, and loading coke," No. 12,508, bearing date June 16, 1905.

25,209.—Thorp, T., F., & H. T., "Anti-vibrating supports." Oct. 31.
25,254.—Ross, E., "Mantles." Oct. 31.
25,312.—Constantinescu, G., "Carburetting air." Oct. 31.
25,332.—Dyer, W. C., and Ritchie, S. S. & H. E., "High-speed internal-combustion turbine." Nov. 1.
25,336.—Macklow-Smith, A., "Gas-calorimeters." Nov. 1.
25,412.—Brook, F. H., "Valves and cocks." Nov. 1.
25,442.—Thompson, R., "Tap." Nov. 2.
25,504.—Soddy, F., "Separation of mesothorium from monazite sand, and for the concentration of mesothorium in crude products obtained from minerals containing thorium." Nov. 3.
25,585.—Chandler, D., "Gas-lamp galleries." Nov. 3.
25,607.—Reid, F. T., "Time mechanism for gas-valves." Nov. 4.
25,716.—Wyld, W., "Distillation of ammoniacal liquor." Nov. 5.
25,739.—Higgins, W., and Kemp, G. H., "Inflammable spirit for use in the manufacture of illuminating gas." Nov. 5.
25,767.—Eaglesham, J., and Campbell, M. D., "Cooling coke, coalite, and like substances." Nov. 5.

Henry Howarth, of Bradshaw, was found on his bed with the end of some piping, which had been attached to the gas-bracket, in his mouth; the gas being turned on. Deceased had been depressed for some time, and was under the care of a doctor. At the inquest, a verdict of "Suicide while temporarily insane" was returned.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Carbonizing Results.

Sir,—The capital paper, on "Carbonizing," read by Mr. Harris last March before the Midland Association, together with the excellent discussion to which it gave rise a week or two ago, makes really most interesting reading, and will provide much food for thought and careful deliberation to those who, in the near future, are contemplating extensions of carbonizing plant.

The yield of gas per ton of coal, as well as the make per mouthpiece, quoted on behalf of this, that, and the other system causes one to wonder when, if ever, finality in these directions will be ultimately reached. When comparing such quoted results, however (in connection with this particular paper and the discussion later), the thought occurred to me that probably these figures were not wholly comparable one with another, though they may be on the broad grounds of quantity produced and illuminating (or calorific) value. What about temperature and pressure when registering the quantity made—more particularly the former? It is generally recognized that makes of gas should be corrected to the standards of 60° Fahr. and 30 inches barometer; and it seems to me that, when stating results obtained, it would enable truer comparison to be made, and the values of the several systems to be better appreciated, were such done and so stated, or were it always understood that it had been done. On most important works' correction of volume on account of these two factors is systematically made; but, unless similar adjustment is effected by those giving their carbonizing results, it appears to me that the figures so quoted are really worthless as a reliable means of comparison.

Margate, Nov. 11, 1910. J. M. Campbell.

Brick and Concrete Gasholder Tanks.

Sir,—I have read Mr. Herbert W. Alrich's paper submitted to the American Gas Institute last month, of which you publish the first portion in this week's "Journal." The paper contains some criticisms of the one I read in November last before the Manchester Association of Students of the Institution of Civil Engineers, on "The Design and Construction of the Large Gasholder Tank at Manchester," which was designed by the Chief Engineer, Mr. J. G. Newbigging, M.Inst.C.E. With your permission, I should like to deal with some of the points Mr. Alrich has raised with reference to this paper, which was one dealing also with "the principles governing the design of gasholder tanks in general"—the one at Manchester having been already designed and simply used as an illustration.

Mr. Alrich first questions the figure of 220 lbs. per square inch (31,680 lbs. per square foot) used for the ultimate resistance to tension of brickwork in 1 : 3 cement mortar, and mentions that Trautwine gives 220 lbs. per square inch as the "average ultimate tensile resistance of brick" alone. My figure of 220 lbs. per square inch for brickwork in cement mortar, 1 : 3, is obtained from Mr. Thomas Newbigging's "Gas Manager's Handbook." Rankine gives 280 to 300 lbs. per square inch for brick alone. Taking this for brick, and 175 lbs. for 1 : 3 cement mortar given by Mr. Alrich, we have about 227 lbs. per square inch as the value for the combination. This averaging is approximately correct, as the cross area of the joints *plus* the area of the bond are nearly equal to the sectional area of the bricks in the wall.

Later, Mr. Alrich says, in reference to my methods of calculating the strength of masonry tanks by dividing the wall into segments: "The summation of the moments of stability of these was assumed as co-operating with the tensional resistance of the ring in resisting the bursting pressure." I assumed nothing of the sort, and cannot believe that such tension exists where a puddle-backing is used behind a porous wall. Further examination will show that circumferential tension in the wall was not mentioned. In fact, the question of tension in the ring due to water pressure is all dependent on the earth backing, and the method of keeping the same tight up to the wall. In the case of the Manchester tank, the puddle was well rammed and watered as it was deposited between the wall and the undisturbed ground, which was good and very firm. The puddle thus provided a tight filling—being put in as the wall rose; so that when the wall was completed, and no water was in the tank, a compression stress was produced in the ring, which would be further augmented by the puddle being kept wet for the whole time. When the water was run in, the effect would be to restore equilibrium; for the water would soak through the brickwork, and the pressure would be met by the puddle and the hard clay behind.

In taking one section of the tank as a dam, the whole structure was assumed to be well knit together. Not that the piers were independently stable, but that some assistance is obtained from the circular form of the structure and its properties as a monolith; the possibility of the failure of one section between the piers being allowed for, because it is the weakest part of the wall and would therefore fail first.

Perhaps Mr. Alrich would point out where my formulæ "ignore the most elementary principles of analytical mechanics, and the laws of Nature as well." Also, in what way they "offend ordinary mechanical instinct." He is certainly the first person to refer to them in this way. A little more investigation on his part would, I think, show him that they are based on the elementary laws of moments, similar to those in use for retaining walls.

With reference to his remarks on my assuming the backing to have the same resistance at all depths. I would ask him to again consult Newbigging's "Handbook," where he will find that the resistance per square foot for clay is 1200 lbs. average, which is the figure that I have taken. In England, the safe load usually allowed on clay for foundation work is $1\frac{1}{2}$ tons or 3360 lbs. per square foot as a maximum. Allowing for this at the greatest depth and nothing at the surface of the ground, we have 1680 lbs. as the average safe resistance to compression per square foot. The figure of 1200 lbs. is, therefore, very much on the right side. Mr. Alrich's reference to shaving off the uppermost

layer of earth, 1 inch thick with a pressure of 100 lbs. per lineal foot, is thus misleading. Further, in this case the earth would be subjected to a purely shearing action on the lower edge of the strip, and not to a simple compression stress as is the case lower down.

Personally, I consider the most severe stresses come on a masonry tank immediately after completion, when the tank is empty and the wet puddle and surrounding ground are pressing hard on the "green" tank wall—tending to burst in one of the sections between the buttresses by breaking the bond of the section at the piers. Reference to my paper will show that I have dealt with this, and have obtained a factor of safety of 7·7 for the Manchester tank.

This tank has just undergone a severe test. It was filled with water eleven months after the completion of the brickwork—taking 68 days to fill. It was then allowed to stand filled a few days after absorption had ceased, and was then emptied. Examination failed to detect any signs of failure, or cracking.

The value of any formula is judged by the way it is borne out in practice. The formulæ submitted in my paper, therefore, cannot be very wide of the mark.

The American tanks mentioned by Mr. Alrich as having diameters of 185 feet and depths of 42 feet, with walls 7 and 8 feet in thickness, show a most extravagant use of material. A tank of this size in England would have a wall no thicker than 3 ft. 10½ in. at the outside, unless the ground were very bad.

Mr. Alrich in his calculations assumes that there is maximum ring-tension at approximately the centre of water-pressure. This may be perfectly true for a tank above ground. But does such tension come into play so long as the earth behind the wall is pressing thereon with a pressure equal to, if not greater than, that of the water on the other side, and thus putting the wall in equilibrium? I contend that it does not.

Lastly, Mr. Alrich considers that he is justified in assuming an ellipticity of ½ inch per 100 feet of tank diameter, and the proceeds to calculate the extra stress caused by this ellipticity. Seeing that this ½-inch is but 0·00041 of the total diameter, or about three times the depth of the inequalities in a well-built brick wall, it is, to say the least of it, cutting things too fine for practical purposes, especially when dealing with brickwork. In common parlance, it seems like "splitting hairs."

There are many more points in his paper with which I should like to deal, but I have already trespassed on your space sufficiently.

FRANK H. ROBINSON, Assoc.M.Inst.C.E.

Manchester, Nov. 11, 1910.

LEGAL INTELLIGENCE.

GAS COMPANIES AND PRIVATE ROADS.

Redhill Gas Company Summoned.

A case of considerable interest to the gas profession, and one in which an important point of law was raised, occupied the attention of the Reigate County Bench on Saturday, when the Redhill Gas Company were summoned at the instance of the Surveyor to the Reigate Rural District Council for "that on the 25th day of July, in the parish of Merstham, the Company, being the undertakers within the meaning of the Gas-Works Clauses' Act, 1847, unlawfully did open and break up a certain street there called Albury Road, without giving such notice as is required by the Statutes in that behalf to the Rural District Council of Reigate, or to their Clerk, Surveyor, or other officer, of the intention of the said Company to open and break up the same, contrary to the provisions of the Gas-Works Clauses Acts and the Statutes of the said Company."

Mr. W. W. MACKENZIE appeared for the District Council; and Mr. A. A. METHUEN represented the Gas Company.

Mr. MACKENZIE briefly explained the powers of the Company with respect to the opening of roads, but pointed out that the Act provided that three clear days' notice should be given to "the persons having the management or control of the streets" in which such work was carried out. As this was not a private lane or street defined by Statute, the Company were bound to give this notice; and section 9 of the Act further stated that plans should be submitted, and that the work should be carried out in accordance with such plans. The penalty for every offence was one not exceeding £5. There was no doubt this was a thoroughfare for public passage within the meaning of the Act.

The CLERK: Is there any question as to whether this road has been dedicated to the public?

Mr. METHUEN: I do not dispute there is a public right of highway over the road; but it is not a highway repairable by the inhabitants. That is the real point. It is a private road.

Mr. MACKENZIE said the portion of the road in dispute was dedicated by the owners to the public six years ago.

Mr. METHUEN: "Dedicated to the public" is a very awkward expression to use. What happened was that the owners dedicated to the public a right of passage over this road. The real point in the case is whether they can require us to give notice in respect of a road which is not repairable by the inhabitants at large.

Mr. MACKENZIE argued that the District Council had "control" over the road because it was an obligation imposed upon them by Statute to prevent an obstruction. Six years ago, the owners agreed to dedicate the road to the public; and the road was made up in accordance with plans submitted to the District Council and under the superintendence of the Council's Surveyor. The Council also took a sewer down the road at the expense of the public. Before 1835, any land laid out as a highway and used by the public instantly became repairable by the inhabitants of the parish, now represented by the District Council. In 1835, it was found from experience that so many highways were laid out in this way, especially in towns, that a great burden was placed upon the ratepayers in repairing new streets. It was then enacted that no highway should be repairable by the parish unless the street was formally made up to the satisfaction of the surveyor and approved by two justices. This Act did not affect the question as to whether or not it was a public highway. It still left the matter where it was—namely, that a public highway was one over which the public had a right to pass.

The CHAIRMAN (Sir J. Colman, Bart.): Do you claim the absolute right of the District Council to control any road or path dedicated to the public?

Mr. MACKENZIE: Yes.

Formal evidence having been given,

Mr. METHUEN, on behalf of the Gas Company, said this was a very important matter. It was not a question merely as to whether they had to give notice in respect of streets which were becoming town streets, but whether they had to give notice in respect of any land over which there might be any right of public highway. It was an enormous question. This was not an urban district, but a rural district; and constantly there were calls to take gas up to a private house where they might have to go under a footpath and lay their pipes. If his friend's contention was right, they would have to give notice, submit plans, and wait for the inspection of the Local Authority in each instance before they could carry out such works. After all, it was not merely a question of convenience. The real point which he would ask the Bench to decide was, Had the Rural District Council any right to require notice or plans in respect of a road not repairable by them? He submitted they had not. This land was not vested in the public. In the case of *Harrison v. Duke of Rutland*, the plaintiff, in order to uphold what he deemed to be the rights of the public, stood upon a path over which there was a right-of-way on the Duke of Rutland's land. Harrison was removed from the highway; and an action for trespass was then brought. The Court of Appeal held that Harrison was a trespasser, because the right to pass over the land was the only right the public had. The duty of the District Council was to protect the public rights; but this did not refer to the road itself. His learned friend could not show a single thing which gave the District Council the right to interfere with the road. They had no property in it.

Mr. METHUEN, in reply to the Clerk, said the owners were the proper persons (if any) to receive this notice; but he did not think it was necessary under the Gas-Works Clauses Act.

Mr. MACKENZIE said it was a startling proposition that, in the case of a public highway not repairable by the public, no notice was necessary.

The BENCH, after a brief consultation, said there must be a conviction, and imposed a fine of £2 and costs. Upon the appeal of Mr. Mackenzie, they awarded the District Council 15 guineas costs.

Mr. METHUEN: Your Worships will state a case?

The CHAIRMAN: Certainly. It is a very important question, and a proper case to take further.

Unsuccessful Claim against Messrs. Gibbons Bros.

At the Wandsworth County Court last Tuesday, before his Honour Judge Harrington and a Jury, George Simmonds, a labourer, sued Messrs. Gibbons Bros., Limited, of Dudley, for £150 compensation, under the Employers' Liability Act, for injury caused when employed by them at the Wandsworth Gas-Works on the 22nd of July. Plaintiff, with two other men, was engaged in unloading a cart full of iron pipes about 4 feet long, and from 6 to 12 inches in diameter, when the first pipe lifted off the cart slipped and struck him on the right knee. He had to go to the Bolingbroke Hospital, and attended there till the 13th of October. He subsequently went to St. George's Hospital. He had not been able to do any work since the accident. Mr. R. Griffiths, a surveyor, said he thought the method of unloading the cart was unsafe. Dr. Bouck, who examined the plaintiff on the 16th of August, said he was suffering from what was practically a sprained knee, and this would prevent him lifting heavy weights. He would, however, be well in three months. For the defence, Dr. Fergus, House Surgeon at the Bolingbroke Hospital, said that when plaintiff came to that institution on the 22nd of July he had some water on the knee, and there was a small abrasion on the right side of the knee. He was an out-patient till Oct. 13, when witness thought he had practically recovered and was fit for work. Dr. W. Cooke, who examined the plaintiff on Oct. 6, said he considered plaintiff would be able to return to work in a fortnight. In cross-examination, he said he thought the man was shamming pain. Arthur Parish, the defendants' foreman, said the weight of the pipe which fell was 1 cwt. 1 qr. 18 lbs.; and it was perfectly proper to unload such pipes by hand and in the manner in which those in question were unloaded. The two men who were working with the plaintiff having given evidence as to how the accident happened, George Gatland, a yard foreman in the service of the Gaslight and Coke Company, corroborated the statement of Mr. Parish as to the method of unloading the pipes. The Jury returned a verdict for the defendants; saying they thought the action ought never to have been brought. His Honour concurred; and judgment was entered accordingly. Mr. Wilde, who appeared for the defendants, agreed to Simmonds being awarded compensation under the Workmen's Compensation Act; and he was allowed £12.

North Oxfordshire Water Company, Limited.

Last Saturday, Mr. Justice Warrington made the usual order in respect of this Company in a debenture-holder's action, which came on as a short cause on motion for judgment. Mr. Thorpe appeared for the plaintiff.

Water Supply Scheme for Heacham.—At the Public Hall, Heacham, last Tuesday, Mr. W. O. E. Meade-King, M.Inst.C.E., held an inquiry into an application made by the Docking Rural District Council to the Local Government Board for authority to borrow £6250 for the purpose of providing a supply of water for the parish of Heacham, in accordance with a scheme prepared by Mr. E. Herbert Stevenson, who explained its details. There was no opposition.

MISCELLANEOUS NEWS.

PRESENTATIONS TO MR. W. R. HERRING.

His Farewell to Edinburgh Employees.

On the evening of Tuesday last, Mr. W. R. Herring, on retiring from the position of Chief Engineer to the Edinburgh and Leith Gas Commissioners, was the recipient of valuable presentations—the gift of the employees and workmen under him in the offices and works. The ceremony took place in the Technical Office. There was a large attendance of the workpeople, for whose convenience a special train was run from and to Edinburgh.

Mr. A. Masterton, who succeeds Mr. Herring as Engineer, presided. The occasion, he said, was a unique and eventful one for their guest, and they had met to wish him God-speed in his new venture.

The Chairman, at a later hour of the evening, said it was with the greatest pleasure, not unmingled with regretful feelings, that he had undertaken the duty requested of him that night. It had been his privilege to have been at many gatherings since he became connected with the gas industry, but this one was unique in its character, because it was the ending of an important chapter in the annals of their professional history. They had reached a transition stage, on the platform of which they looked back to the past and forward to the future. Naturally, many changes had taken place during the thirteen-and-a-half years of Mr. Herring's administration. Old things had passed away, and a new and more important era had been entered upon at the Granton works. When Mr. Herring came north among them, they predicted that he was the right man in the right place, and that they were fortunate in getting him as their chief. He had not disappointed them. He had proved a good friend to them all, as they could testify. As regarded his capabilities, they had only to become acquainted with the organization and details of the magnificent work which he had designed and brought to completion. Men of note had usually monuments raised to them after they had passed away; but Mr. Herring had erected one in his lifetime, which would be seen by generations yet unborn. He had had many opportunities, in their acquaintance, of forming an opinion of Mr. Herring's character; and he felt it would be wrong of him if he omitted to say a few words, although he knew that Mr. Herring would rather that he did not. He would pardon him when he gave this testimony—that they had ever found him thoughtful and generous in his dealings, considerate and just in business, and fair and honourable among the employees. They had noted more than once his keen judgment and unbending strength of principle, allied to his clear perception of duty, and the power to decide promptly. He had often had complex and difficult questions to solve, subjects of a varied and delicate nature requiring a cool head and a quick understanding to consider them. He had faced these difficulties with a masterly mind; and he had never had to acknowledge defeat. Although he was leaving the old, familiar place, he was not severing his connection with them entirely. They should gladly welcome his advent among them from time to time, with hearty enthusiasm. They should follow him in his future career; and, judging from their knowledge of his work in the past, they had every confidence that he would meet with unparalleled success. He had their best wishes for this, and also for good health and strength. He had now to ask Mr. Herring, in the name of the officers and employees—in short, of all those who had been under his jurisdiction—to accept a silver rose bowl as a token and proof of their respect and esteem, and as a lasting remembrance of their past association. With unfeigned pleasure he turned to Mrs. Herring, and begged that she would accept, from the same sources, a silver salver, as an evidence of their goodwill and regard for her. They trusted that she would find pleasure and comfort in her new home, and be long spared to her husband and family. With the greatest heartiness he handed over the gifts to Mr. and Mrs. Herring. He called upon those present to join with him in drinking to the long life, health, and prosperity of Mr. and Mrs. Herring and the children.

The inscription on the rose bowl was:

> "Presented to W. R. Herring, Esq., Member of the Institution of Civil Engineers, on the occasion of his retiring from the position of Chief Engineer and Manager to the Edinburgh and Leith Corporations Gas Commissioners, by the officers and employees, as a token of their respect and esteem. Edinburgh, 11th November, 1910."

The inscription on the salver was to the same effect, with Mrs. Herring's name substituted.

Mr. Herring, on rising to respond, was greeted with great enthusiasm. He said that no man could find himself in the position in which he found himself that night without being moved by the very heartiness of their reception. Mr. Masterton had in most gracious terms referred to him, to his work, and to his association with them; and he had also told him of the spontaneous character of the suggestion, which came from themselves, that they would not allow this incident in his life to pass without marking it indelibly upon his mind. This they had undoubtedly done. Not only had they asked him to accept, on behalf of his wife and himself, very handsome and costly gifts, but the manner of their giving was, if possible, even greater than the gifts themselves. He had, as Mr. Masterton remarked, been with them now rather more than 13½ years. It was unique, as Mr. Masterton remarked, if they remembered that so much change had taken place during this time in the organization of the undertaking. It had just occurred to him that not a single department of the great undertaking was as it was fourteen years ago. The works were changed, and the other departments were all changed; not even one of them being now housed in the same quarters as they were at the beginning of his term of office. In making these changes, it had been inevitable that there had been a little rough ground to traverse; but, on the whole, and with the concurrence and the expressed wish of the Commissioners, they had, as far as practicable, made provision for the comfort and wellbeing of those who carried on the operations. He thought it could be claimed that they were all working under more comfortable and more healthy conditions than in the old days. It was also gratifying to him to know that the changed conditions were appreciated in the respective departments. It was not easy, in carrying on a work such as this, to make provision as far as perhaps one would wish for the comfort and welfare of those around them. But, as employees, they had been fortunate in having over them a body of business men, in the persons of the Gas Commissioners, who had always been ready to see the necessity of studying the welfare of those they employed; and it did not need him to remind them of what had been done for the employees of the undertaking. The sick fund had been encouraged to the extent of backing it, should it ever be found necessary to back it, by the funds of the Commissioners. But what he thought was of even greater importance was the provision that had been made for the retiral of those in their employ—optionally at 60, but compulsorily at 65. He had always realized, in every undertaking with which he had been connected—gas and otherwise—that it was a very hard case for an employee to be working ten, twenty, thirty, and perhaps forty years for an employer, and then, when he became too old to work, or was enfeebled by sickness, to have nothing to look forward to but his own scanty savings, and which he had to rely upon just at the time of life when he ought to have less care for his future than at any other period. Fortunately, in their case, this had now been provided for them; and on a scale which they must consider liberal. There were many who had retired on the full scale; and he was glad to see several of them there that night, hale and hearty. One thing which had surprised him more than another was the large number who could have retired at 60 on the full pension scale, but who had preferred to be allowed to work on. Although they could add nothing to the amount of their pension, they preferred to work on so long as they felt fit for their work. This was an indication as to how the employment was appreciated. He had referred to the rough ground which it had been necessary to traverse in making the changes which had been made in the organization of the undertaking; and it occurred to him that they might look upon the whole organization as an arch. An arch, as they knew, was made up of a great number of individual pieces. There were so many pieces on the face of the arch, seen by every passer-by; there were a larger number of pieces under the surface; and there was a still greater number beneath. These were all unseen. Yet every piece was playing its part; and without each individual member, the other members could not do their part. This was the position with themselves. Some were seen on the face; others had to be looked for under the surface; others they knew were there, but they could not see them once they were placed in position. He had had the honour of being for years the keystone of the arch. It was an honour that he had very much appreciated. It was a position that he had been proud to fill; and he could not vacate it without deep feelings of regret, for it had been a very important epoch in his life. Some years ago, he would have spurned the idea of ever allowing fate or destiny to move him on; but they were not masters of their own destiny. Something had moved him on, and, as they knew, he was going; but he was glad to see—and he appreciated it very much indeed—that the Commissioners had found a way of retaining his services in their employ, and not, as it were, cutting him adrift from his own child. His heart had naturally been built in this great undertaking. He was going to say that every brick and every rivet had formed part of his thoughts at the time it was necessary to place them. It was impossible for one to break away from such an association without feelings of real regret. In again thanking them for their handsome gifts, he could not say more than that he did sincerely thank them. They should show them to their friends, as a memento of their life there; and they should hand them to their children, both of whom, he was going to say, knew about as much about Granton as they did themselves. His little daughter, when she was but five years of age, in quite an informal ceremony, laid the first brick of the gasholder tank. He himself carried her on his shoulder down the plank. Then his little son, he also without ceremony, laid the first brick of the second section of the works. He could assure them that his children had taken as great an interest in the works as anybody could have done. Their whole lives, so far as their memories were concerned, had been spent at Granton; and he knew they had spent many happy days there. They would therefore associate with this event and ceremony and the sight of the lovely gifts, their childhood's recollection of their father's work.

At the call of the Chairman, three cheers for Mr. Herring were given with great heartiness. Mr. Herring, it was explained, was obliged to leave, as he was going to London that night. As he moved from the table, taking farewell of those beside him, the audience sprang to their feet and burst into the pathetic Jacobite song, "Will ye no' come back again." Immediately afterwards, Mr. and Mrs. Herring, attired for travel, emerged from the dressing-room; and as they walked down the hall, the handshaking on all sides was hearty and continuous. Having reached the door, Mr. Herring turned, and for a second or two surveyed, with evident emotion, the still more emotionally moved assemblage; then, with a wave of good-bye, he passed out and disappeared from his followers and his friends in the North.

The Chairman, at a later stage of the evening, proposed the toast of "The Gas Commissioners," which was responded to by Judge Bryson, the Convener of the Works Committee, and by Judge Inches, the Convener of the Finance and Law Committee. The former stated that Mr. Herring, before he went away, asked him to say, what he had forgotten, that he had been the keystone of the arch, but that Mr. Masterton was now filling that important position—that Mr. Masterton was now the keystone of the arch which held the whole thing together, and that he hoped they would give the same service to Mr. Masterton that they had given to him.

Mr. M'Gillivray, Works Foreman at Granton, proposed the toast of "The Chairman," which was duly acknowledged; and the proceedings, which had taken the form of a concert, given by the employees of the Commissioners, and had been very cheerful throughout, were brought to a close at half-past ten by the singing of "Auld Lang Syne."

OLDHAM GAS-WORKS EXTENSION.

Inauguration of the New Four-Lift Spiral-Guided Holder.

The Chairman and Members of the Oldham Gas Committee invited a number of gas engineers in Lancashire and adjoining counties to be present at the inauguration of the four-lift spiral gasholder (described and illustrated in last week's "JOURNAL," p. 392) which has been erected at the Higginshaw Station by Messrs. Robert Dempster and Sons, of Elland; the ceremony being fixed for Monday of last week. In the early part of the afternoon, the company assembled at the entrance to the Hollinwood Gas-Works, and having inspected them proceeded to the site of the tank which is now in course of construction for a spiral-guided holder that will have a capacity of 5½ million cubic feet, a description of which was published in the "JOURNAL" for Aug. 16 last (p. 455). From Hollinwood the party travelled by tram to the Higginshaw station for an inspection of the new holder.

Mr. J. W. BROADHEAD (of Messrs. R. Dempster and Sons), before asking Alderman Thompson, J.P., the Chairman of the Gas Committee, to turn on the gas from the new holder to the town mains, explained that the new holder, which had replaced a two-lift holder, though not the highest of its kind in the world, was the highest in proportion to its diameter. Since it had been inflated, it had stood the test of several rather severe storms. When a gale was blowing at the rate of 90 miles an hour, with a pressure of 40 lbs. to the square foot, a total pressure of 178 tons would be exerted on the holder if fully inflated. To meet this pressure, each of the carriages (36 in number) round the tank would have to stand a pressure of 5 tons; but each carriage was capable of standing a pressure of 20 tons. He had to congratulate the Chairman and the members of the Gas Committee on their progressive policy, which he hoped would be more than amply justified. He then asked Alderman Thompson's acceptance of a handsome silver rose bowl as a memento of the occasion.

Alderman THOMPSON, in tendering his thanks, said it had always been the endeavour of the Committee to keep up with the times; and much of the success of the undertaking was due to the carrying out of this policy. The old gasholder, which had been displaced by the new spiral-guided one, was erected 39 years ago, and brought into use the following year. It had a capacity of 400,000 cubic feet; and by the new holder the storage capacity had been increased by 375,000 cubic feet. The reason why the Committee decided upon having a spiral-guided holder was on the score of expense; and the only anxiety they had was whether this system for a four-lift holder would stand wind and weather. However, on the information obtained from experts, and also on the advice of their Engineer (Mr. T. Duxbury), the Committee came to the conclusion it would be quite safe to adopt the spiral-guided system, which meant a saving to them of £1000. The new holder had already stood the test of wind and weather, and proved its stability; and he felt satisfied that it would answer the purpose for which it had been erected. It would be known as the "Elland Holder," because the Contractors had their works there. The Committee were entirely satisfied with the way in which the Contractors had done their work; and he hoped the holder would be a credit to them.

A DINNER.

Alderman Thompson then turned on the gas from the new holder to the town mains. The party having inspected the plant in use at the Higginshaw works, returned to Oldham by special trams, and were entertained at dinner at the Town Hall. Alderman Thompson presided; and those present included the Mayor (Alderman Schofield), the Town Clerk (Mr. J. H. Hallsworth), the General Manager of the Gas and Water Departments (Mr. A. Andrew), the Gas Engineer (Mr. T. Duxbury), and the Works Superintendent (Mr. J. Dudley).

After the toast of "The King" had been submitted from the chair and duly honoured,

Mr. ISAAC CARR proposed "The Oldham Gas Committee and Success to the Undertaking." Having observed that if spiral-guided gasholders were well anchored in solid ground, there was no reason to have any fear as to their safety, he said the Oldham gas undertaking was in the forefront of those in this country. When they came to consider the magnificent works they had inspected that day at Hollinwood and at Higginshaw, it was evident that no money had been spared where money was wanted for the improvement of the plant, so that the manufacture of gas could be carried out with efficiency and with cheapness. It was not surprising, therefore, to learn that they could sell gas cheaply at Oldham; and he hoped they would go still further in this direction. They in Oldham were travelling on right lines; and he wished them every success.

Alderman THOMPSON, responding, said that he and his colleagues on the Gas Committee were delighted to have so many gas engineers and experts in gas manufacture present with them that day. He desired to thank Mr. Carr on behalf of the Gas Committee for the compliment he had paid to them. The Oldham Gas Committee had always tried to keep their works up to the highest state of efficiency; and he was pleased some of the experts present had found something in connection with the works that they could commend. They all recognized that a vast amount of money was sunk in gas undertakings in the country; and they also recognized the great importance of the gas industry. At one time it was thought that electricity would supersede gas for many purposes; but in his opinion there was a grand field for both. Through the adoption of improved stoking machinery, and other things, they had been able to cheapen the cost of production, and manufacture gas at a very low figure. Not only this, but with the aid of improved appliances for consumption, they had a much more brilliant light; and the demand was greater to-day than ever. It was a matter of satisfaction to know that in a number of places the local authority had given up electricity for street lighting and reverted to gas; and it was to the credit of gas engineers that this had been brought about. If the gas industry was to keep its place, they must have gas engineers not only well informed on the subject of gas manufacture, but possessed of a certain amount of commercial knowledge. There were very few callings in life where so many qualifications were necessary as in the gas industry. A gas engineer was, in fact, a marvellous man of knowledge. Not only had he to be conversant with the manufacture of gas, but he had to be a

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 461.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord. .	88-90	..	5 11 1
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95-98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd. . . .	6⅜-6⅝	..	5 5 8
40,000	5		7	Do. New, £4 paid .	4⅝-5⅛	..	5 9 3
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c. . .	28½-29½	..	5 1 8
311,810	10	,,	7	Bournemouth Gas and Water B 7 p.c. .	16¼-16¾	..	4 3 7
75,000	10		6	Bournemouth Gas and Water Pref. 6 p.c.	14¾-15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246-249	..	5 0 5
330,000	,,		9½	Do. New . . .	185-187	+1	5 1 7
50,000	,,	,,	5	Do. 5 p.c. Pref. .	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb. .	99-101	..	3 19 3
220,000	Stk	Aug 31	11	Brighton & Hove Orig.	215-218	..	5 0 11
246,320	,,		8	Do. A Ord. Stk. .	158-161	+1	4 19 5
460,000	20	Sept. 29	10⅝	British	44-45	..	4 12 4
109,000	Stk.	Aug 11	6	Bromley, A 5 p.c. . .	117-119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c. . .	88-90	..	5 0 0
82,278	,,		5½	Do. C 5 p.c. . .	107-109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb. .	85-87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97-99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3-4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	4½-5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88-90	..	5 [illegible] 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. . .	09½-111½	..	4 9 8
1,513,280	Stk.	,,	5²⁄₁₀	Commercial 4 p.c. Stk. .	105-108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do. .	101-103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79-81	..	3 14 1
800 000	Stk.	June 10	4†	Continental Union, Ltd.	88-93	+½	4 6 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137-139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122-124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk. . . .	104-105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord. .	103-105	..	4 15 3
486,090	10	July 14	12	European, Ltd. . . .	23¾-24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾-18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord. . .	105-106	+½	4 8 0
2,600,000	,,	,,	3½	Gas light and Coke 3½ p.c. max. . .	87-89	..	3 18 8
4,062,235	,,	,,	4	Gas light and Coke 4 p.c. Con. Pref.	103-105	..	3 16 2
4 531,705	,,	June 29	3	Gas light and Coke 3 p.c. Con. Deb.	80-82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92-94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114-116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17-17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C . . .	145-148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112-114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb. . . .	98-100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental .	184-186	+½	4 16 9
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94-96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	120-122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A. .	220-222	..	4 10 1
718,100	,,	,,	7	Do. B . .	163-165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104-106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅝-4⅞	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99-101	..	4 19 0
250,000	100	,,	4½	Met. of Melbourne 4½ p.c. Deb.	99-101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	12¼-12¾*	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102-103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90-91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½-14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd. . . .	138-140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6-6¼	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A. . .	131-133	..	5 3 0
60,000	50	,,	13	Do. B. . .	124-126	..	5 3 2
100,000	50	,,	12	Do. C. . .	117-119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102-104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord. . . .	7¼-7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref. .	5⅛-5⅜	..	4 11 11
488,900	100	June 1	4	Do. 4 p.c. Deb. .	97-99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb. .	97-99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd. . . .	15¼-15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref. .	11¼-11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb. .	51-52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229-231	..	4 6 7
209,984	,,	,,	10	Do. B	229-231	..	4 6 7
523,500	,,	,,	10	Do. C	229-231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾-11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121-123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80-82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155-157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120-122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120-122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121-123	..	4 1 4
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	107-109*	-½	4 11 9
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c. .	141-143	..	4 17 11
483,940	,,	,,	5½	Tottenham and Edmonton B 3½ p.c. .	112-114	..	4 16 6
149,470	,,	June 29	4	Tottenham and Edmonton 4 p.c. Deb.	97-99	..	4 0 0
182,380	10	June 10	8	Tuscan, Ltd. . . .	9-9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98-100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112-114	..	4 7 9
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c. .	139-141	..	4 15 9
85,766	,,	June 29	3	Wandsworth 3 p.c. Deb. Stk.	73-75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

chemist, an analyst, an architect, and a commercial man as well. He was glad to see that the Universities were taking up this question. There was no doubt that much good would result, and considerable advancement be made in the science of gas manufacture. With reference to the works seen by the visitors that day, he might say that during the past ten or twelve years the Gas Committee had made very extensive alterations and improvements. They had spent big sums of money, and increased their capital account to a large extent. The result of all this had been a considerable reduction in the cost of production, which had enabled them to lower the price of gas. Therefore they had been amply repaid for the outlay; and they were now able to supply gas at 1s. 8½d. to 2s. per 1000 cubic feet, net. Though their area of supply—16,000 acres—had not increased, the number of consumers had gone up year by year. When a boom in trade came, the Committee would be in a position to meet the further demand for gas. At present, they had over 50,000 workshops and houses connected to their mains. He thought he was right in saying that Oldham had one of the most prosperous gas undertakings in the country, and had always been in the forefront. Since they took over the works in 1854, they had paid to the borough fund more than £400,000 in aid of the rates, besides supplying gas gratuitously to the value of over £180,000. Therefore he was right in saying that the gas undertaking had been a prosperous one for the ratepayers. He believed, however, that they were to be prevented from giving so much. They were to be limited to £7500 per annum. What would be the result? The gas consumers would get the benefit in having cheaper gas.

Councillor GOODMAN, in submitting "The Contractors," explained the reasons which led the Gas Committee to erect a new gasholder at Higginshaw, and added that it was the aim of the Committee to give the town as good a supply of gas as possible. The Contractors, he said, had done their work well, and the Committee were perfectly satisfied.

Mr. J. W. BROADHEAD, in response, said that his firm had a staff second to none, and were thus able to turn out good work. It was pleasant to know that their efforts to give satisfaction were appreciated by those they worked for. As to spiral-guided holders, his firm was one of the few that advocated the system; and the figures he gave them at the Higginshaw works were, he thought, sufficient to assure them that, with reasonable dimensions, the spiral-guided holder was absolutely safe. As Mr. Carr had said, if they were well anchored down to the ground, they could not possibly have a mishap. For himself, he believed that the spiral-guided holder would be the thing of the future. On behalf of his firm, he had to thank the Chairman and members of the Gas Committee for many kindnesses received from them. They had found the Corporation very considerate indeed; and in connection with the new holder at the Higginshaw station, he desired specially to express his thanks to Mr. Duxbury and Mr. Dudley for the assistance they rendered the men, so that the contract could be completed to time.

The MAYOR, in proposing "The Visitors," said he and his colleagues were pleased to see such a large attendance of gas engineers from different parts, to take part in the inauguration of the new holder. They claimed to be progressive in Oldham; and he thought what the visitors had seen and heard about the gas undertaking would have gone far to prove this statement.

Mr. R. G. SHADBOLT responded, and observed that he and his colleagues from other towns had been much interested in all they had seen. On behalf of himself and the other visitors, he thanked the Corporation for their hospitality.

Mr. H. KENDRICK also responded, and gave some particulars as to the course of lectures arranged for at the Manchester University on the science of gas manufacture and combustion. He said he was pleased to state that a large number of students were availing themselves of the facilities offered under the scheme.

Councillor H. WILDE proposed "The Officials." In the course of his remarks, he paid a high tribute to the services which had been rendered to the gas undertaking by Mr. Andrew and Mr. Duxbury. He added that the latter had the full confidence of the Gas Committee, and since his appointment had carried out at the works many important improvements for the greater efficiency of the department. Through the influence of Mr. Duxbury, they had at the present time a number of students attending the local technical classes studying the manufacture of gas. He also paid a tribute to the other chief officials.

Mr. DUXBURY, responding, said he had always been well supported by his Committee in the work he had to do.

Mr. ANDREW also replied; and the proceedings concluded with a vote of thanks to Alderman Thompson for presiding.

SOWERBY BRIDGE GAS-WORKS EXTENSIONS.

Local Government Board Inquiry.

The Urban District Council of Sowerby Bridge having applied to the Local Government Board for sanction to borrow the sum of £15,900 for the purpose of extending and re-modelling their gas-works at Sowerby Bridge, Mr. R. G. HETHERINGTON, Assoc.M.Inst.C.E., one of the Board's Inspectors, held an inquiry last Wednesday, in the Council Chamber, into the subject-matter of the application. Among those present were the Chairman of the Council (Mr. A. S. Firth, J.P.), the Clerk (Mr. Rhodes), the Chairman of the Gas Committee (Mr. J. W. Whiteley), and the Gas Engineer and Manager (Mr. A. W. Bissell). The application was not opposed.

The CLERK said the Council had been empowered to borrow for gas-works purposes sums amounting to £102,000; and there had been actually borrowed £98,422—leaving unexpended borrowing powers to the extent of £3578. With regard to the £98,422, there had been repaid £85,429; leaving £12,993 still owing. On the whole of the works

belonging to the Council—gas, water, sanitary, &c., £197,116 had been expended; and in respect of this, loans totalling £195,255 had been sanctioned, £191,874 borrowed, and £131,912 repaid—leaving £59,962 still outstanding. These figures showed that the Council were in a very sound financial condition. The Sowerby Bridge urban district had an area of 564 acres; but in addition to this the Council supplied gas to the outlying districts of Ripponden, Triangle Richworth, Sowerby, Mill Bank, Soyland, and parts of Luddenden Foot and Norland. The population of Sowerby Bridge in 1901 was 11,475, but was now estimated at 12,200, though the total supplied with gas was estimated at about 24,000. The rateable value of the district for poor-law purposes was £55,832, and for district rate purposes £52,008. The poor-rate was now 3s. 10d. in the pound, and the district rate 2s. 10d.—a total of 6s. 8d. A penny rate produced £202. In consequence of the growth of the population and the increased requirements of the district which had taken place the past few years, the extra demand for gas from inside and outside districts made the gas-works totally inadequate to supply the wants of the gas area. The present works were old and in a dilapidated condition; and should the increased demand continue, great difficulty would be experienced in affording a sufficient supply under present circumstances. Their normal daily capacity was 525,000 cubic feet, and the demand varied from 550,000 to 650,000 cubic feet. The present holder capacity was 670,000 cubic feet. It would be observed that extreme measures and considerable tact had to be exercised to cope with the demands of the district at present. The seriousness of the position made by the unprecedented demand last winter compelled the Gas Committee to consider making the proposed extensions.

Mr. J. W. Whiteley (the Chairman of the Gas Committee) was then called to submit the proposed scheme. He said that ever since he had been a member of the Council (9½ years) it had been their policy to defer spending money until the original loan was paid off; but the extensions and renewals at the gas-works must not be delayed any longer. The retort-house was 49 years old, and was braced and buttressed up at many points. The benches were also in such a state that it would be penny wise and pound foolish to attempt to patch them up any longer. There were three reasons why the Council should proceed at once with the scheme. First, because the condition of the works, for an annual output of 125 millions, was altogether inadequate and unreliable. Secondly, because the Committee were having an increase in the demand for gas month by month; the output so far this year being 3,300,000 cubic feet in excess of the corresponding period of 1909, while the prospects of a further increase were very rosy, as there was likely to be a larger demand for gas for manufacturing purposes as well as for cooking. Thirdly, because the judicious expenditure of the money asked for would justify the outlay by increasing the efficiency of the works, in carbonizing at a much less cost, and getting very much more gas per ton of coal. The Committee felt that they were only doing their duty to the ratepayers by asking the Inspector to consider the scheme in a favourable light. They had not entered upon the enterprise without investigating the matter. They had consulted other gas engineers, and reports had been made and considered by the Gas Committee from all the places they visited. In the Council there had been an almost unanimous vote in favour of the scheme the Committee were submitting. There might be objections taken to the fact that a portion of the proposed new works would be built on leasehold land. But only two-thirds of the proposed new plant would be on leasehold land; and there were still 44 years to run. If the Local Government Board would grant the Council powers to borrow on a 30 years' repayment, they would have 14 years in hand after the loan had been repaid. He concluded by expressing the hope that the Inspector would get the matter through as soon as possible.

Mr. Bissell then gave details of the scheme. He stated that during the last eight years they had put the Luddenden Foot works on a proper and satisfactory basis; and the present application was for the Sowerby Bridge works alone. The latter works were in a fair state, except the parts they had to consider specially at this inquiry—viz., the retort-house and benches, the coal-store, tar and liquor tanks, and condenser. These it was proposed to remodel and extend to provide for the present and future, as far as ground space would allow. Then they believed the works would suffice for 25 to 30 years, and by an extension of the retort-bench for a further period, according to what was then put down. The present benches were for producing 525,000 cubic feet of gas daily, against 768,000 cubic feet with the new benches under the same conditions, but with stoking machinery a million cubic feet per day. The average daily demand in winter was from 550,000 to 650,000 cubic feet; and on one dark day they reached 781,700 cubic feet, which was the maximum demand, while 606,000 cubic feet was the maximum make—both occurring last December. The figures of expenditure were: Retort-house, £3400; retort-benches, £6490; elevators, hoppers, &c., £2750; stoking machinery, £1500; water, tar, and liquor tanks, £950; condenser, £450; wheeling platform, £310; removing the station meter and house, and altering the pipes, £200. There would be a small sum realized for old material. Last winter it was necessary to have all the plant working continuously for two months; and he believed the demand for gas had come to stay. There was an increase of more than 7½ per cent. for the half year ending September last, against the corresponding period of 1909. The price of gas had been reduced in Sowerby Bridge from 2s. 3d. to 1s. 9d. per 1000 cubic feet net; in the out-districts, except Luddenden Foot, from 3s. to 2s. 4d. net; in Luddenden Foot from 3s. 4d. to 2s. 4d. net—bringing all the out-districts to one common price. The present application did not include anything for larger gas-mains or gasholder; perhaps this might come up later. The proposed improvements were really needed. Questioned by the Inspector as to the £3084 of loan still unborrowed, the witness said they wanted the money at once in order to pull down the old retort-house and build a new one; any deficit thereon being charged against the new loan. This would carry them on till the larger loan was sanctioned for further extensions.

Mr. Firth, Chairman of the Council, supported the application.

The inquiry then closed, and the Inspector signified his intention of visiting the gas-works.

EXTENSION OF THE BURTON-ON-TRENT GAS AREA.

Purchase of the Barton Gas-Works.

The Burton-upon-Trent Town Council had before them at their Meeting last Wednesday the report of the Gas and Electricity Committee, which contained a proposal that the Corporation should acquire the undertaking of the Barton-under-Needwood Gas Company, with the right to supply gas in their district.

Alderman Lowe, the Chairman of the Committee, in moving the adoption of the report, said that on more than one occasion those who had been interested in the Needwood Company had approached the Committee with the idea that they should acquire their undertaking and supply the gas in Barton. Up to the present they had not considered it to the advantage of the Council that they should do so; but now they believed it would be for the mutual benefit of themselves and the gas consumers if they took them over. After some negotiations, it had been agreed between the Committee and the Gas Company, subject to the approval of the Council, and also subject to their obtaining powers under a Provisional Order of the Local Government Board, to acquire the whole of the Company's assets for the sum of £850. It was arranged that the Barton Company should keep their own book debts and pay their own liabilities. The Council would take over a house, half-an-acre of land, and the whole of the mains, some 2½ miles in extent; and for the sum named they had made a very good bargain. He confessed the Company met them in a very fair spirit, and adopted the line that they would not stand out for any big price, so long as they could get the Corporation to supply Barton with gas at a reasonable figure. The Council would understand that in the assets acquired there would be a ready-money value of between £200 and £300. In order to supply the gas consumers in Barton, it would be necessary for them to lay mains from the borough boundary to Barton Turn, and increase the main by 1000 yards, costing £3000. They proposed to lay mains that would be of such a capacity that they would not only be able to supply gas to the existing consumers, but to meet a considerable increase in the demand for gas which was expected there. Indeed, the mains would be constructed to supply four times the quantity of gas required at the present time. The consumers at Barton were now paying 5s. 6d. per 1000 cubic feet for their gas; and the Committee proposed to supply it to ordinary consumers at 4s. The Council would agree, when he pointed out that at present there were 391 possible consumers in the Barton district, and only 74 of them used gas, that there was considerable scope for an increase in sales. In addition to this, they would be passing through the parish of Branstone, and they hoped to supply the inhabitants of this village with gas at a price to be fixed later. He moved the resolution with every confidence. The Committee also asked the Council to give them power to deal with the matter. It was important that they should not have to consult the Council on every point, because when the Local Government Board Inspector came down, it would be necessary to make one or two decisions on the spot. He had a statement from Mr. Bell, their Consulting Engineer, in which he said they were acquiring the property on very favourable terms indeed.

Mr. Livens seconded the motion.

Mr. Bassett asked what was the consumption of gas annually; what the sales produced; what profit the Company had made; and how long the existing plant had been in use.

Mr. Rowland said, as a Council, they required a little more information. They were spreading their area of responsibility beyond their natural boundaries; and if this was a part of their commercial development, he would be glad to hear of it. But they were dealing with a business which was to all intents and purposes a non-paying one; and it was a question whether they were justified in spreading the area of their influence to so wide a district as Barton.

Mr. Austin was also of opinion that the Council required a little more information before giving the Committee the powers they were asking for. The very fact of Barton being unanimously in favour of the scheme seemed to raise a doubt as to whether it was such a bargain as was stated. Moreover, they had had no official or reliable figures upon the matter. He was certainly of opinion that they should have some definite and expert advice as to the condition of the mains in Barton; while as to the value of the works, they would be of little utility to Burton, as they were going to make their gas at home.

Alderman Rowland said he saw the position of members desiring fuller information; but, on the other hand, with regard to such matters, when they were negotiating with a number of authorities they could not put before the full Council the whole of the facts. There must be a certain amount of reserve on the part of the Committee, and they must either leave it there or quash the proposal at once.

Mr. Thornley pointed out that they were not dealing with the people of Barton, but with a private Company. Before the Committee asked for a free hand, they ought to have obtained a definite census of the people who would consume gas. He was not inclined to take on his shoulders any responsibility. The possibility was that they might have to relay two miles of mains; and the Committee should have given the Council something more definite than they had done.

Alderman Lowe, replying to Mr. Bassett, said the Company's sales last year were 1,668,000 cubic feet, and the profit was £81. The cost of the works now would be scrap price at £2 10s. a ton.

Mr. Bassett then moved, as an amendment, that the matter be referred back to the Committee for further information. He said the sale of gas at 4s. per 1000 cubic feet would be only £100 a year; and they were asked to give £850 for the works. They would have to spend £3000 on mains, and also attend to the wants of the consumers six miles away. He failed to see where the benefit would be to the people of Burton.

Mr. Rowland seconded the amendment.

After some further remarks,

Alderman Lowe, in reply, said that if they obtained the Provisional Order they would have a monopoly of gas supply for Barton and Dunstall. They had now power to go a mile beyond their boundary, and

there was no reason why they should not supply Branstone. They had not actually canvassed the district; but they were sure to get an increased consumption. They were paying £850 for the works themselves, for which they would get £100 as scrap iron to-morrow; and there were the house and land as well. Alderman Lowe gave various details as to the prospects of the purchase, and urged that the application for the Provisional Order should be made at once.

Mr. BASSETT then asked leave to withdraw his amendment; and this was done with the seconder's consent.

The report of the Committee was adopted with one dissentient—Mr. Rowland.

Alderman LOWE then moved the formal resolution sanctioning the application for the Order; and it was carried.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

Action in Regard to the Bank Overdraft.

In the course of the inquiry by the Local Government Board into the question of the proposed extension of the boundaries of Birmingham, considerable notice was taken of what was alleged to be an illegal bank overdraft, amounting to about £300,000, in connection with the Gas Department. The matter is now to come before the Courts for decision, as last Thursday writs were served upon the Town Clerk and the City Treasurer, in an action at the suit of the Attorney-General, who has been set in motion by a ratepayer, calling upon the Corporation to show cause why they should not make good the above-named amount. A general declaration is to be asked for that the appropriation of loan balances as working capital for trading undertakings is illegal. It is stated that the Corporation are prepared to meet the case, as they have been advised that their practice is perfectly good. While it is admitted that there is an overdraft on the revenue account of the Gas Department, there is a credit balance on capital account; and it is claimed that the one balances the other. It is necessary for the Department to have working capital; and they are said to be acting on the powers which were taken over from the Gas Companies. The matter of the loans was raised some time ago, when the question of the inclusion of Yardley in the Greater Birmingham scheme was discussed; and the Town Clerk then explained that there were overdrafts on the water and gas accounts. The borrowing powers of the Corporation, he said, extended to enable money raised in the exercise of them to be utilized for "working capital," and a balance had always been kept, and was still in hand, sufficient for this purpose, with the result that there was, in fact, no overdraft with the bankers, but, on the contrary, a considerable credit. The Corporation had been advised that the West Ham case did not decide this to be illegal, but quite otherwise.

Handsworth has been pointed to as the place of origin of the action; and the "Birmingham Daily Mail" says that while members of the District Council repudiate the suggestion that the Council has in any way instigated the proceedings, it can hardly be doubted that the action is being taken at the instance of a resident of that district. The Council, it is asserted, were in no way responsible for the litigation; and it could not be too clearly understood that not a penny of liability with regard to the matter would fall upon the Council. Birmingham declined to admit that the overdraft was a liability, and contended that they had done nothing which was at all *ultra vires*. This was the point to be settled; and there was no doubt that if the judgment of the Court went against Birmingham the position of affairs would be considerably modified.

MUNICIPAL AFFAIRS AT ST. HELENS.

When returning thanks for his election as Mayor of St. Helens, Alderman Joseph Beecham remarked that in 1900 the rateable value of the borough was £345,000, and the total rates 4s. 9d. in the pound. This year the rateable value was £390,000, and the rates 6s. 10d. This large increase had been caused by expenditure on education, parks, hospitals, sewer works, highways, tramways, &c. In the water department, on which they were not allowed to make a profit, the cost of water both for household and trade purposes had been increased; but this was due to the large expenditure on new works at Melling and the reservoir at Brownedge. The gas-works was an undertaking that had always been ably managed by the Engineer (Mr. S. Glover) and the Gas Committee. In 1900, over 327,000,000 cubic feet of gas were made, against 462,000,000 cubic feet last year. The prices ten years ago were for lighting 2s. 6d. per 1000 cubic feet, and for power 2s.; and now the rates were 2s. 2d. and 1s. 8d., less large discounts. Since 1900, no less than £47,500 had been handed over to the relief of the rates. The electricity works had made rapid strides. In 1900, they sold 113,000 units for lighting to 173 consumers; and they had seventeen motors with a total of 72 H.P., and using 24,800 units. Last year, however, they supplied 420,000 units for lighting, and had 264 motors with a total of 2030 H.P., using over 900,000 units. These figures were for the year ending March 31; but during the past six months there had been an increase of 45 per cent. on the units sold during the same period last year. The total average price obtained in 1900 was 3·42d. per unit, the cost of production being 2·29d. But to-day the average price obtained was 1·48d., and the total cost of production 0·66d. per unit.

Reductions in Price.—The Directors of the Littleborough Gas Company announce that, owing to the increasing consumption of gas for all purposes, there will be a further reduction in price, commencing with the March quarter next year. The new prices per 1000 cubic feet will be: For lighting, 2s. 5d. to 2s. 9d. net; non-lighting, 2s. 2d. and 2s. 3d. net; and engines, 1s. 7d. to 2s. 3d. net. In the case of slot-meters, 4d. per 1000 cubic feet will be returned in cash. As from the 1st ult., the price of gas has been reduced by the Wexford Gas Company from 2s. 9d. to 2s. 7d. per 1000 cubic feet. No meter-rent is charged.

PUBLIC LIGHTING OF WESTMINSTER.

Offer by the St. James's and Pall Mall Electric Light Company.

At the Meeting of the Westminster City Council last Thursday, the Works Committee reported that the St. James's and Pall Mall Electric Light Company had written to them pointing out that, under the new contract for public lighting, the sixteen flame arc lamps and posts put up in Regent Street remained the property of the Council. The Company suggested that they should be allowed to remove and retain as their own property the arc lamps and carriers, as they were put up on the initiative of the Company at the joint expense of the Council and themselves, each contributing the sum of £145, and had been maintained by the Company at an illuminating power of more than 3000 candles per lamp for the past eleven months at the low rate of £17 per lamp per annum. They stated that at the time of making the new contract the Council could hardly have contemplated so drastic a measure as the forfeiture, after a brief period, of the Company's capital sunk in what was a successful demonstration for the public benefit. It having been intimated to the Company that the Council could not be advised by the Committee to allow them to retain the lamps, the Company in a further letter stated that it was a pity these lamps should be "scrapped," and the mains laid by the Company for the purpose of street lighting allowed to become derelict; that it would be an advantage to the Council and the Company that provision should be left for a continuance of the experiments on this method of lighting (which so far had been a pronounced success), as there was no doubt that in the course of the next five years immense improvements would be made in the distribution of light for important thoroughfares by high candle power electric lamps, and these should not be overlooked by the Council. The Company proposed that they should be authorized to use the existing flame arc lamps and mains, and to erect in Piccadilly Circus three steel posts of approved design, in positions to be selected, each post to be (say) 35 feet in height, and to carry four of the lamps. They offered to provide and erect the posts, erect the twelve arc lamps, and maintain them under contract with the Council for a period of five years, for the full normal hours of lighting under the terms of the Council's specifications and requirements, free of all charge and cost to the Council. The Company expressed the hope that the Council would recognize the *bonâ fide* nature of the offer, which would enable the experiments to be continued for their mutual information. The Company further offered, in the event of any improved lamp or method of lighting by electricity being introduced during the period of the contract, to change over (by arrangement with the Council) to such system. The electric arc lamps proposed to be erected in Piccadilly Circus will not be in place of, but in addition to, the high-power gas lighting to be provided by the Gaslight and Coke Company under the new public lighting contract. The Committee recommended the Council to accept the offer of the Company; and this was agreed to without dissent or discussion.

WARRINGTON WATER-WORKS EXTENSIONS.

Local Government Board Inquiry.

An inquiry was held in the Warrington Town Hall last Friday, by Mr. R. C. Hetherington, Assoc.M.Inst.C.E., one of the Inspectors of the Local Government Board, into an application made by the Corporation for sanction to borrow £23,799 for the purpose of their water undertaking, including the execution of some works in the townships of Burtonwood and Winwick-with-Hulme. The Deputy Town Clerk (Mr. A. T. Hallaway) said the Corporation acquired the water-works in 1890, and nine years later they were extended. The area of supply was 40,000 acres, and there were three systems—a trade supply, a low-level supply, and a high-level supply. The second comprised the whole of the borough and a small portion of Cheshire. The water was supplied by gravitation from two service reservoirs at Winwick. The combined pumping plant raised 2,900,000 gallons per 12 hours; 2,300,000 gallons of this being available for the low-level supply and all future demands. At the present time the low-level system was supplied by an 18-inch main, and it was being overworked. The proposal before the Inspector was to lay another 18-inch main, giving 3 million gallons per day, or a maximum demand of 242,000 gallons per hour. This it was estimated would be ample for the district's requirements for many years. The figures now were 18·45 gallons per head, compared with 22 gallons in 1900. Complaints had at times been received of the scarcity of water. The reasons for the application were, first, that the present 18-inch main was overworked; secondly, that they were not able to supply the higher portions of the borough; and, thirdly—and this had caused the Water Committee very serious anxiety—the danger to the large works and buildings in the town in respect of fire. Part of the application was for £6000 for the laying of mains in the future. Evidence in support of the application was given by the Water Engineer (Mr. J. Gray) and the Medical Officer of Health (Dr. J. Coote Hibbert).

DERWENT VALLEY WATER UNDERTAKING.

Supply of Water to Enderby.

The question of obtaining an improved water supply for the prosperous granite village of Enderby, which lies about 4½ miles to the south-west of Leicester, has for some years engaged the attention of the local authorities. The population have long suffered from the want of an adequate supply, being dependent upon shallow wells, which have been exhausted by the encroaching of the granite quarry workings; and in some cases the sources of water have become impure in quality as well as deficient in quantity. Many schemes were brought forward, but without any practical result. About four years ago, the water question became so urgent that arrangements had to be made by the

Enderby Parish Council to cart water and distribute it among the inhabitants; but on the Leicester water supply being extended by agreement to the Leicester and Rutland County Asylum, which is in the parish of Enderby, the Blaby Rural District Council approached the Corporation, and arranged for a supply from a hydrant as a temporary measure. Eventually, in April last year, an agreement was entered into with Leicester, whereby the mains of the Corporation were extended to the Narborough Cross Roads; and at this point a supply of water in bulk was sold to the Enderby Parish Council, who were to lay their own mains and distribute the water. The scheme for the distribution of water in the parish was prepared and submitted to the Rural District Council, and application was made to the Local Government Board, who approved the scheme and sanctioned the raising of money to carry out the works. Mr. Charles Chamberlain, of Leicester, was the contractor for the main laying, &c., and Mr. J. H. Iliffe for the street services. The Water Committee of the Leicester Corporation carried out the main laying from the connection with the main of the Derwent Valley Water Board; the line consisting of 4360 lineal yards of 12-inch and 4050 lineal yards of 10-inch main, together with special works, valves, trenches, and main laying, at the cost of about £6700. The supply was turned on by the Chairman of the Water Committee of the Leicester Corporation on the 5th inst.

The whole of the work has been carried out under the supervision of Mr. Frederick Griffith, M.Inst.C.E., Water Engineer of the Leicester Corporation. The mains have been laid by workmen engaged direct by the Water Committee; and on this long length of main being tested, it was found that there was not a bad joint in it. This reflects great credit on the care and skill of Mr. N. B. Davis, Assoc.M.Inst.C.E., the Assistant-Engineer, and the workmen engaged in laying and jointing the pipes.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The meeting of the Eastern District of the Scottish Junior Gas Association at Kirkcaldy this afternoon was an exceedingly successful one, bearing out once more the wisdom of the policy of holding the meetings in different places. There was a very good attendance, and an excellent programme and well-balanced presentment of fare provided by both the senior and the junior elements in the gas industry. It was evident, from the rapt attention which was given to the address of Mr. W. Ewing, of Lochgelly, that his remarks were going home. Mr. Hutchinson's paper upon purifiers was a production so complete that its full effect can only be realized by study, and by comparison with handbooks.

Mr. W. R. Herring, who has been during his comparatively short period of office in Scotland a tower of strength to the gas industry in the North, retired from the scene of his labours in an interesting manner, tinged with dramatic effect, on Tuesday evening. He has done so much to improve the lot of the gas worker—in the physical nature of his surroundings (which at Granton are as paradise to the abyss when compared with the working conditions prevailing in many works, not all of which are either old or regarded as out of date), and on the financial side of the workers' employment in the satisfactory wages paid in the present and the pension which is in prospect—that it was only what was to be expected that an endeavour should be made to mark the workers' appreciation of Mr. Herring's care for them. The appreciation, as will be seen from the report on another page of the proceedings at Granton on Tuesday evening, took the form of a presentation of handsome silver mementoes. The workmen, to the number of 400, assembled in the Technical Office at Granton, under the genial chairmanship of their new chief, Mr. A. Masterton; and the evening was spent right blithely in song, recitation, and music, including bagpipe selections, interspersed with the necessary remarks attending the presentations to Mr. and Mrs. Herring and one or two toasts. I do not need to dilate upon the stately language with which Mr. Masterton prefaced his handing over of the gifts, further than to say that it was a universal acknowledgment that the task could not have been more befittingly performed. It was in Mr. Herring's words of thanks, and in the reminiscent observations in which he indulged, that the interests of the evening centred. Mr. Herring spoke under strong emotion. It was evident that he had, and has, Granton entwined round his being so completely that, although he has quitted its portals, he is still there in mind and in affection. There was, in his remarks, a deeper note than that of attachment to the works, to be found in the regard for his workpeople, which, it will be seen, was the leading topic of his address. The reciprocation of that regard, it was touching to observe, found expression on the part of the workmen, in their eagerness to shake hands with their departing chief. Those who saw the departing scene will not soon forget it. There was emotion on both sides—on the part of Mr. Herring, who was taking leave of a trusted band of workers, and on the part of the workers, who were parting with one who had consistently befriended them. Mr. Herring is no longer a gas manager. He has risen to a higher sphere of his profession, after doing good work in it. The Granton Gas-Works are not his only monument. He has left behind him a staff of workers the most contented that can be found anywhere; and he has closed a period of management which, to those under him, is full of kind recollections only. It is a significant fact, and a testimony to his ability and his goodness of heart, that now he has gone back to England, after thirteen years' service in Edinburgh, he has left in charge of the works, in almost every department of the manager's side of the undertaking, the gentlemen whom he found in office when he came from Huddersfield. He has worked all through with the staff of assistants which were selected by his predecessor. The staff have reason to be grateful to Mr. Herring; and I know they are. There is another class which have a great regard for Mr. Herring; and their regard is perhaps as great a tribute as that of any—I refer to the representatives of the Press. Mr. Herring was never so busy but what he could see a Press man;

and no Press representative ever left him with the feeling of disappointment. Other reflections might be indulged in, over a career which, if it has been short in these northern parts, has been brilliant; but enough has been written to indicate the feeling with which Mr. Herring is regarded among his now recent colleagues and acquaintances in Scotland. In Scotland he has done a great work; and in Scotland there is cherished, and will be cherished for long, the happiest recollections of him.

The county of Fife is, to all appearances, about to be, in the near future, the *El Dorado* of Scotland. It is on the southern shore of the county that the Rosyth Naval Base is being established, in connection with which, in the course of a few years, there will be a large population located, and much public money expended. But the principal wealth of the county will be found in the development of the coal trade. Great strides in this direction have already been made; and there is no reason to believe that a limit to these has been reached. This week it is announced that the Fife Coal Company are about to revive the coal industry at Valleyfield, to the west of Rosyth, by which, it is anticipated, a large town will be called into being. Of course, all this importation of population and capital means, among other things, that there will be a wide field for gas supply. It is more than likely that this view of the situation has occurred to the leaders of commercial communities within the area which will be the scene of the forthcoming appreciation; but so far, except in the case of the Corporation of Dunfermline, there is little appearance of forward anticipations being cherished. In the case of Dunfermline, it is two years since they obtained control of the lighting of Charlestown and Limekilns, on the seashore quite close to Rosyth. They are at present promoting a scheme for an extension of the burgh boundaries so large as to bring them down to the property of the Naval Base—a distance of several miles; and the latest intimation is that last night, at the request of the Town Council of Culross, Mr. T. Stewart, the Convener of the Dunfermline Gas Committee, attended a special meeting of the Council for the purpose of discussing a proposal to supply gas for public and private lighting in the burgh. The suggestion is that the Corporation should lay a main to Culross, and give a supply on the high-pressure system, as in the case of Limekilns and Charlestown. Mr. Stewart submitted information regarding the proposal; and an interchange of views took place. A very obvious advantage of the scheme, it is submitted, is that a large number of customers would be secured on the line of pipe, which would pass through Crossford, Cairneyhill, Torryburn, and Newmills. It is computed that ere long, if the scheme is carried through, the pipe would supply a population but little short of 20,000. There is no gas supply in Culross.

The Helensburgh Town Council last night agreed that those gas consumers outside the burgh who use a million cubic feet of gas a year and over shall be charged at the same rate as consumers inside the burgh—viz., 3s. 4d. per 1000 cubic feet, which is a reduction of 2½d.

The Dalkeith Gas Company have reduced the price of gas to all consumers from 3s. 10d. to 3s. 6d. per 1000 cubic feet.

The report of Mr. A. Gillespie, of Glasgow, to whom the Corporation of Arbroath recently remitted to value the whole works and plant at the gas-works, was submitted to the Gas Committee of the Town Council on Tuesday. Mr. Gillespie states the capital value of the works to be £64,000. He made a valuation of the works a number of years ago, when he placed the amount at £47,800. The increase since then is due to the many alterations and improvements that have been carried out in recent years.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 12.

Sulphate of Ammonia.

The market has continued to have a drooping tendency throughout the week, and the volume of business has been small, consumers for the most part pursuing a hand-to-mouth policy. Values have been fairly well maintained, however, by the fact of the parcels offered having been taken up by dealers in order to cover previous sales. Although in some instances small transactions are reported at slightly less money, the closing quotations can be taken as £12 18s. 9d. per ton f.o.b. Hull, £13 per ton f.o.b. Liverpool, and £13 per ton f.o.b. Leith. The forward position has become rather neglected; makers still maintaining their views, and buyers not being inclined to operate.

Nitrate of Soda.

The market for this article is again without alteration in either tone or value, and to-day's prices are still 9s. 4½d. and 9s. 7½d. per cwt. for ordinary and refined qualities respectively, on spot.

LONDON, *Nov.* 14.

Tar Products.

The markets for tar products have continued steady throughout the past week. Pitch has remained firm; and there have been one or two transactions during the week, which, however, have not had very much effect on the market, though it is understood that in some quarters purchases were made at a slightly lower price. Creosote is in about the same position, though the volume of new business is not very great. Benzols and naphthas are steady; but there has been no material increase in price. In crude carbolic, business has been done at a very much better price for both 50's and 60's; and as much as 1s. 1½d. has been refused on the east coast for delivery several months ahead.

The average values during the week were: Tar, 17s. to 20s. 9d. *ex* works. Pitch, London, 34s. to 34s. 6d.; east coast, 32s. 6d. to 33s. 6d; west coast, Clyde ports, 36s. 6d. to 37s. 6d., Manchester, 32s. to 33s. Liverpool, 32s. 6d. to 33s. 6d. Benzol. 90 per cent., casks included, London, 7½d. to 7¾d.; North, 7½d. to 7¾d.; 50-90 per cent., casks included, London, 7¾d. to 8d.; North, 7½d. to 7¾d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4¼d.; North, 3⅜d. to 3¾d.; solvent naphtha, casks included, London, 11½d. to 1s. 0½d.; North, 11d. to 1s.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 10½d. to 11d. Creosote, in bulk, London,

2⅜d. to 2½d.; North, 1⅞d. to 2¼d. Heavy oils, in bulk, 2⅝d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d.; west coast, 1s. 1d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market continues very firm; but in all quarters makers are asking higher prices, and they expect to realize these before many days are past. To-day actual Beckton is quoted at £12 12s. 6d. Outside London makes are £12 10s. In Hull, the price is £13 1s. 3d. to £13 2s. 6d.; Liverpool, £13 3s. 9d.; Leith, £13 5s.; and Middlesbrough, £13 2s. 6d.

Tar Products.

Representative manufacturers give the following as fair current values for the week ending Nov. 12.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast. Liverpool.	West Coast. Manchester.
Tar, crude .	ton	21s.	18s.6d.-21s.	19s.6d.-21s.6d	18s.6d.-20s.6d.	18s.6d.-20s.6d.
Pitch . .	,,	35s.-36s.	32s. 6d.	32s. 6d.-33s.	34s.	33s. 6d.-3[illegible]s.
Benzol, 90%	gal.	8¼d. 8½d.	7d.-7½d.	8d.	7¼d.-7½d.	7½d.-7¾d.
Benzol, 50/90%	,,	8½d.	8d.-8½d.	9d.	8d.-8¼d.	8d.-8¼d.
Toluol, 90%	,,	9½d.	9d.	10d.	10d.	10d.
Crude naphtha, 30% .	,,	—	3½d.	3½d.	3¼d.	3¾d.
Light oil, 50% .	,,	—	2¾d.	3½d.-3¾d.	3d.	3d.
Solvent naphtha, 90/160 .	,,	—	10¼d.	10½d.	10½d. 11d.	11½d. 1s.
Heavy naphtha, 90/190 .	,,	—	11d.	11d.	11½d. 1s.	11¾d. 1s.
Creosote in bulk	,,	2¼d.	2¼d.	2d.	2d.-2¼d.	2d. 2¼d.
Heavy oils .	,,	3¼d.	2½d.	2¼d.	2¼d.	2¼d. 3d.
Carbolic acid, 60's	,,	1s. 0½d.	1s.-1s. 0½d.	1s. 0½d.	1s. 0½d.-1s. 1d.	1s. 0½d.-1s. 1d.
Naphthalene, crude drained salts . .	ton	—	37s. 6d.	40s.-42s. 6d.	4[illegible]s. 6d.	47s. 6d.-50s.
Do., pressed	,,	—	50s.	63s.	60s.	60s.
Do., whizzed	,,	80s.	—	—	70s.-72s. 6d.	70s.-75s.
Anthracene .	unit	2d.	1½d.	1½d.	1¼d.	1¼d.

Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade in the North has shown a little more activity—the unsettled condition of the Welsh mines having diverted a few orders to the North of England. In the steam coal trade, best Northumbrians are quoted from 9s. 8d. to 10s. per ton f.o.b. Second-class steams are 8s. 6d. per ton; and steam smalls vary from 5s. 6d. to 6s. 6d. The northern steam coal collieries have had rather fuller work—mainly from the cause named. In gas coal, there is a good demand, though a scarcity of steamers has limited the shipments a little. Durham gas coals are in full supply, and may be quoted at about 8s. 6d. to 9s. 6d. per ton f.o.b.; while for "Wear" specials, up to 10s. 4½d. is asked. There is now a full delivery of gas coals on the long contracts; and this must be expected to continue until after the turn of the year, as the great consumers will need to accumulate stocks for the weeks of largest use. There are inquiries for gas coal for delivery over next year at some of the Italian ports; but the prices offered do not tempt sellers to forward contracts at present. One or two small lots of gas coal have, however, been sold to Swedish ports. Coke is quiet. Gas coke is now more plentiful; but the price is steady at about 14s. 3d. per ton f.o.b. Tyne or Wear.

Scotch Coal Trade.

Trade moves slowly; even the struggle in South Wales having as yet had little effect in Scotland. There is, consequently, little change to record. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 305,005 tons—a decrease of 5345 tons upon the preceding week, and of 18,437 tons upon the corresponding week last year. For the year to date, the total shipments have been 13 740,642 tons—an increase upon the corresponding period of 616,104 tons.

High-Pressure Gas Lighting in Lewisham High Road.—The Works Committee of the Deptford Borough Council have had under consideration a letter from the South Metropolitan Gas Company, applying for permission for the erection of 64 high-pressure gas-lamps on the footway of the eastern side of Lewisham High Road, between Nos. 119 and 249A. It is proposed to place 53 of the lamps on the kerb of the footway in a continuous line, about 22 feet apart; the remaining 11 being erected on the private forecourts abutting upon premises and shops. The scheme has been promoted by the Lewisham High Road Traders' Association; but the lamps when erected will be under the direct control of the Gas Company as to lighting and maintenance. The Company state that each lamp will have an approximate illuminating power of 1500 candles. The Committee have, subject to the usual sanction, given the Company the required permission under protective conditions.

Delivery of Coals at the Yeovil Gas-Works.

At last Wednesday's meeting of the Yeovil Town Council, the Chairman of the Gas Committee (Alderman Gould), in presenting his report, said there had been much correspondence between the Committee and the South-Western Railway Company with regard to the alleged delay in delivering waggons of coal to the gas-works. There had also been serious complaints from traders in the town; and some time ago it was said that there were 50 waggons on sidings at Yeovil Junction which could not be brought to the town station on account of lack of accommodation. The Manager of the Gas-Works (Mr. E. Howell) said he could not help thinking that the Railway Company were not treating the matter with seriousness. The accommodation at the South-Western goods station might have been sufficient ten years ago; but it was ridiculously inadequate now. Complaints from traders and manufacturers were general and emphatic, and, so far as the gas-works were concerned, the inconvenience and the increased cost of transit of materials were getting intolerable. Owing to the delay in the delivery of coal, they had had to make inroads into their reserve stocks; and it was possible that serious inconvenience in connection with the gas supply of the town might be caused. The Town Clerk (Mr. H. B. Batten) read correspondence between the Council and the Railway Company, who had replied that the matter was receiving attention. Letters were also read to the Council from trading firms complaining of delay. Mr. Matthews said that though there had been some criticism, no remedy had been suggested. The remedy lay with the Council. It was for them to consider what steps might be necessary; and they might make application to the Railway Commissioners. It was a very serious matter that the commerce of the town should be affected; and, in view of Mr. Howell's statement that the Company were treating the matter lightly, the Council must adopt strong methods. The Town Clerk suggested that if he wrote strongly to the Company perhaps the matter might be arranged in an amicable way; and there were many good reasons why this should be done. This course was ultimately adopted.

The New Issues of Capital at Tunbridge Wells and Redhill.—Tenders for the £2000 of consolidated "D" stock which the Directors of the Tunbridge Wells Gas Company recently invited in the "JOURNAL" have been considered by the Directors. We understand that applications for upwards of £5000 nominal of stock were sent in, the purchase money representing investments of nearly £11,000. The new issue of capital, which, under the sliding-scale, will be entitled to a dividend of $9\frac{3}{4}$ per cent. per annum, was allotted at an average price of $4\frac{1}{2}$ per cent.; something like 62 per cent. of the applicants failing to secure an investment. For the £5000 of ordinary "B" stock of the Redhill Gas Company recently advertised in the "JOURNAL," applications were received for £8515; and the average price realized was £102 1s. per £100. Both of these issues may be regarded as most satisfactory to the Companies.

Coke-Oven Gas at Caerphilly.—According to what transpired at the meeting of the Caerphilly Urban District Council last Tuesday, coke-oven gas is proving to be not so satisfactory as was attempted to be made out not very long ago. Mr. Harding complained that the gas in Caerphilly was defective. It appeared that a good deal of cheap gas was being bought from the Powell Duffryn Company and pumped down to Caerphilly from Hengoed. The penny-in-the-slot consumers complained that very often the pennyworth of gas did not last more than an hour; and this was not fair to them. It was decided that the gas should be tested. Mr. Tom Evans also complained of the quality of the gas at Nelson; and the Surveyor was instructed to make a test and report.

Quality of Devonport Gas.—At the meeting of the Devonport Town Council last Wednesday, Mr. Weeks complained of the low illuminating power of the gas, and asked what proportion of water gas was being supplied. Alderman Moon also commented on the poor quality of the gas. Alderman Tozer, the Chairman of the Gas Committee, said that at present they were using 27 per cent. water gas, which was in excess of what it should be. The Council had, however, recently sanctioned an expenditure of nearly £6000 for improvements and renewal of the plant; and when this work was carried out, they hoped to be able to supply a larger proportion of coal gas, and maintain the illuminating power at a higher standard. Speaking at a public meeting next day, Alderman Tozer said the gas undertaking was on a very sound financial basis, but the gas was not of the quality it should be. The Gas Committee were now spending a large sum on improvements, the result of which would be the production of a larger quantity of gas per ton of coal, and the use of a smaller percentage of water gas. He believed they would then get better illuminating power.

Increased Storage at the Hertfordshire Asylum Gas-Works.—The General Purposes Committee of the Hertfordshire County Council, having had their attention drawn to the inadequate storage capacity at the gas-works at the Three Counties' Asylum, consulted Messrs. W. R. & W. Phillips, of Luton, on the matter. The present storage is only 27,700 cubic feet, while the heaviest daily consumption is 55,000 cubic feet. The gas is used in connection with the lighting of the whole of the building and for the driving of the gas-engines, which are used for pumping the water required for domestic purposes and the fire system, and furnish motive power for all the machinery. Gas is also used for cooking purposes in the kitchens, and in stoves for heating the Asylum. Messrs. Phillips advised the erection of a new steel tank and a single-lift gasholder having a capacity of 30,000 cubic feet, arranged for conversion at some future time into a two-lift holder of a capacity of 61,000 cubic feet. The Visiting Committee of the Asylum, having considered Messrs. Phillips' report, decided to adopt their recommendation; and they instructed them to prepare plans and specifications and invite tenders for the work. The result is that the Committee have, subject to the usual sanction, resolved to accept the tender of Messrs. Robert Dempster and Sons, Limited, of Elland, which was the lowest submitted.

French Gas Employees' Gratitude to a Manager.

The employees at the Amiens station of the European Gas Company have set a good example by publicly expressing their thanks to the Manager (M. Bertin) for an act of thoughtful consideration on his part. Owing to the high prices of provisions, and the consequent tax upon the resources of the employees, M. Bertin, unsolicited by them, put himself in communication with the Directors with the view of obtaining an increase in the men's remuneration. The request was favourably received, and granted, with the result that as from the 1st inst. the emoluments of the entire *personnel* have been substantially raised. In a signed paragraph inserted in a local paper without the knowledge of M. Bertin, the employees expressed their gratitude and devotion, and, in the name of their families, asked him to convey this expression to the General Manager (Mr. W. Williams) and Directors, and thank them for their kindness.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards sold, by order of the Directors, 400 additional ordinary £10 shares and £1000 of 4 per cent. perpetual debenture stock of the Lowestoft Water and Gas Company. The shares rank for a maximum dividend of 7 per cent.; but the last dividend on similar shares was at the rate of 5½ per cent. per annum. They fetched from £10 5s. to £11 5s. apiece. The debenture stock was sold at £103 to £103 5s. per £100. On the same occasion, £300 of original stock of the City of Ely Gas Company, Limited, ranking for a maximum dividend of £10 per cent., but carrying 8 per cent., free of income-tax (equivalent to 8½ per cent., less tax), realized £160 to £161 per £100. A few fully-paid £10 shares in the Gas-Meter Company, Limited, on which a dividend at the rate of 10 per cent. was paid for the year ended the 30th of June last, fetched £13 10s. to £14 per share *cum div.* as from the 1st of July last. In accordance with the announcement in the "JOURNAL" for the 1st inst., Messrs. W. J. Villar and Co. sold on Monday last week, by order of the Directors, £3000 of 7½ per cent. stock of the Taunton Gas Company. It was part of a sum of £40,000 authorized by the Taunton Gas Act, 1897; and it fetched an average of £162 11s. 4d. per £100. At the Royal Hotel, Norwich, last Tuesday, Mr. S. Mealing Mills offered for sale a number of debentures, stocks, and shares in local undertakings. A few £20 shares in the British Gaslight Company, Limited, realized £43 10s. apiece. Some 3½ per cent. perpetual debenture stock of the Norwich Water Company, fetched £95 per £100; some £10 fully paid 5 per cent. preference shares in the same Company, £12 10s. each; and some £10 ordinary shares, £16, £16 2s. 6d., and £16 5s. each.

Oriental Gas Company, Limited.

At the ordinary general meeting of this Company to-morrow, the accounts to be presented for the half year ended June 30 last show that there was a moderate increase in the gas-rental compared with the figures for the preceding year. There was a considerable advance in the receipts for tar; but this was neutralized by a diminished yield from the sale of coke, the market for which commodity continues in a very depressed condition. The Directors report that the sanction of the Local (Bengal) Government has been given to the terms agreed between the Corporation of Calcutta and the Company for a new contract for the supply of gas to the public lamps for a period of twenty years from the 1st of May, 1911, at which date the existing contract will expire. In order to meet the greater requirements of the Corporation under the new contract, and to be in a position to satisfy a prospective expansion in the demands of other public bodies and of private consumers for gas, not only as an illuminant but for industrial and domestic purposes, the Company have been actively engaged during the year in main-laying operations and in augmenting and improving the manufacturing capacity of the works. This has involved considerable outlay, which has been met by the appropriation of £20,000 from the contingency fund. The Directors point out that the strength of the undertaking and its trading capabilities will be largely fortified by this expenditure. Further operations are being vigorously prosecuted and are expected to be completed early in 1911. The price of gas to the private consumers will be reduced by half a rupee (equal to 8d. English) per 1000 cubic feet, as from the taking of the December indices. The Directors recommend the payment of the usual dividend of 4½ per cent., free of income-tax, making a total dividend of 8 per cent. for the year. They express their regret at having to report the resignation of Mr. R. Hesketh Jones, who was a Director of the Company for seventeen years, and Chairman for the last ten years. Acting in accordance with the Company's Articles of Association, they have appointed Mr. Stanley H. Jones, M.Inst.C.E., to fill the vacancy thus caused.

Chester Water Supply.—The Chester Water Company propose to construct a reservoir for the storage of water previous to filtration. So far as the scheme has as yet been settled, the reservoir will be constructed upon land adjacent to the west side of Eaton Road, with a line of pipes leading from the present intake to the proposed reservoir, and thence to the water-works. The total capacity of the reservoir, which will be divided into four compartments, will be 76 million gallons. The Company propose to apply next session for parliamentary authority for the scheme.

Municipal Electric Wiring.—Opposition is being organized to a Bill which will be introduced next session to confer upon local authorities having electricity supply powers the statutory right to engage in the wiring of premises for electric light and in the sale of electrical apparatus and fittings. The measure is being promoted by the Incorporated Municipal Electrical Association—a body formed by municipal electrical engineers and members of municipal electricity committees. The main opposition comes from the Electrical Contractors' Association; and it is based on the contention that municipal wiring and sales departments will constitute unfair and unnecessary rate-aided competition with an established branch of retail trade.

Value of Hertfordshire Gas and Water Undertakings.—The Rate Committee of the Hertfordshire County Council report that the total figure at which the gas and water undertakings stand in the existing county rate-books, is £96,105 gross and £65,505 rateable value. The result of a revaluation made by Messrs. H. Trustram Eve and W. G. Cooke is to raise these figures to £107,606 gross and £73,074 rateable—an increase of 11½ per cent. The properties of the Metropolitan Water Board have not been dealt with.

A Queen's Heavy Gas Bill.—According to a Central News telegram from Lisbon, in the "Pall Mall Gazette" last Friday, the "Seculo" had received information to the effect that the Gas Company had seized private property belonging to the Dowager Queen Maria Pia for payment of an indebtedness of £3200 for light. It was also reported that the Company had communicated with the dethroned King Manuel, asking whether he would desire to discharge this liability, or whether he preferred that the Royal property should be sold by auction.

Hastings Corporation and the Gas-Burner Bills.—In the notice last week of the proceedings at the meeting of the Hastings Town Council on the 4th inst., at which the accounts for the opposition to the Gas-Burner Bills were presented and passed for payment, it should have been mentioned that the Public Lighting Committee recommended that further opposition should be abandoned; and the fact that this was agreed to *nem. con.* seems to show that the Council are disinclined to continue what has been a costly (and apparently useless) fight. One speaker probably voiced the opinion of many of his colleagues when he said that they did not know the opposition would cost so much, or they would have let the other towns go their own way.

Wombwell Gas Undertaking.—The annual report on the Wombwell gas undertaking was submitted to a recent meeting of the Urban District Council, who considered it highly satisfactory. The gross profit on the year was £2835, which, after deducting repayments of principal and interest on loans amounting to £1557, left a net profit of £1278. The net profit the previous year was £876; and in the year before that, £110. A reduction in the price of gas of 3d. per 1000 cubic feet and the abolition of meter-rents were in force during the last two years. The working expenses showed a reduction of £433 on the previous year, though 1,807,000 cubic feet more gas were sold. During the year, 316 new consumers were added; the total consumers being 3583. Various additions to the plant are contemplated.

Alderman Gibson on Supporting Rates Out of Gas Profits.—In the course of an inquiry held at the Manchester Town Hall on Friday, by Mr. A. G. Drury, in respect of an application made to the Local Government Board by the Corporation for authority to borrow £30,000 for the purposes of the electricity supply undertaking, Alderman Gibson, the Chairman of the Gas Committee, was called on behalf of the Ratepayers' Association, whose representative (Mr. J. C. B. Percy) had adversely criticized the policy of the Electricity Department. He said that for many years the Gas Department had been practically subsidizing the rates—a policy he did not agree with. He agreed, however, with that of the Electricity Department; but since both belonged to the same Corporation, he contended they should both be treated alike.

The British Coalite Company announce that their Barking works, which were closed down some weeks ago, have been started again.

We have received from Messrs. John Russell and Co., Limited, of 145, Queen Victoria Street, E.C., their new catalogue of gas lighting fittings and accessories, which contains a selection of this season's designs in pendants, brackets, lamps, &c.

The Local Government Board have sanctioned several loans for the purposes of the gas undertaking of the Torquay Town Council—viz., £210 for a sulphate-house, £290 for sulphate plant, £1100 for mains and services, £2450 for meters (£150 for ordinary and £2300 for prepayment), and £300 for cookers.

A first and final dividend of 2⅝d. in the pound has been declared in the bankrupt estate of John Robert Little, proprietor of gas-works, Burgh-le-Marsh, Lincolnshire; and a supplemental dividend of ⅜d. in the pound in that of the London Gas-Mantle Manufacturers, Limited, of 28, Fitzgerald Avenue, Mortlake.

The British Lighting Development Company, Limited, was registered with a capital of £1250 (1200 ordinary shares of £1 each, and 1000 deferred shares of 1s. each) to carry on the business of manufacturers of, and dealers in, gas fittings and appliances; also to acquire the business carried on by the British Lighting Development Company, &c.

One of the largest single orders ever placed with a gas-stove firm for an installation of cooking apparatus has been received by the Richmond Gas Stove and Meter Company, Limited. The apparatus, which includes a very great variety of the Company's manufactures, has been ordered by His Majesty's Office of Works for the new Money Order Office; and we learn that the total value of the order is approximately £1750.

At Stockport, some days ago, four children had a narrow escape from being asphyxiated. During the night, the supply of gas became exhausted; and one of the daughters, before going to work, placed a penny in the slot of the prepayment meter, not knowing that a tap in the room in which the four children were asleep was turned on. When the fact was discovered, as a result of the moaning of the children, they were all unconscious. One of them had to be taken to the infirmary, but all recovered in the course of a few hours.

We have received from the James Keith and Blackman Company Limited, a neat catalogue holder which they have had made for containing their numerous publications, and facilitating reference thereto. The catalogues are all of one size (7 in. by 4½ in.), in wrappers of different colours; and their titles are printed on white paper inside the lid of the holder, which has the appearance of a leather-bound book—the back being gilt lettered with the name of the Company and those of their specialities. A flap, closing with a catch, keeps the contents from falling out.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

General Manager (Gas Engineers). No. 5313.
Draughtsman. No. 5315.
Draughtsmen (Junior and Senior). No. 5319
Working Manager (Midlothian). Applications to Messrs. Wishart and Sanderson, Edinburgh.
Traveller (Burners). No. 5316.
Accountant Clerk. No. 5317. Applications by Nov. 21.
Working Foreman Gas Fitter, &c. Shanklin (I. of W.) Gas Company.
Man for Maintenance Work. Ilfracombe Gas Company.
Foreman Stove and Meter Repairer. No. 5318.

Situations Wanted.

General Manager (Gas Fitting, &c., Trade). T. L. Cuttell, Stockton-on-Tees.
Distribution Inspector and Salesman (Home or Abroad). No. 5314.

Plant, &c. (Second-Hand), for Sale.

Experimental or Test Gasholder and Tank. Clayton, Son, and Co., Hunslet.

Stocks and Shares.

Barnet Gas and Water Company (by Auction). Dec. 6.
Bristol Gas Company (by Auction). Dec. 8.
Pinner Gas Company (by Auction). Nov. 22.
Southend Water Company (by Auction). Nov. 22 and Dec. 6.

TENDERS FOR

Gasholders, &c.

Dudley Gaslight Company. Tenders by Nov. 21.

Pipes, &c.

Rhondda Urban District Council. Tenders by Dec. 1.

Purifiers.

Dunedin (N.Z.) Corporation. Particulars of T. Cole and Son, Westminster. Tenders by Jan. 25.

Steel and Ironwork, &c., for Retort-Bench.

Sheffield Gaslight Company. Tenders by Dec. 6.

Sulphate of Ammonia Plant, &c.

Sutton-in-Ashfield Gas Department. Particulars of Messrs. Corbet Woodall and Son, Westminster. Tenders by Dec. 6.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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See Illustrated Advertisement, Oct. 25, p. 238.

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It is also used for the enrichment of Gas.

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Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

GAS Tar wanted—3000 Tons for Year. Offers to be sent to Chemische Fabrik für Teerprodukte und Dachpappen, G.m.b.H., Campe by Stade, Germany.

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Address No. 5314, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a reliable Traveller for Inverted Gas-Burner Business. Must be a Thoroughly Experienced Man.

Apply, by letter, to No. 5316, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, at once, a Smart Young Man for MAINTENANCE WORK. Must have Knowledge of up-to-date Methods.

Apply, stating Age and wages, required, to the Manager, Gas-Works, Ilfracombe.

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Apply, by letter, with *copies* of Three Recent Testimonials, stating Age, and Salary required, to No. 5313, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

MANAGER (working) wanted for a Small Town in Midlothian. Consumption, about Four Millions. Must be a Competent Fitter. Wages, £75 per Annum, with Good House, Coal, and Gas.

Apply, stating Age and Experience, to Messrs. Wishart and Sanderson, W.S., 23, Rutland Street, Edinburgh.

WANTED, a Competent Gas-Fitter as WORKING FOREMAN GAS-FITTER, CANVASSER, and MAINTENANCE INSPECTOR, for the Shanklin (I. of W.) Gas Company.

First-Class men only need Apply.

Apply, by letter, giving Particulars of Training, present Employment, and Wages required to Frank C. Taylor, Engineer and Secretary.

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Apply, by letter, stating Age, and Experience, &c., to No. 5319, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a Gas Company near London, a FOREMAN for Gas Stove and Meter Repair Shops. Applicants must have had Experience in this kind of work and thoroughly understand all branches, including the proper adjustment of Gas Apparatus of all descriptions.

Apply, by letter, stating Age, Qualifications, and Wages expected, to No. 5318, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Senior Accountant Clerk, thoroughly conversant with Books and Accounts of a large Gas Undertaking (South of England). Shorthand an advantage but not a necessity. Accurate and quick at figures. Age not to exceed 35 Years.

Applications, in own handwriting with *copies* of not less than Three recent Testimonials, to be sent, not later than Nov. 21, to No. 5317, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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Address No. 5310, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.

STORAGE TANK, 18 ft. long, 13 ft. 6 in. wide, 6 ft. deep, of ⅜-inch thick Boiler Plate. Also CAST-IRON TANKS. Inquiries Solicited.

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GAS-PURIFIERS

THE City Corporation of Dunedin, New Zealand, invite TENDERS for the Supply and Delivery at Dunedin of one Complete Set of PURIFIERS, consisting of Two Boxes, each 30 feet by 30 feet by 5 feet deep.

Plans and Specification may be seen at the Offices of Messrs. Thomas Cole and Son, Civil Engineers, 11, Victoria Street, Westminster, S.W., between the hours of Ten and Five any week day (except Saturdays.)

Tenders are to be addressed to the Town Clerk, Dunedin, New Zealand, and to be received by him not later than the 25th of January, 1911.

SUTTON-IN-ASHFIELD URBAN DISTRICT COUNCIL.

GAS-WORKS EXTENSION.

TENDERS are invited for the Supply, Erection and Setting to Work of a SULPHATE OF AMMONIA PLANT, having a capacity of 20 Tons Liquor per diem, with all Accessories Complete, at the New Gas-Works.

Drawing, Specification and Form of Tender can be obtained from the Engineers, Messrs. Corbet Woodall and Son, of Palace Chambers, Bridge Street, Westminster, S.W., upon the payment (by Cheque only) of a deposit of £2 2s, which will be returned on receipt of a *bonâ-fide* Tender.

Tenders on the Form supplied are to be delivered not later than Ten a.m. on Tuesday, the 6th day of December, 1910, addressed to the undersigned and endorsed "Tender for Sulphate of Ammonia Plant."

The lowest or any Tender will not necessarily be accepted.

John D. Fidler,
Clerk to the Council.

Council Offices,
Sutton-in-Ashfield, Notts.

TOWN OF DUDLEY GASLIGHT COMPANY.

TENDERS FOR GASHOLDERS.

THE Directors of the above Company invite TENDERS for the Cutting Out of an existing SINGLE LIFT GASHOLDER, 100 feet diameter by 26 feet deep, with Guide Framing, and for the Supply and Erection of a TWO-LIFT GASHOLDER in existing Tank, at the Gas-Works, Dudley (Inner Lift 97 feet diameter by 26 feet deep; Outer Lift, 99 ft. 6 in. diameter by 26 feet deep), with STEEL GUIDE FRAMING Complete.

There are a limited number of Sets of (three) Prints, together with Copies of Specification, to be had on Application to the undersigned on payment of the sum of £1 1s. per Set, or Copies of Drawings and Specification may be taken at the Company's Offices, Gas-Works, Dudley.

Sealed Tenders, to be delivered on or before Twelve noon on Monday, the 21st day of November, 1910, addressed to the Chairman, Town of Dudley Gaslight Company, Gas Offices, Dudley, and endorsed "Tenders for Gasholders."

The Directors do not bind themselves to accept the lowest or any Tender.

T. E. Stillard,
Secretary.

Gas-Offices, Gas-Works,
Dudley, Oct. 26, 1910.

TO ENGINEERS AND IRONFOUNDERS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for STEEL AND IRONWORK for Twelve Settings of Ten RETORTS, at their Neepsend Works, as follows:—

For the Supply and Delivery only of CAST-IRON BUCKSTAY SHOES, ASH PANS, AND FURNACE FITTINGS.

For the Supply and Erection of STEEL AND IRONWORK, consisting of Rolled Steel Joists, &c., forming Floors and Bench Framing.

For the Supply and Erection of STEEL AND IRONWORK in Hydraulic Mains, Ascension Pipes, Chequer Floor Plates, Gas and Tar Mains, &c.

For the Supply and Delivery only of 232 Self-Sealing RETORT MOUTHPIECES, 24¼ in. by 16¼ in. ◠ shape.

Drawings may be seen and Specifications, with Forms of Tender and Quantities, obtained, on and after Nov. 17, on Application to the Engineer, Mr. J. W. Morrison, at the Company's Offices, Commercial Street, Sheffield.

The Directors do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed, must be Delivered by post to Mr. Hanbury Thomas, Managing-Director, not later than the first post on Tuesday, the 6th day of December.

Wm. Hamby,
Secretary.

Commercial Street,
Sheffield, Nov. 10, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the

PINNER GAS COMPANY, LIMITED.

NEW ISSUE OF 800 £5 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 22, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Executors of Solomon Blaiberg, Esq., decd.

SOUTHEND WATER-WORKS COMPANY.

200 £10 NEW ORDINARY FIVE PER CENT. MAXIMUM SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Nov. 22, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF £5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 6, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the

BARNET DISTRICT GAS AND WATER COMPANY.

NEW ISSUE OF £10,000 "D" CAPITAL WATER STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 6, at Two o'clock, in Lots.

Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

THE BRISTOL GAS COMPANY.

GEO. NICHOLS, YOUNG, HUNT, ALDER, and CO. are instructed to SELL BY PUBLIC AUCTION, at their Sale-Room, 49, Broad Street, Bristol, on Thursday, the 8th day of Dec., 1910, at Three p.m. precisely, in Lots of £100 each, or less,

£15,000

FIVE PER CENT. MAXIMUM GENERAL CAPITAL STOCK, and

£10,000

NEW DEBENTURE STOCK,

(Bearing *INTEREST AT THE RATE OF FOUR POUNDS PER CENTUM PER ANNUM*, payable Half-Yearly, in June and December),

of and in

THE BRISTOL GAS COMPANY,

Issued by the Company under their Statutory Powers.

The Stocks will be Sold and Registered in the Books of the Company *FREE OF EVERY EXPENSE* to Purchasers thereof.

Full Particulars and Conditions of Sale may be obtained of the Auctioneers, 49, Broad Street, Bristol; Mr. T. D. Sibly, Solicitor, Exchange, Bristol; or of

John Phillips,
Secretary.

Chief Offices: Colston Street,
Bristol.

RHONDDA URBAN DISTRICT COUNCIL.

New Water-Works.

MAIN THROUGH BLAENRHONDDA TUNNEL.

THE Rhondda Urban District Council are prepared to receive TENDERS for the Supply of about 675 Tons of CAST-IRON PIPES, 22 inches internal diameter, 12 feet long, together with about 25 Tons of BENDS, SPECIALS, and GRATINGS for same, all to be delivered at the North Dunraven Siding, Taff Vale Railway, Rhondda Branch.

A Copy of the Specification and Form of Tender, with a Schedule of Quantities, may be obtained, on and after the 9th day of November, 1910, at the Office of Mr. Joseph Vevers, the Engineer, the Water-Works Office, Treherbert, Rhondda, upon production of a receipt, signed by the Accountant of the Council, for the required deposit of Two Guineas, which deposit will be returned after the receipt of a *bonâ-fide* Tender, with all the Items in the Schedules Fully-Priced out, but will be Forfeited in case of withdrawal of Tender after Acceptance by the Council.

Sealed Tenders, addressed to the Chairman of the Water-Works Extension Committee, at the Council Offices, Pentre, Rhondda, endorsed "Tender for Cast-Iron Pipes, &c.," must be delivered at my Office not later than Ten a.m., on Thursday, the 1st day of December, 1910.

The Council do not bind themselves to accept the lowest or any Tender.

Dated this 8th day of November, 1910.

W. P. Nicholas,
Clerk of the Council.

The Council Offices,
Pentre, Rhondda, Glam.

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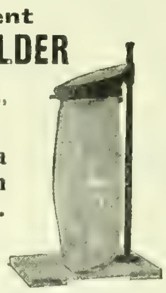

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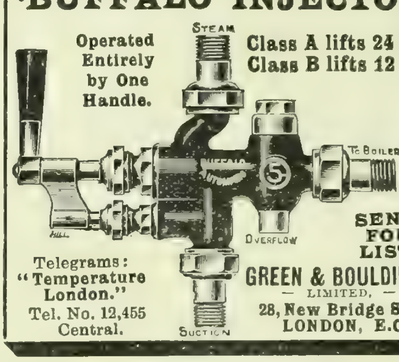

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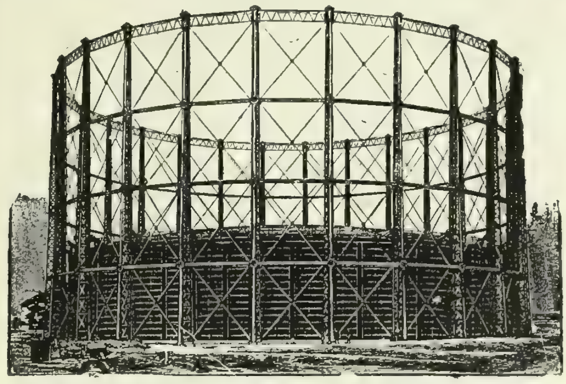

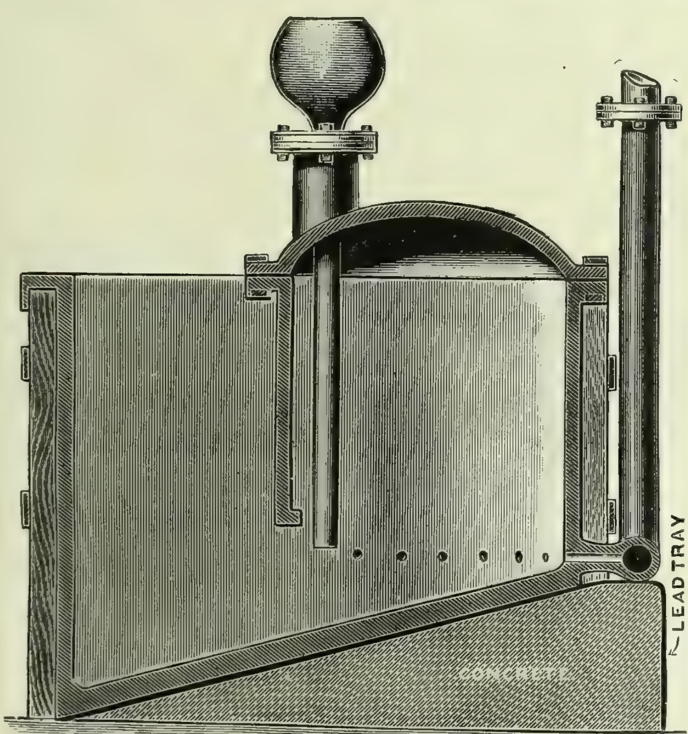
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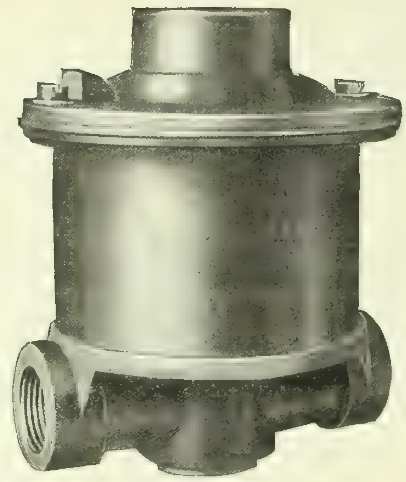
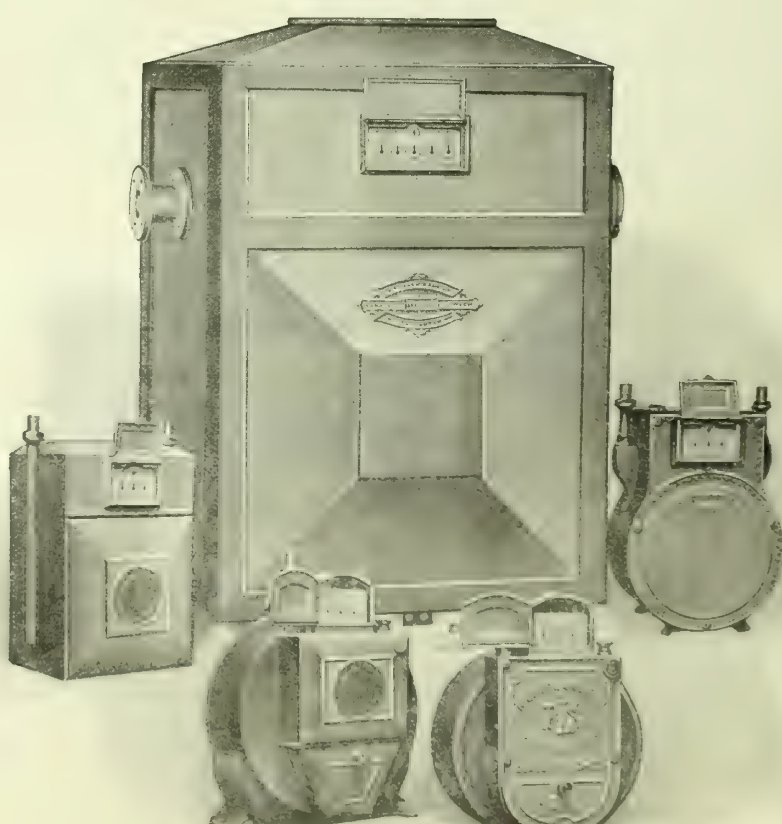
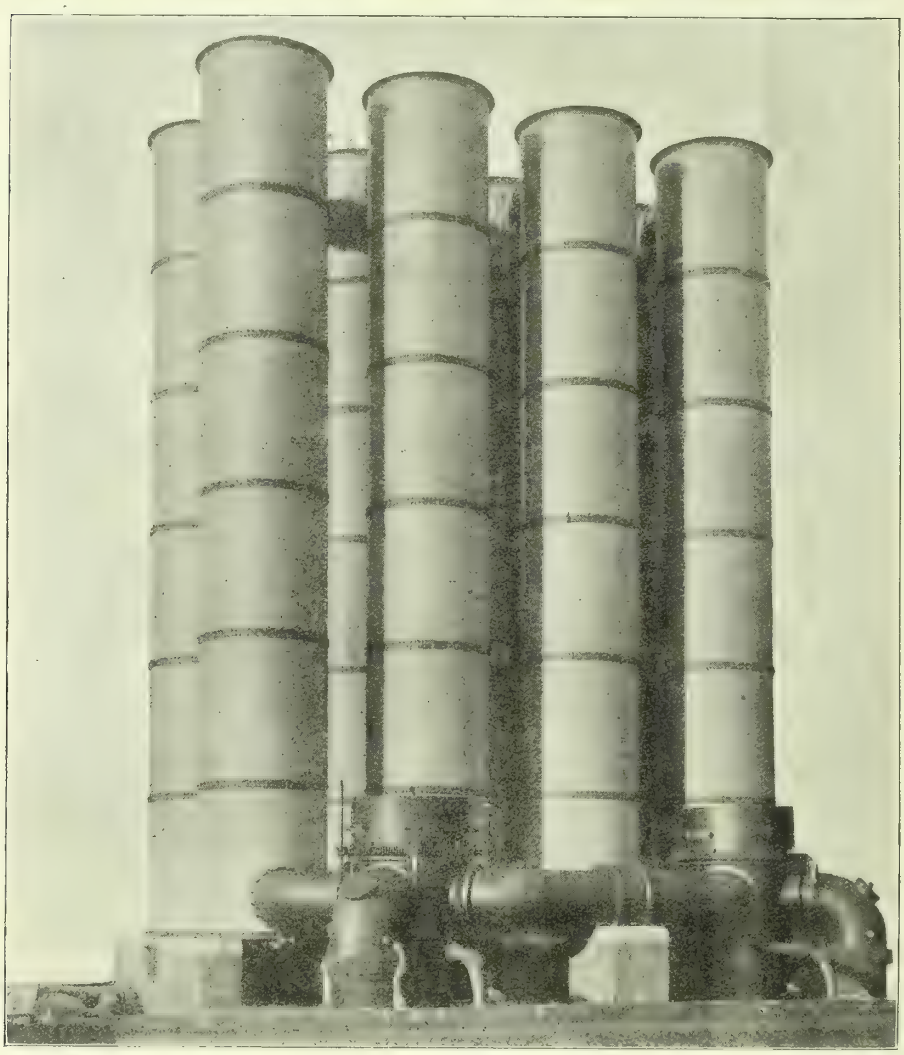




Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Nov. 15, 1910.

THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

Vol. CXII. No. 2480.] LONDON, NOVEMBER 22, 1910. [62nd Year. Price 6d.



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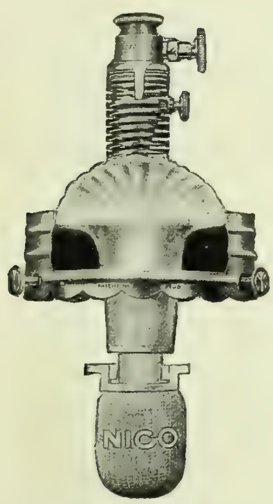

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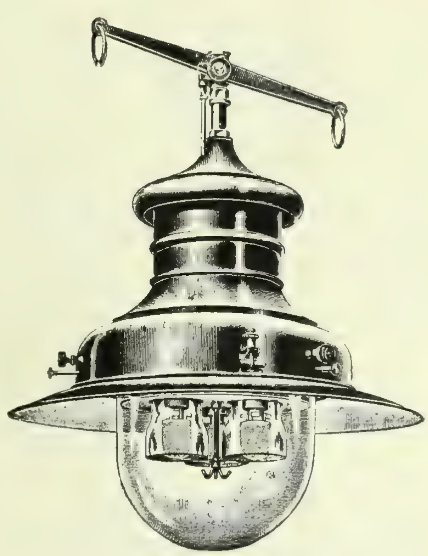

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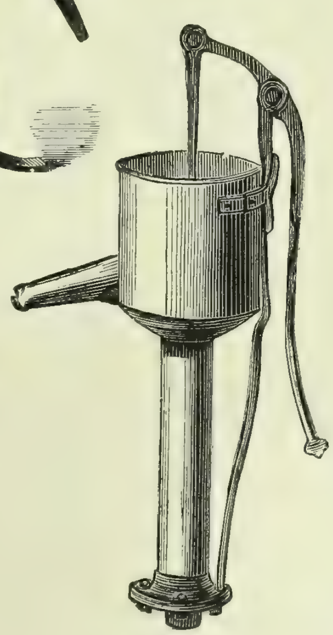

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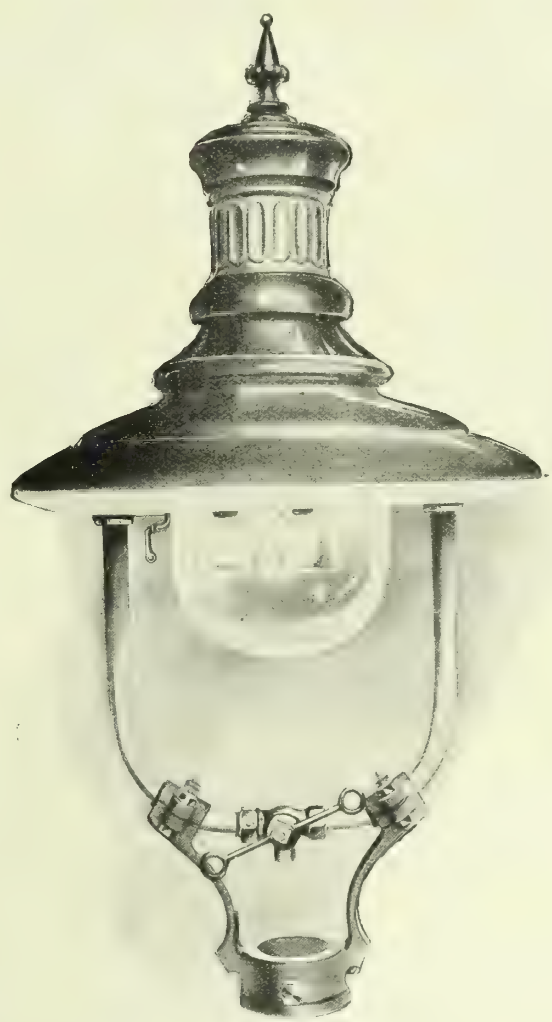

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2480.——TUESDAY, NOVEMBER 22, 1910.

EDITORIAL NOTES—GAS, &c.

A Grand Conquest.

The Standard Burner Bills Passed by the Commons.

In the annals of gas legislation, last Tuesday will stand conspicuous as the day when Parliament practically set its seal on the rightful claim of the gas industry to a standard test-burner that does justice to the gas supplied, and that is suitable for common application. Perseverance has a conquering habit. In this case, the fight has been long and vigorous; and the last stage in the Commons coheres with the unqualified success that has attended the promoters throughout, and is a silent but significant comment on the simulated indignation and fury of the opposition during the whole course of the Bills through Parliament. In this there is subject for much meditation on the part of authorities who were incited to add their strength to the small number of those who were really hostile. The promoters are to be heartily congratulated on the complete rout of the opposition; and to all those who in any way rendered assistance in preparing to meet the further threatened resistance to progress, the thanks of the gas industry are due. It is a magnificent victory; and the good effect on the progressive affairs of the industry will be enduring. Not only has it completely vindicated the right of companies to combine in a joint promotion for a common benefit, but it has demonstrated the fact that Parliament will not be slow to redress any real grievance oppressing a great statutory industry if the grievance is clearly, fairly, and courageously put before them.

The utter collapse of the opposition on consideration and third reading was a complete surprise. It was known that there had been happenings at Liverpool—though this was the active source of instigation to further organized hostility—that had caused the withdrawal of the Corporation from further participation in the attempts to inflict fatal or crippling injury on the measures. There were still, however, the remaining municipal authorities, and there were the Members of the House who had been approached to take up the opposition upon their account. But when the Speaker put the motion for the consideration of the Bills, following up with commendable celerity with a motion to suspend certain Standing Orders so as to enable the Bills to pass immediately to the third reading stage, not a dissentient voice was raised. We are not at all inclined to think that the Liverpool withdrawal had anything to do with the total non-appearance of opposition in the House; as a matter of fact, by a little twist, and making use of appearances rather than of facts, the Liverpool settlement might have been used for the purpose of claiming, on behalf of other authorities, that amending concession should be incorporated in the Bills. In our opinion, the real explanation of the complete disappearance of the opposition in the House may be found in some remarks made in these columns a fortnight since, when urging that all gas companies should contribute any influence that might be within their power to secure the co-operation of Members of Parliament in resisting the attempt to subvert the deliberate verdicts of Committees of both Houses. We then wrote: "Their [the opponents'] action, after the fair "trial of the question in both Houses, is nothing short of "an iniquitous attempt to degrade parliamentary pro- "cedure in respect of Private Bill Legislation. . . . "We hope Members of Parliament will rise superior "to the singularly false position in which the vindic- "tiveness of the opponents of the Bills seeks to place "them." We can quite imagine that, when Members were asked to oppose the Bills at this stage, and, on due inquiry, found that they had (after a stubborn contest) passed unscathed the Committees in both Houses, they would hesitate to help any opponent to play the proposed contemptible game of endeavouring to wreck the Bills, or of wringing some concession from the promoters for no better reason than that the opposition had signally failed to achieve their object after a patient and searching inquiry by two Committees of the Houses of Parliament. The political crisis into which the country has been precipitated might well have placed the Bills in dire peril but for the carefully thought-out strategy of those responsible for the conduct of the measures, which resulted in their being passed with dramatic swiftness out of harm's way, and returned to the safe haven of the House of Lords.

In the midst of the gratification over the success of the measures, we are also happy to know that more harmonious relations now exist between the Liverpool Corporation and the Gas Company; and it is hoped that the Corporation will henceforth take a more enlightened view of the legitimate line of advance of the gas industry than they were manifestly taking but very recently. Another point of satisfaction is that these harmonious feelings have been brought about entirely irrespective—we desire this to be particularly marked—of the Standard Burner Bills, although, as a necessary consequence of the understanding arrived at, the Corporation could not persist in participating in any further hostile action against the measures. But this has also to be clearly acknowledged—that the Liverpool Gaslight Company, in composing their differences with the Corporation, were honourable and loyal to their fellow-promoters; for the arrangement that has effected peace with the Corporation was made subject entirely to the approval of all the co-promoters. Had it been found that there was anything about the agreement that was prejudicial to their fellow promoters, then the sign-manual of the Company would still have been wanting at the foot. But happily there was nothing in the proposal mischievous to those with whom the Company stood shoulder to shoulder in the fight, nor to the gas industry in the future; and it therefore received the benevolent blessing of the general body of promoters.

It has been a great victory; and there is nothing that we need say now as to the importance to the gas industry of the success of the jointly promoted Bills. Their loss would have meant a partial setting-back of the hands of the clock. The gas industry, however, is fortunate in the result; and its thanks are due to those who adhered with so much tenacity to the carrying of the Bills through Parliament, and who—counsel, parliamentary agents, and expert witnesses—gave no opportunity to the opponents to score points, gave them no quarter, and proved the fatuity of their whole proceedings in this connection. While there has been a grand victory for the promoters, there has simultaneously been a grand lesson for the municipal forces in opposition. They were caught in the noose thrown from Liverpool, and were drawn into a conspiracy to oppose a matter that was settled by Parliament now some years past, and to endeavour to prevent the emancipation of the promoters of the Bills from a condition that held them under subjection to something that was not to their or to their customers' economic advantage under the present circumstances. Failure—and deserved failure—has dogged the steps of the opponents through the whole session; and the cost of their Quixotic expedition has no doubt caused others besides the Town Clerk of Hastings to stagger (*ante*, p. 384). From the first, it was a forlorn cause. The opponents were warned and counselled, but without avail. They persisted in their own way, in the face of all that was patent to any ordinary intelligence. They went as straight for defeat as it was possible for them to go; and they have secured it, at considerable sacrifice of money and energy. Some of the opponents recognized the foolishness of the whole proceeding after the contest in the Lords; and it was numerically an emaciated opposition that appeared in the House of Commons, though the remnant was as virulent as ever—possibly through it being constituted mainly of owners of electricity supply concerns. But happily, we believe, this has brought to an end once and for all the struggle over this matter between the gas industry and the municipal calumniators and ill-wishers of private gas enterprise. The victory will be a good thing for the gas industry in the future, and it may be taken for

granted that any Company desiring to adopt the standard burner will be allowed to do so for the asking. We do not expect that any other municipal authorities will care to court the same ignominy that to-day covers those who were the opponents of the Standard Burner Bills during the present session.

Changing the Geographical Boundaries.

THE Gaslight and Coke Company are, in the coming session of Parliament, proposing to annex additional territory, and so provide themselves with fresh breathing places on their present borders. The proposition now before us is, so to speak, the reasonable and expected sequel to the absorption of the West Ham Company's area in the session of 1909. That was a piece of statism that was generally approved as wise by competent judges. That expansion, however, added to the boundaries of the Gaslight Company an area that is already well populated, but it carried their borders up to more open areas, with prospective developing potentialities which would supply them with desirable outlets. Two of these areas—those of the Barking Gas Company and the Chigwell, Loughton, and Woodford Gas Company—it is now proposed to amalgamate with the Gaslight area, or to purchase outright. On annexation, it will follow as a natural consequence (provision for this will be made in the Bill) that the controlling conditions applying to the Gaslight and Coke Company's supply will come into force in the areas. Assuming amalgamation, the shareholders of the two Companies will be immediately in an equally good condition to that occupied by them at the present time, with all the prospective economy and opportunities that are inherent to a concern possessing such large resources as those of the Gaslight Company; and, having regard to the lower price of gas in the area of the latter, the customers of the two small Companies may look to deriving advantage in connection with price compared with their present position. From their point of view, the consummation of the scheme is a thing to be desired, though there is indication in the notice of the Bill to be promoted that there must be no expectation of a single flight down to the Gaslight price. A provision will appear to the effect that "any differential price to be charged in the areas now " forming the limits of supply of the two Companies, shall " not be taken into account in ascertaining the rate of divi- " dend payable by the Gaslight Company upon their ordinary " stock under the provisions applicable to that Company " with respect to the sliding-scale of price and dividend." The immediate benefit to the Gaslight Company is not, of course, so valuable as the prospective. The total annual sale of gas in the two areas is probably at present only about 270 million cubic feet, and the number of consumers—ordinary and slot meter—aggregate 10,000 or upwards. The last record in hand shows the share capital (10, 7, and 6 per cent. dividends) of the Barking Company to be £102,000, and 4 per cent. loan £36,260; and the issued consolidated 5 per cent. stock of the Chigwell, Loughton, and Woodford Gas Company to be £106,500, and 4 per cent. loan £14,100. Information as to the other purposes of the Gaslight Company's Bill will be found in the digest of the notice published in another column.

The Antiquated in Gas Lighting.

IN this year 1910—something like three decades after the incandescent gas mantle appeared on the horizon of the gas industry's view—it is one of the surprises arising from our journalistic work that there should be such frequent meeting with instances of considerable numbers of flat-flame gas-burners still occupying positions in the lighting of streets and of public and other large institutions. It may be contended that this is not the fault of the suppliers of gas, but rather of the controlling local authorities. We are not prepared, in view of experience of what has been done elsewhere, by initiative and perseverance, to admit the contention as being in all cases valid or as serving as a sufficient excuse. Lethargy and want of diplomacy on the part of gas suppliers concerned have a part in the survival of the antiquated in gas lighting of which complaint is made. Before us now is a case in which there is a proposition on the *tapis* for the conversion to electricity of 500 public gas-lamps and a relatively large saving is predicted by adopting electric metallic filament lamps of only 32-candle power. As the matter is investigated, it is found that only 100 of the gas-lamps have been converted to the incandescent form. What is the result? Comparison of cost and street-lighting efficiency is now being made between the metallic filament lamps and gas-lamps four-fifths of which are of the flat-flame type; and the result must inevitably be that the local authority will look favourably upon, and public opinion will incline to, the proposed conversion to electricity, unless (if the matter has not already gone too far) the gas suppliers bestir themselves and offer, as they are quite in a position to do, an improved and economical form of lighting that will put the metallic filament lamp out of the running. Even then they expose themselves to the shaft of sarcasm as to the stimulating effect on them of well-directed competition. We do not believe in, nor have we any sympathy with, this lack of initiative on the part of gas suppliers until they are forced, by the activity and the superior diplomacy of their competitors, to move from the corners in which they have been ensconced. Their inertia brings upon them loss of prestige and business, and harms the gas industry generally by the advertisement given to the apparent savings, without announcing them to be the results, not of the incompetence of modern means of gas lighting, but of a witless policy on the part of the gas suppliers. Nemesis is sure, under such circumstances, to have her day; and for the result the blame must be upon those who are in fault. In competitive business, the proper thing is to fortify to the full extent of one's ability, so as to make things as difficult as possible for the competitor.

There are, we know, some local authorities who deliberately place obstacles in the way of improvements being effected in public gas-lighting when they are interested in the electricity undertaking; but all local authorities are not, of course, obstructive. If it can be shown that change means at once economy and improvement in lighting efficiency, it requires a local authority of peculiar nerve and power who will care to face the uncomfortable consequences of appearing before the ratepayers without some rational explanation for rejection. However, most local authorities welcome suggestion of the kind; and few, unless electrically bound, would refuse a demonstration on the part of the gas suppliers as to what they are able to do in the way of betterment. We never forget, as a worthy and shining example of diplomacy and commercial acumen, the system inaugurated in South London by Sir George Livesey (and the policy has been continued in the making of further improvement) of offering to convert the public lamps for the realization of an advance in efficiency and economy in costs, and to pay for the change by the economies effected over a term of years. That was a statesmanlike move; and the result is that we undertake to say that, in proportion to the mileage of streets through which electric cables run, there are fewer street electric lamps in South London than in the cabled thoroughfares of most populous cities and towns. The Gaslight and Coke Company have also worked wonders by showing local authorities how they can secure economy and higher efficiency through exchanging old lamps for new, and by offering to them an easy instalment plan for the payment of the initial cost. It may be said that these two Companies, with their abundant resources, are in a better position in this matter than the smaller of the provincial gas companies. They are not a tittle the better off. The economies and efficiencies of modern gas-lamps for ordinary pressures are as much protective weapons at the service of the small as of the large companies; and, in their own interests, all companies should press for, and assist their adoption throughout their districts.

We see all round that, where gas companies are content with a *laissez faire* policy, there electric light has easier entry, and figures, unfortunately, are made to look serious against gas by comparison of the old-fashioned in gas use with the new in electricity use. The competitors know well the weak spots. Much business, in streets and large institutions, has been lost through indifference and negligence in not pressing improvements upon the notice of the local authorities. Let every effort be made to remove the disadvantage placed upon gas in these days of more strenuous competition by (where these have existed) a past lethargy or an inadequately developed commercial diplomacy and policy. The year 1910 has now almost run its course. It should end with a strong resolution in those places to which reference is directed here, to set at once to work in a serious attempt to weed out antiquated means of lighting, and to get them supplanted by modern means, or at any rate to get a sample lamp or burner of new type installed. If at first there is not success, then there is the excellent advice of the old couplet to follow—"try, try, try again." Not long ago, the Chairman of the

Imperial Continental Gas Association made the boast that, in Berlin, they could not, in any place of ordinary use, find a single flat-flame burner in existence. All had been changed to the incandescent type. Why should not the same be the condition elsewhere ?

Ferranti : Idealist and Visionary.

We have been in the habit of looking upon Mr. S. Z. de Ferranti as being in most things original ; but in the address that he delivered, in his capacity of President of the Institution of Electrical Engineers, at the meeting inaugurating the new session's work, he simply trod in the path worn by good men before him, but who were occasionally inclined to soar from the land of practical aims and work to realms of impracticability. He has taken a fancy for the pithead (in various parts of the country) as being the proper place for the generation of electricity ; transmitting the current thence by a cobweb of cables to all parts of the country for the supply of energy, heat, and light. Siemens and others long ago, and more recently Sir Oliver Lodge, suggested that the same thing might be done in regard to gas supply ; and the late Mr. B. H. Thwaite, some years ago, sketched, before the Royal Commission on Coal Supplies, a plan which his enthusiastic nature had evolved for generating electricity at the South Yorkshire coal-fields for the supply of London and towns *en route*. Therefore in this matter the President of the Institution of Electrical Engineers cannot claim any fresh conception.

Mr. Ferranti's main reason for desiring to see the projected change is a benevolent consideration for the economy of the nation. The starting-point is a most laudable one ; but beyond that Mr. Ferranti completely collapses in the attempt to construct a case for giving material effect to his vision. If he proves anything at all, it is that the gas industry at the present time is employing the coal it uses to better economic advantage than the electricity or any other industry. He believes that, taking all the uses of coal into consideration, we are only getting back an amount represented by useful work of one kind or another of much less than 10 per cent. of the energy in the coal ; and the throwing away of 90 per cent. is a matter for the gravest concern. But this presentment of the average—whether true or not—does not apply to all the uses of coal. It would not apply to the coal consumed in the production of town gas ; and reading with care the case that Mr. Ferranti puts forward in favour of electricity generation by concentration at the pithead, it is quite clear that, of all the processes in which coal is employed to-day, the one by which town gas and a number of valuable secondary products are realized is the one that is most beneficial in its total yield of the original contents of the coal. This cannot be said for steam-driven electricity generating plants. Speaking, generally, Mr. Ferranti says : "We now "dissipate nearly the whole of the valuable bye-products "contained in the coal." That is not so in the case of coal carbonization for the production primarily of gas ; and from whatever standpoint the matter may be examined, it seems abundantly plain that if on economic and utilitarian grounds pithead conversion of the coal were really desirable in the interests of the country, a scheme of gas supply would be a more rational method than one that goes the step further into electricity generation.

What Mr. Ferranti dreams of is the treatment of the coal at central stations at the pithead, converting it into gas and other products, and then again converting the gas into electricity for use all over the country for light, power, heat, and chemical action, as and when required at any point. But there are certain conditions to success that he has not yet fathomed. The conversion of the coal into electricity and its distribution must be effected at a low capital cost. How this is to be accomplished, he does not sufficiently explain. He has also arrived at the conclusion that a heat conversion efficiency of at least 25 per cent. must be obtained if the scheme is to be a success. But he is not very positive as to whether such a conversion efficiency can be obtained in practice, though in gas-engine driven alternators there is a system which is theoretically capable of returning 25 per cent. of the energy in the coal in the form of electricity. He believes a load-factor of 60 per cent. could be secured. His faith is great. The estimated capital cost of generating-stations is placed by him at 175 millions sterling ; the capital cost on the distribution system is an unknown quantity. But he makes the round figure of 500 million pounds as the total capital cost by putting down 325 millions for the distribution system. We will not enter into all the visionary financial structure. But it may be mentioned that 60 million tons is the calculated annual consumption of coal ; and this would yield (it is a modest estimate) 3 million tons of sulphate of ammonia. This large-scale production, however, it is thought, would knock down the price to £8 per ton. Thus the sulphate produced would yield 24 millions sterling ; and this would reduce the cost of the coal (reckoned at 10s. per ton) to 6 millions sterling. He also assumes that the electricity would be supplied at an average price of ⅛d. per unit throughout the country. Among the effects would be a saving of 80 to 90 million tons of coal a year ; food, through the abundant production of a fertilizing agent, would be produced cheaply ; labour would be saved ; manufactures would be stimulated. There is thus a glorious future in store ; the world bows its knee to the great Ferranti. So enamoured is he of the project that the more he thinks over it, the more he is convinced that, "at the present rate of progress, the all-electric "idea, with its far-reaching changes and great benefits, may "become an accomplished fact in the near future." That is the point at which Mr. Ferranti (whose record contains much good work, and, as is only human, some mistakes) has arrived ; and if his best friends can advise him to leave off thinking further about it, they may prevent worse consequences than the mere putting of the scheme upon paper and in the records of the Transactions of the Institution of Electrical Engineers.

As, however, Mr. Ferranti went so far, we should, out of pure interest, have liked him—equally unprofitable though it would have been—to have examined the proposal in comparison with an all-gas scheme, in order to have ascertained his views as to whether the latter would be more economical in cost, and of greater value to the nation at large in respect of heat efficiency. Further in relation to the all-electricity scheme, he has not carried far enough his inquiry into the aspect of economy. All the existing capital invested in both the gas and electricity industries as existing would have to go, for gas and the local electricity systems would be absolutely useless ; many of the present conditions appertaining to these industries in regard to the distribution of labour and work, and local earning and spending power, in the towns throughout the couutry, would be destroyed ; the big contributions of these industries to the local exchequers would not be adequately counterbalanced—in short, many radical changes would be effected, all bearing on the economic side of the matter. The ultimate economy is, however, not settled by an airy sketch of the immediate design and the immediate consequences of such a scheme ; the question is more far-reaching than that. But there we will leave the scheme, with an apology for touching it at all. But the excuse must be that Ferranti, President of the Institution of Electrical Engineers, seriously claims consideration for it.

Healthy Signs.

From various quarters there has come information that the current half year for the gas industry will prove to be one of which there will be no need to complain. Gas consumption has, at any rate in cases in mind, had its increase ; and the cold weather (with, in London, a dense fog last Thursday) should, in view of the progress in gas-fire installation, enable the half year to wind up in a manner that is particularly cheering to the industry, subject to there being no wide departure from seasonal expectation. Residual products, too, have been maintaining a good position, and should be found in most cases to have rendered substantial aid. That the proprietors of the Gaslight and Coke Company will have no cause for anything but gratification over the half-year's working is adumbrated by a coming event, resolved upon by the Board of Directors at their meeting last Friday—that is, a further penny reduction to consumers from the taking of the meter indices in December ; making the price 2s. 7d. per 1000 cubic feet. Half-a-dozen years ago, a man who prognosticated that the Company incorporated potentialities that, developed, would allow of the price in a quinquennium being reduced by 4d. per 1000 cubic feet would have been looked upon by not a few as a person bereft of reason. But the apparently impossible has been proved to be materially possible.

At the last meeting of the proprietors, there was prediction on the part of the Governor (Mr. Corbet Woodall) as to a further penny being taken off the price. "Looking at "all the circumstances," he remarked, "I can safely promise "that the price of gas will be again reduced from Christmas "next." This reduction is worthy of special note, because it includes the district of the defunct West Ham Company,

one important local authority in which area were, or pretended to be at one time, dubious as to the security of the position of the local consumers in relation to progressively cheap gas under the Gaslight and Coke Company. Their fears have doubtless now been set at rest. But the annexation of the West Ham area has swollen the aggregate sum of a penny reduction. In the Gaslight area as it existed before amalgamation, it was estimated that 1d. per 1000 cubic feet was equivalent in the total to £80,000 a year; now it may be reckoned, including the West Ham area, that 1d. per 1000 cubic feet means £90,000. Therefore, the three penny reductions in the Gaslight area prior to the present one represent together about £240,000 a year; and, adding the £90,000 next year, a sum of £330,000 will approximately represent the reduction from the amount the consumers are asked to pay for the quantity of gas consumed in contrast with five years ago. This shows the latent strength the Company possessed; but it required someone to discover it who knew how to utilize it. Other changes in price may, we believe, be looked for in and near the Metropolitan area from the end of this half year.

Stagnant Conditions and Differential Prices.

In an article contributed recently to our columns by Mr. R. W. Edwards, of Aldershot, there was illustrated the stimulating effect of a price (using a discount or rebate meter) for cooking and heating lower than that for lighting in districts where conditions exist that are not particularly encouraging to the adoption of gas for the two former purposes. Confirmation comes from Mr. H. J. Woodfine, of Wellington, Salop. This is a small town of slow growth in an agricultural district, in which the people are (as usually happens in such areas) a bit conservative in regard to making departure from some of the ways of their forefathers. Cooking by gas was for long there a plant of stunted growth; but Mr. Woodfine took the matter in hand, and convinced his Directors that they had got to show the people it would be worth their while to adopt gas for cooking, and that the best way to do this was to sell gas for the purpose at 2s. 6d. per 1000 cubic feet as compared with 3s. 6d. for lighting—using the discount meter for the purpose. Work was inaugurated on the lines proposed. Result: The growth of the plant was stimulated; and it has borne luxuriantly during the last four years. All—consumers and shareholders, and (we hope) Mr. Woodfine as well—have reaped benefit. Lighting and power prices have been reduced, and dividends have been increased. These things would not have happened without the extension of business, which was only attainable this one way. The actual figures are given in the article. Mr. Woodfine need not worry himself as to whether or not differential prices are equitable. It is sufficient for him that they have removed stagnant conditions, and have, in the result, conferred advantage broadcast in the town. That is of more importance than fidelity to a principle that, under the conditions of the town, meant stagnation and not progress of the gas business. The experience is recommended to others similarly circumstanced.

The Inverted Burner in Berlin

The lighting of Berlin is often quoted by gas people, and just as frequently the electrical people try to reduce the importance of the trend of affairs there by claiming all sorts of vague things for the relatively small share the electric light has in the illumination of the streets. An interesting article, communicated by Mr. Richard Hentze in another column, exactly defines the present position of the two illuminants in Berlin streets. Briefly, their relations are that 313 miles of street are lighted by high and low pressure gas-lamps, and only 19 miles by means of electric lamps. During the last five years, high-pressure gas lighting has netted a gain of 27 miles of streets; the electric light, only 1½ miles. These figures speak volumes as to which is regarded as the favourite form of lighting for the city; and it is the inverted lamp —of the high and low pressure forms—that has turned the city authorities so completely in favour of gas lighting. The figures quoted are remarkable; those pointing to the ascendancy of the inverted burner are no less so. In the city alone, at the end of this year, there will be gas-lamps with an aggregate illuminating power of upwards of 8,000,000 candles, of which more than 5,200,000 candles, or 62 per cent. of the total, represent high and low pressure inverted gas-lamps. The remaining vertical burners are to be converted to the inverted type. Mr. Hentze's article is short; but its length is no criterion of its interest and value.

And In Fogs.

Thursday was a day of, during several hours, dense fog throughout the larger parts of London streets; and the "Evening News" sent out representatives to see how the lights of London —new and old—were behaving themselves in a sample of the worst of atmospherical conditions, when their efficiency is put to the severest test. The report of the emissaries appeared in the form of an article the same evening; and the most conspicuous feature is the impression it cannot fail to convey—if we accept as fair and impartial the report of the lay observers—that the only means by which the electrical industry can at all hope to, in point of efficiency, compete in fog with the latest systems of gas lighting is by a lavish use of flame arc lamps. We are not prepared to endorse any idea of an equality in efficiency in fogs; but it is only fair to let the investigators have their say. They went East and West, and report that the lighting systems adopted have at last made vehicular and pedestrian traffic easy and comfortable under the worst conditions.

Extracts from the Report.

Bridge Street is lighted by high pressure incandescent gas-lamps; and the observers say "the contrast between the diffused light and the flickering globes of two old arc electric lights near to Ludgate Hill Station was an object-lesson in the fight between the newest form of gas lighting and the oldest in electricity." In Farringdon Street, flame arc lamps, standing high in the centre of the road, "gave a widely diffused light of a sunshiny character, with no shade." In Fleet Street, "the lamps on the new gas-brackets fixed to the houses shed a white light over the whole area." In Cannon Street, the centrally suspended flame arcs "provided plenty of light, which was thrown evenly all over the road." Observation apparently did not extend to the centrally suspended Keith lamps the opposite end of Cannon Street, the light from which, in addition to covering the roadway and paths, penetrated well along the side streets in the neighbourhood. Beyond the City boundary at Holborn Bars, "one came across an antiquated form of gas lighting. Here, at 25-yard intervals, gas-lamps with ordinary mantles lined the roadway; but their illuminating power in no way compared with the high-pressure gas system of Fleet Street, or the new electric arcs of Cheapside and Holborn." If, in the heart of London, one needed the best example of the difference between ordinary electric arcs and high-pressure gas, one got it at Temple Bar. "On the City side the gas-lamps gave a brilliant light; on the Strand side, the dull looking arc, drooping from a high standard, seemed to hang its head in the gloom, as if ashamed of itself." Further west, in parts of Westminster, the electric light has been replaced by gas. "Along Pall Mall and up St. James's Street the new high-power incandescent gas-lights on high standards down the middle of the road gave a bright and effective light in the fog. From St. James's Street to Piccadilly Circus the electric light standards are being taken down to-day. In Regent Street electricity made a much braver show against the fog than in other parts of Westminster. A new type of light has recently been installed, which is yellower and richer than the white arc light, and penetrates the fog *almost as effectively as the new gas-lights*." Evidently the past in electric lighting, and some of the new types of electric lamps, must (in the opinion of these observers) be discarded to compete with gas in fog; only the very best forms of flame arc lamps being of effective service.

Gas Engineering of the Day.

In other columns is published a paper by Mr. J. A. P. Crisfield on the "Mechanical Engineering Problems in Illuminating Gas-Works." Inasmuch as Mr. Crisfield is Constructing Engineer to the United Gas Improvement Company of Philadelphia, he has had remarkably fine scope for carefully marshalling the considerations, and for selecting the best, that should be applied to the design and technical running of gas-works. The points of his contribution on the subject are too many for full comment. But there is a broad lesson to be extracted from the paper, and it is that no general principles or types or practices can be applied to all gas-works. Each one from design throughout has to be considered in relation

to its own individual characteristics and circumstances. If gas engineering could be reduced to mere forms, then we should have to say adieu to the high rank it has attained in the engineering profession (though inadequately recognized in this country), to individuality, to initiative, to the further application of science to practice, and to many other matters that make for progress. Reflecting upon Mr. Crisfield's paper, there is in it a reminder of the big distance the gas engineer has pushed his work from the constructional and the routine into mechanical engineering. In the large and moderate size works, mechanical operation to-day crowds upon the gas engineer on all sides. In dealing with future economies in gas manufacture, Mr. Crisfield does not think they will be many, or in the total represent much, in view of what has already been done. "What reductions in the cost of the finished product will be made will be accomplished by close attention to the small savings possible in increasing thermal and mechanical efficiencies, and in the substitution of mechanical for human labour. These are problems which will be solved only by the trained mechanical engineer." In this country, the greatest reductions that have been effected in recent years in the cost of the finished product have been through change of practice in the utilization of existing plant, and there is still more to be done in this way. We have not heard much from America as to the use of full or nearly full charges in horizontal retorts, with longer carbonizing periods.

The Forthcoming Coalite Meeting.

The meetings of the shareholders in the British Coalite Company and the Coalite Syndicate should be close at hand; and people are beginning to wonder what the Chairman and Directors will have to say for themselves and their operations during the year. We should imagine from the conspicuous inactivity of the twelvemonth that the report from the Board will be a comparative blank. Perhaps, however, they are keeping up their sleeves some fresh surprise for the shareholders in relation to prospects. The Board have been good at this sort of thing; the surprises and predictions have been equally good at dissolving and vanishing into the air immediately outside the meeting-room doors. We should imagine that the most exciting talk will on this occasion come from the shareholders' side of the table. But something will have to come from the chair; and we would ask Sir William Preece, if he presides at the meeting, not to blame the gas industry for the Company's misfortunes. Assistance has been rendered by gas undertakings at both Plymouth and Hythe. What has happened commercially at Plymouth should assist to form padding for the Chairman's speech; and what has happened at Hythe—well perhaps a veil had better be drawn over the utter fiasco. The Chairman will be able to point, with that pretty jocularity for which he is famed, to the example of the wise and discreet conduct of the affairs of the Company in letting down the Barking plant for some weeks for reorganization and repairs before the winter; and restarting it again somewhere about the beginning of November (as attested by the Company's advertisement contractors, in a letter dated Nov. 8), after the coal-cellars of the British householder had been replenished for the winter season. Among others, we shall look with interest to the meetings a few weeks hence, and not the least part of the interest will be in seeing how gracefully Sir William will manage to avoid knocking himself against the corners and points that he left obtrusively projecting from his speech last year.

Orient Prospects.

The proprietors of the Oriental Gas Company, Limited, are feeling in a felicitous condition to-day over their prospects. It was not long since that they were, for politic reasons, kept by the Board in a state of partial obscurity as to what the future was to be in regard to a most important part of their business—that is to say, the public lighting of Calcutta. But now that the delicate issues attending negotiation have all come to a head, and have been sealed, and a contract for the great city for twenty years lies safely among the valuable property possessed by the Company, there is no longer any need for withholding information; and so the new Chairman of the Company, Mr. H. D. Ellis (who made his first appearance as the successor to the venerable and honoured Mr. R. Hesketh Jones), at the meeting last Wednesday, had a story full of interesting detail to impart to the proprietors as to what is being, and has been, done, to put the Company into a position the better to meet its obligations, and to increase its commercial vigour and opportunity. The tale is worth reading. It tells of no half-hearted measures, but of a full appreciation of needs and of the value of prospects; and what is also of importance it shows that the financial resources of the Company, through careful husbanding in the past, have been equal to all that has been done in plant extensions and renewals (and there is more to be done yet), without adding to the capital account in any way. At the same time, the proprietors have been receiving a good dividend over a long course of years—a dividend that has yielded, at the market price, a return on the investment the highest (with but two or three exception) in our stock and share list. This is not the time to ask for more dividend. The Directors are, through the policy that is being pursued, building about the Company a protection to future interests that is of greater importance than a present addition to the dividend warrants. The Board are to be congratulated on the enlarged prospects that lie before the Company; and the man at the helm in Calcutta—Mr. James C. Watson—with his loyal staff, should be remembered. Sagacity and diplomacy at the seat of active operations have had a large part in placing the Company in a position from which the future can be viewed with complacency. Though the works have required much done to them within a short space in the way of modernization, it must be remembered that, until the new public lighting contract was concluded, a large part of the business of the Company was hanging in the balance. But all was ready, at the right moment, for executing the work required; and the money was in the coffers with which to do it.

New Mayors.—In addition to the new Mayors connected with the gas industry mentioned in the "JOURNAL" last week, we have to record that Mr. W. S. Rowntree, the Mayor of Scarborough, is the Chairman of the Gas Company.

Scottish Junior Gas Association (Western District).—The members paid a visit on Saturday afternoon to the Cadzow Colliery, near Hamilton. In addition to the colliery, the visitors had an opportunity of inspecting very efficient coal-washing plant, by which apparently worthless material is brought into a condition fit for use in furnaces.

Sir William Arrol Married.—The marriage was solemnized at the United Free manse, Doune, Perthshire, last Wednesday, of Sir William Arrol and Miss Elsie Robertson, second daughter of the late Mr. James Robertson, of the National Bank of Scotland, London. Sir William, who is head of the firm of Sir William Arrol and Co., the makers of the Arrol-Foulis stoking machinery, and builders of the Forth and Tay Bridges, was born in 1839. For ten years, till 1906, he represented South Ayrshire in Parliament.

Banquet and Presentation to Mr. Herring.—On Monday last week, the Edinburgh and Leith Gas Commissioners entertained Mr. W. R. Herring at a complimentary banquet at the Caledonian Station Hotel. The company consisted of the present Commissioners, as well as those who have at any time served in this capacity. At the meeting of the Commissioners the same day, Provost Smith mentioned that it was the last meeting to be attended by Mr. Herring as their Chief Engineer and Manager. He reminded the Commissioners of the valuable services rendered by Mr. Herring since he received the appointment on Feb. 15, 1897, and expressed their regret that he had found it necessary to resign it—a regret happily qualified by their retaining his assistance as Consulting Engineer. The Provost assured Mr. Herring that he had their best wishes for the future, and that they were confident he would have a very successful professional career. The Commissioners resolved to present Mr. Herring with an excerpt from the minutes, signed by the Right Hon. William Slater Brown, Lord Provost of Edinburgh, the Statutory Chairman, and by the other members of the Commission.

The Stafford Appointment.—The vacant position of Engineer and Manager of the Gas and Electricity Departments of the Stafford Corporation, consequent on the removal of Mr. Hubert Pooley to Leicester, has been filled by the appointment of Mr. W. M. Valon, of South Shields, a son of the late Mr. W. A. M. Valon. The successful applicant, who is only thirty years of age, is at present engaged as Chief Assistant to Mr. T. H. Duxbury, the Engineer and Manager of the South Shields Gas Company, to whom he went, about four-and-a-half years ago, from Mr. J. W. Morrison, the Engineer of the Sheffield Gas Company. He commenced his professional career, under his father, at the Ramsgate Corporation Gas and Water Works, where he was for three years. He went to Sheffield in 1900 as articled pupil to Mr. Morrison; and, on the completion of his pupilage in 1903, he was appointed Engineering Assistant, in which capacity he had charge of alterations and extensions involving an outlay of £150,000. At South Shields he had control, in Mr. Duxbury's absence, of the Shields and Jarrow Works, and also the electricity-generating plant for the former. His training and experience, therefore, well qualified him for the position he has obtained; and we cordially wish him success in his new and more responsible sphere of work.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 597.)

THE general run of things on the Stock Exchange was a good deal better than anyone expected. At first, they were in a state of agitation over the political upset, and trying to make forecasts as to a Dissolution and a General Election. But minds became calmer, and eventually even a cheerful tone prevailed; and this continued firm up to the end. Business, however, was far from active; for caution was the rule. The opening day was in an uncertain mood, and the announcement of a failure was not encouraging. Consols were unchanged, the Foreign Market was calm, and the Americans were strongly supported from New York. But Rails were depressed by labour troubles; and most other markets were dull. Tuesday was weak and inactive—a prey to election rumours. Consols fell $\frac{1}{4}$, and rails still drooped. But on Wednesday the political incubus was lighter, and a better feeling set in. Consols recovered $\frac{1}{8}$; and Rails were in demand at higher prices. A good tone ruled the Foreign Market; while Americans were strong and active. Thursday was a quiet day, but cheerful and undisturbed. All the chief departments were bright, except Americans, which began to recoil. Friday saw the improved tendency in full swing. Home Government issues were strong on points connected with the Election and the Sinking Fund. Consols rose $\frac{3}{8}$; and the other markets were quite firm. Business was quiet on Saturday, but the cheerfulness was unimpaired. Consols rose another $\frac{1}{8}$; and the chief markets generally were in good case. In the Money Market, there was always a good demand, and rates hardened accordingly for short loans; but discount terms eased away materially before the close. Business in the Gas Market quite maintained its pressure; and transactions in some issues rarely dealt in came to swell the aggregate of operations. The general tendency was good; and several quotations advanced their figures. In Gaslight and Coke issues, the ordinary was active and firm with a slight disposition to rise; transactions ranging from 105 to 106. In the secured issues, the maximum marked $87\frac{1}{4}$ and $87\frac{1}{2}$, the preference $103\frac{3}{4}$ and 104, and the debenture from $80\frac{1}{2}$ to $81\frac{1}{2}$. South Metropolitan was very quiet and firm at $121\frac{1}{2}$ and $122\frac{1}{2}$; and the debenture was done at $80\frac{3}{4}$. In Commercials, the 4 per cent. was dealt in at $106\frac{1}{4}$, the $3\frac{1}{2}$ per cent. at 102, and the debenture at $79\frac{3}{4}$ and $80\frac{1}{4}$. Among the Suburban and Provincial group, Alliance and Dublin changed hands at 89, Brighton ordinary at 160, Bournemouth at 29, ditto "B" at $16\frac{3}{8}$, ditto preference at $14\frac{3}{4}$ free, Brentford preference at 120, British at $44\frac{5}{8}$ and $44\frac{3}{4}$, and Wandsworth debenture at 75—a rise of 1. On the local Exchange, Liverpool "B" marked 164. In the Continental companies, Imperial was the only issue dealt in—marking from $184\frac{1}{2}$ special to 186. Among the undertakings of the remoter world, Bombay changed hands at $6\frac{5}{8}$, and ditto part-paid at 5 (a rise of $\frac{1}{8}$ each), Buenos Ayres debenture at $97\frac{1}{4}$ and 98, Monte Video at $12\frac{5}{16}$, Primitiva at from $7\frac{5}{16}$ to $7\frac{7}{16}$, ditto preference at from $5\frac{3}{16}$ to $5\frac{5}{16}$ (a fall of $\frac{1}{16}$), ditto debenture at $98\frac{1}{4}$, and River Plate debenture at $98\frac{7}{8}$.

ELECTRICITY SUPPLY MEMORANDA.

The Awakening—Free Flame Arc Lamps for Piccadilly Circus—New Flame Arcs for the Strand and Elsewhere—Joint Publicity Activity—Hastings Guardians Refuse to Investigate—Points for their Consideration.

THERE is more evidence of the genuine fright of the electricians over the public lighting successes of the high and low pressure inverted gas-burner. The latest move is really the most laughable incident in the whole history of the Westminster lighting contract. The St. James' and Pall Mall Electric Supply Company have felt most acutely the stigma of the dislodgment of arc lamps in that choice area comprising Regent Street, Piccadilly Circus, St. James' Street, Pall Mall and thereabouts; and they have lately been going on hands and knees to the Westminster City Council, whining for permission to pack a dozen flame arc lamps that are being uprooted from Regent Street on to three steel masts, 35 feet high, in Piccadilly Circus. So anxious are the Company over this that they are willing to do anything, and pay anything, to remove a little of the humiliation they have suffered. But the terms, in our opinion, are more humiliating still. They offer to provide and erect the posts and the four flame arcs to each, to enter into a contract with the Council for five years to maintain them for the full normal hours of lighting, and free of all charge and costs to the City Council! Free of all costs! Nothing could be cheaper. But how frightfully the Company must have fretted over the recent blow to have induced them to come down so low as this undignified proceeding. Competition of arc lamps with modern gas lighting has reduced the price of the current to a fraction of a penny per unit; but these Piccadilly Circus lamps will be supplied with current and carbons and be generally maintained without costing the ratepayers a penny piece. The electrical industry may rest assured that the gas industry will not venture to compete with such terms as these. But there is danger in what is proposed to be done. There is danger in having too much light in one place where there is a lot of vehicular traffic; and although these twelve lamps, of reputed 3000-candle power each, are going to be carried on standards 35 feet high, seeing that they are to be in addition to the Gas Company's high-power lamps, Piccadilly Circus may find itself overdone with illumination. The Committee of the City Council by whom the matter has been considered are willing for the offer to be accepted, providing the Council will also consent. We wonder how, with these arc lamps running during lighting hours, the City Council are going to take its photometrical tests of the gas-lamps to see that they are complying with the specification. The "Electrical Times" chuckles, and claps its hands gleefully, over this arc lamp installation in Piccadilly Circus. Three standards, each carrying four 3000-candle power flame arc lamps, "will enable the general public to judge for itself the real value of the 'gas victory' in Westminster." There is a little explanation wanted here. Looked at from its several points of view—especially from those of the fantastic offer of the Electricity Company, and the bunching together of four 3000-candle power lamps on each column—it seems a somewhat queer way of enabling the general public to judge of real value.

Street lighting by the new high and low pressure gas-lamps has, there is no question, come as a bolt from the blue to the electricity suppliers of London; and there is sudden and unseemly haste to set their public lighting affairs in better order—much to the gratification of the makers of flame arc lamps, who had been feeling they could do with a little more encouragement. The Charing Cross (West-end and City) Electric Supply Company are one of the private enterprises that have suddenly developed an affection for flame arc lamps; and the order has gone forth that the old style arc lamps in their area must make a hasty retreat to the scrap heap. The Company have entered into a contract for "regenerative" flame arcs; and these are to replace the lamps in use along the Strand (from Temple Bar to Charing Cross), in Trafalgar Square, and part of Charing Cross Road. The shock must have been a severe one to cause the St. James' and Charing Cross Companies to bestir themselves in so remarkable a fashion. They recognize what the electrical papers fail to do, that modern gas lighting is a powerful competitor. Their actions are peculiarly eloquent. If the editors of our electrical contemporaries could exchange places for the space of (say) twelve months with the managers of certain electric lighting companies in competition with an active gas company, they would come out of the ordeal considerably chastened in spirit; and the former babbling of the decadence of the gas industry would be looked back upon with some amount of regret and humiliation.

The Electricity Publicity Committee have, or at any rate the Chairman (Mr. H. B. Renwick) has, had their or his dignity highly offended by the "Financial Times." Our financial contemporary had a few days since one of its periodical leading articles on things electrical, in which all sorts of current matters affecting the electricity supply industry were marshalled with the view of mirroring its present position to account for its stick-in-the-mud condition in relation to the Stock Exchange. The matter upon which the "Financial Times" can speak with authority is as to the neglect of electric lighting shares that exists in these days; and several reasons, having a more or less important bearing upon the unattractiveness of the shares to the public, are adduced for this attitude. Mention is made, among other causes, of the want of recuperative business power on the part of the metallic filament lamp; and of the fact that various undertakings have thought fit to protect themselves by raising the price of their lighting current. But the point submitted by the "Financial Times" that irritated the Chairman of the Electricity Publicity Committee was this: "The Joint Publicity Committee is not quite so active as the gas companies, nor does it work upon so well-organized a plan." We are not above giving credit to electricity campaigning where credit is due; and as for a well-organized plan, the electrical industry is, for the time being, in a superior position to the gas industry. But for individual systematic publicity activity, several gas undertakings are more enterprising than most, if not all, electricity undertakings. A co-operative effort is on foot; but the foot seems to have a clog attached to it somewhere. It is the misapprehension of our financial contemporary that gives Mr. Renwick some amount of pain, and has induced him to call the "JOURNAL" to his aid to show that the boot is on the other leg. We do not mind this. It is quite a legitimate thing to do; but Mr. Renwick objects to the misrepresentation of our financial contemporary, just as we object to the misrepresentations of the Electricity Publicity Committee. Their activity the last twelve months we willingly and freely acknowledge. Mr. Renwick's own *résumé* of that work is as follows:

> Circulars, pamphlets, leaflets, &c., dealing with every phase of electric supply have been issued to supply authorities for distribution by them throughout the United Kingdom. In this short space of time, the rate of distribution amounts to well over 1,000,000 circulars per annum. Posters and showcards have similarly been got out; and during these few months, nearly 10,000 have been exhibited. The cumulative effect of such circularizing and poster work throughout the length and breadth of the United Kingdom must have a most beneficial effect in pushing business and in popularizing the uses of electricity. Further, the work of the Committee with regard to advertising and Press work is, of course, widely known.

Just so; and not always to the credit of the Committee. This reference to posters reminds that during the past week there has been seen on the hoardings in South London, a fine copyright pictorial poster of the South Metropolitan Gas Company. Measured by the eye, it is about 9 ft. by 5 ft., and the design is very attractive.

One of the most scandalous instances of dereliction of duty on the part of a Board of Guardians in connection with the lighting of the establishments under their care comes from Hastings. The Board seem to be completely obsessed with the view that all considerations relating to the matter must perish but the one that, as a public authority, they must give their patronage to the Corporation electricity undertaking. It is as manifest as anything can be that there has been behind the scenes influences at work among the Guardians in favour of the Corporation Electricity Department, while the door has been held fast against the admission of any competition, and against all consideration as to whether, by a less capital expenditure than the installation of the electric light will demand, the modern incandescent gas-burners could not be applied, and produce an annual economy in comparison with what is now proposed to be done. The Guardians stand convicted on their own showing of burking all proper deliberation of the question from every aspect; and of accepting the offer of the Electricity Committee without any adequate knowledge as to what they are committing themselves to. It is, as we say, one of the most scandalous pieces of abuse of trust we have ever come across in connection with a Board of Guardians. The Building and Repairs Committee, in their report on the subject (which has been adopted), say they "have very carefully considered the offer of the Electricity Committee." If they have, they apparently do not understand what it means. But not a word is there in the report to the effect that there has been any invitation to the Gas Company to submit an alternative scheme, and that careful consideration has been given to it. If the Guardians were so utterly prepossessed by electricity (and after consideration came to the conclusion that the modern gas-burner did not satisfy them in the matters of economy and efficiency), they had before them a letter from Mr. C. F. Botley, on behalf of the Hastings and St. Leonards Gas Company, which concluded with these words: "If there is any real desire or need for electricity at the workhouse, I am, on behalf of my Company, in a position to furnish such supply at a figure which the Corporation Electricity Department cannot compete with either commercially or legitimately." In view of this statement, what does Mr. W. Cruttenden, one of the Guardians (what a name for public trustees who kick an offer of economy out doors without even giving it the courtesy of consideration!), mean by "the Committee had tried to deal with the matter in an honest and straightforward way." That is not true. Nor was Mr. Kelly—another Guardian—saying what was correct, when he remarked that the Guardians desired "to serve the best interests of the ratepayers." They have a novel way of showing their desire. Would any business man say that he was serving his own best interests by making a purchase without considering the respective values and prices of goods of which he desired to become possessed? The Hastings Guardians may robe themselves in garments of white, but the whole truth is that they did not want to serve anybody but the Corporation Electricity Department. If the Guardians were so satisfied that there was no saving to be effected by bringing their gas-lighting system up to modern standard, why need they have feared allowing the Gas Company to submit a scheme? Certainly, it would have shown that they were not afraid that the Electricity Department would be unsuccessful over the Gas Company; and —Mr. Cruttenden mark this—it would have been "the honest and straightforward way." The Local Government Board, we doubt not, will make a note of the negligence in this matter on the part of the Guardians.

The Guardians have no right to claim that there will be a saving by adopting electric lighting in comparison with gas. They are making comparison with the system of lighting that has existed since 1902; the honest, straightforward, commonsense comparison is with the cost and lighting power afforded by a modern system of gas lighting. Now let us see what it is the Guardians have accepted on the recommendation of the Borough Electrical Engineer, and inquire into this talk about the interests of the ratepayers being served by patronizing the electricity undertaking. First of all, the expenditure on the gas piping and fittings at the workhouse is to be abandoned, whereas the piping and fittings could be utilized in installing a modern system of gas lighting. Next money has to be spent by the Electricity Department specially on the laying of a cable to supply the workhouse. Further, an estimated—estimated only—capital expenditure of £400 to £468 is to be incurred in installing the electric light in the workhouse. These three things represent in the total a fair amount of money. But, say men who do not know much (if anything) about the matter, but have been led by the ears by the Borough Electrical Engineer, "this is all in the interests of the ratepayers." It is a singular and incomprehensible way of serving those interests. That, however, is one aspect of the matter; now as to another. There is nothing definite about this affair in any way. The Guardians, it is plain, are taking a leap in the dark. The whole question is wrapped in estimate. It is "estimated" that the annual cost of the electric lighting will be £225, including a small allowance for gas for cooking purposes; and it is "estimated" that there will be a saving of £57 on the old-style lighting. But as to what the position would be with a modernized scheme of gas lighting, the Guardians do not care a rap. The installation is to comprise 486 electric lamps—12 of 100-candle power, 12 of 55-candle power, 81 of 32-candle power, 58 of 25-candle power, 323 of 17-candle power. Fancy 323 of 17-candle power! These lamps, it is said, will light the premises effectively. Different ideas exist as to what is effective lighting. The light throughout the place, all lamps going, will only aggregate 11,393-candle power. It is plain to any lighting expert what the Electrical Engineer has done. He has cut down the illuminating power to the narrowest possible limits, in order to show (with a very small allowance for renewals) some saving in the annual charge (which there will not be, taking capital outlay and depreciation into consideration) compared with the old system of gas lighting. The 486 lamps are to take the place of 610 gas-burners. Supposing the 610 burners were exchanged for inverted burners of 50-candle power each, consuming $2\frac{1}{4}$ to $2\frac{1}{2}$ cubic feet of gas an hour, there would be a total illuminating power given throughout the place of 30,500-candle power, against the 11,393-candle power the Borough Electrical Engineer is offering; if 486 burners, then the 50-candle power inverteds would be equal to an illuminating power of no less than 24,300 candles. The scheme submitted by the Electrical Engineer is not likely to stop where it is. More light will indubitably be wanted; and more expense will be incurred. We submit that enough has been said here to show that the Guardians have not given the matter full and careful consideration, and to cause the Local Government Board to refuse their sanction to the present scheme until the Guardians have fulfilled their obligations as a public body independent of the Corporation.

Personal.

In the "JOURNAL" for the 8th inst., it was mentioned that Mr. J. W. Turner, of Scunthorpe, had declined the position of Gas Manager to the Abercarn District Council. We learn that it has now been filled by the appointment of Mr. J. A. BRENTNALL, of the Croydon Gas-Works.

Mr. W. HAROLD A. CHESTER, son of the late Mr. W. R. Chester, of Nottingham, has recently been successful in the examination for the admission of Associate Members of the Institution of Civil Engineers. He is at present employed by the Nottingham Corporation Gas Department, under Mr. J. H. Brown, the Engineer and General Manager, with whom he served his articles.

Obituary.

West Bromwich has lost a popular townsman, and the Corporation Gas Committee a valuable Chairman, by the death of Alderman J. E. WILSON. Deceased had an apoplectic seizure; and he never recovered consciousness. He was elected a member of the Town Council in 1890, and three years later was made a Justice of the Peace. He was Mayor of the borough for two years (1905-7), and shortly after vacating the civic chair he was elected an Alderman. On the death of Alderman Farley in 1902, he was chosen for the chairmanship of the Gas Committee, in which capacity his great business ability was invaluable; for, notwithstanding the competition the gas undertaking has had to face, it is in a remarkably strong position. Deceased was in his 63rd year.

The death occurred last Wednesday, after a short illness, at the age of 67, of Mr. JOHN SPENCER, of Island Lodge, Handsworth. Deceased was the third son of the late Mr. John Spencer, of the Phœnix Iron-Works, West Bromwich; his brothers being Sir Ernest Spencer, who for many years represented West Bromwich in Parliament, and Mr. Samuel Spencer, of Messrs. J. E. & S. Spencer, of Great St. Thomas Apostle, E.C., who is well known to many of our readers as the Chairman of the Colonial Gas Association, a Director of the Croydon Gas Company, and from his connection with other gas undertakings. Mr. John Spencer commenced business in 1874 as a tube manufacturer at the Vulcan Tube-Works, but later acquired the Globe Tube-Works, Wednesbury, which became one of the largest in the district. It was subsequently converted into a private limited liability Company, with Mr. Spencer as Chairman. The deceased gentleman was a County and Borough Magistrate, a member of the Institution of Mechanical Engineers, and also of the Iron and Steel Institute.

Estimation of Sulphur in Coal and Coke.—The author of an article in a German publication criticizes the various methods in use for the estimation of sulphur in coals and coke. According to an abstract of the communication in the "Engineer," for the estimation of the total sulphur a modification of Brunck's method is recommended. The fuel is burnt with a mixture of cobalt oxide and sodium carbonate in a combustion-tube in a current of oxygen gas. The resultant mass is dissolved in hydrochloric acid, and the solution is then evaporated to dryness to render the silica insoluble. A Peligot tube is used during the combustion, to absorb any volatilized sulphur; and the contents of this tube, after neutralizing and boiling to expel the excess hydrogen peroxide, are added to the dry mass in the evaporating basin. A little hydrochloric acid is then added, and after filtering off the silica, the sulphate in the clear solution is precipitated with barium chloride in the usual manner. For the estimation of the volatile sulphur, Sauer's method is recommended. This method is based upon combustion of the fuel in a current of oxygen, and absorption of the gases produced in a suitable oxidizing medium. The author has improved this method by filling the front portion of the combustion-tube with cuttings of platinum wire, which are heated to redness during the test.

WORKMEN'S COMPENSATION STATISTICS.

Another of the annual Blue-Books which periodically receive attention in "Journal" pages has been issued—namely, the Home Office statistics of compensation and proceedings under the Workmen's Compensation Act, 1906, and the Employers' Liability Act, 1880. The volume before us deals with the year 1909; and, as before, it is divided into two parts. On the present occasion Part I. (statistics of compensation cases in certain industries) may be dealt with—leaving Part II. (administration of the Acts) for a second article.

It is pointed out by Mr. Edward Troup, who signs the report, that this year there are available for the first time substantially complete returns from the seven great groups of industries—namely, mines, quarries, railways, factories, harbours and docks, constructional works, and shipping—statistics with regard to which are made by or on behalf of employers in pursuance of the order of the Secretary of State under section 12 of the 1906 Act. These are the industries which, by reason of their being subject to regulations under other Acts, or of their concentrated character, afforded a possibility of obtaining returns sufficiently complete and accurate to be of value. The earlier Acts contained no provision for the making of returns to show the working of the systems of compensation which they established; and the sources from which official statistics could be obtained were therefore limited to cases as to which some sort of proceedings ensued—the great majority of cases (those in which a settlement was arrived at by agreement) being perforce left out of consideration.

The collective returns included 99,959 employers who reported cases of compensation. In the industries here concerned, the average number of persons employed coming within the provisions of the Act was over 6½ millions, of whom more than 4½ millions came under the heading of factories. The gross total of compensation paid in the seven groups of industries during the year under the Act, according to the returns, was £2,274,238, representing 3341 cases of death, and 332,612 cases of disablement. The average payment in case of death was £154, and in case of disablement £5 6s. It is remarked that, allowing for the industries which are not included in these returns, the amount of compensation paid in all industries can hardly fall short of £3,000,000. The annual charge for compensation, taking the seven groups of industries together, averaged 6s. 10d. per person employed. It was lowest in the case of persons employed in factories—being only 3s. 5d. per head. In the case of railways, it was 7s. 1d.; for quarries, 9s. 2d.; shipping, 10s. 8d.; constructional works, 14s. 11d.; docks, &c., 16s. 8d.; mines, 20s. 1d. In spite of mines being highest in this particular, it is noted that in the coal-mining industry the charge arising under the Act works out at about 0·8d. only per ton of coal raised. The figures given here refer, of course, only to compensation paid under the Act of 1906. They do not include compensation paid under a contracting-out scheme, payments made in cases still outstanding under the earlier Acts, damages under the Employers' Liability Act, or costs of legal proceedings. Thus they do not represent the total charge upon the different industries in connection with the payment of compensation to persons employed in respect of injuries received. The returns for 1909 show a marked improvement on those for 1908, both in completeness and in accuracy. At the close of the year, forms were issued to every employer on the Home Office lists, on which either to make the return or to intimate the fact of his insurance. Out of 132,414 forms issued, only 13,018 were not returned; and there is reason to believe, says the report, that in a large number of these cases the employers were insured. Generally, in the case of the highly-organized industries—such as mines, railways, shipping, and the more important groups of factory industries—the returns seem to be substantially complete; while in others—more especially constructional works and docks—a margin of error must be allowed for. Except in a few cases, no information is available as to the total amount of wages paid in the different groups of industries during the year; and the ratio between the amount of the compensation and the amount of wages paid in each group cannot therefore be estimated.

Coming to the separate industries, the first dealt with is shipping. In 366 fatal cases, the compensation paid was £56,844—an average of £155 per case; and in 6701 accidents involving disablement, the compensation was £71,449, showing an average of £10 13s. per case. The total number of seamen returned as being within the Compensation Act was 240,080; the total compensation paid in the year working out at 10s. 8d. per head. In considering the figures for this industry, there are some special conditions to be borne in mind. For instance, no compensation is payable under the Act in cases of disablement in respect of the period during which the owner is liable under the Merchant Shipping Acts to defray the expenses of maintenance of the injured seamen.

The next returns are in respect of industries carried on in factories to which the Factory and Workshop Act, 1901, applies. Workshops under the same Act are not included. The number of factories on the register of the Factory Department of the Home Office for 1909 was 112,479. Of the occupiers of these, 81,239 were included in the collective returns made by insurance companies, &c.; and 13,705 individual returns were received. The classification is under ten groups: Textile—Cotton; wool, worsted, shoddy; and other textiles. Non-textile—Wood; extraction, founding, and galvanizing of metals, including conversion; marine, locomotive, and motor engineering and shipbuilding; manufacture of machines, appliances, conveyances, tools; paper, printing, stationery, &c.; china and earthenware; miscellaneous. The returns indicate that the number of fatal accidents in regard to which compensation was paid during the year was 744, with compensation of £104,039, or an average of nearly £140 per case; while the total number of disablement cases was 123,134, with compensation amounting to £664,431, or an average of £5 7s. per case. The number of persons employed covered by the returns amounts to over 4½ millions. Both the number of fatal cases in which compensation was paid and the number of persons employed nearly correspond with the figures reported under the Factory Act; but the figures of disablement cases are in excess of those of non-fatal accidents reported under the Act. On a rough estimate, the number of reported accidents which disabled for more than seven days would seem not to have exceeded 100,000. Compensation for industrial disease was paid in 27 fatal cases, to the amount of £4974, or an average of £184; and in 545 disablement cases, to the amount of £10,651, or an average of £19 10s. per case. The total charge for compensation under the heading of factories was £784,095, which works out, on the returns of persons employed, at 3s. 5d. per head. Taking individual trades, the compensation works out at 1s. 10½d. in the cotton industry, 1s. 1d. in the wool, &c., industry, 10½d. in the other textile industries, 7s. 11d. in the wood industry, 7s. 5d. in the metal (extraction, founding, and galvanizing industry), 8s. 7d. in the engine and shipbuilding industries, 3s. 11½d. in the machines, appliances, conveyances, and tools industries, 1s. 6d. in the paper and printing industries, and 3s. 0½d. in the china and earthenware and miscellaneous industries.

In connection with docks, the compensation for 169 fatal accidents was £26,152, or an average of £154 15s. per case. There were 11,621 disablement cases, with compensation amounting to £82,269, or an average of £7. Compensation was paid for industrial diseases to the extent of £635, making the total compensation £109,056. On a total number of employees of 130,886, the compensation works out at 16s. 8d. per head.

The total number of mines at work during 1909 was 3985, owned by 2539 employers, of whom 1889 were insured; and the returns received in connection with this industry appear to have been very nearly complete. The number of cases of death through accident in which compensation was paid during the year was 1456; while the number of deaths through accident during the year reported under the Mines Acts was 1493. The number of cases of disablement through accident in respect of which compensation was paid during the year was 154,798. Of these, 13,692 were cases in which the payment of compensation was continued from the previous year, leaving 141,106 cases in which the first payment was made during 1909. The number of persons injured by accidents occurring in mines during the year (which disabled for more than seven days) was 154,740. The approximate average number of persons employed to whom the Act applies was returned as 984,994; while the total number of persons employed above and below ground at mines, according to the returns under the provisions of the Coal Mines and Metalliferous Mines Regulation Acts, was—omitting the Isle of Man, to which the Compensation Act does not apply—1,041,862. Of course, the compensation figures do not include persons under contracting-out schemes. The amount of compensation paid in respect of the 1456 fatal cases was £237,308, or an average of £163; and in regard to the 154,798 non-fatal cases, £724,269, or an average of £4 13s. The amount of compensation paid in respect of the cases of disease was £27,288; so that the total charge under the Act on the mining industry during 1909 was £988,865, or £1 0s. 1d. per head. The great bulk of this fell upon the coal industry; for of 1493 deaths through accidents during 1909, 1424 occurred at mines producing coal. Similarly, of 154,740 persons disabled by injury, 150,702 were employed at coal mines. During the year, 263¾ million tons of coal were raised, besides nearly 4 million tons of other minerals. Estimating the compensation payable in respect of injuries at other mines at about £30,000, the charge of the Act on coal-producing mines would therefore be, as already mentioned, about 0·8d. per ton of mineral raised.

During 1909, there were 7132 quarries over 20 feet deep at work, in addition to a number of shallow open workings. For 83 fatal accidents there was paid £12,072, or an average of £145 per case, and for 5536 disablement cases, £28,586, or an average of £5 3s. The number of persons employed in or about the quarries was returned as 88,880. The amount of compensation paid in respect of industrial disease being only £2, the total charge on the industry was £40,660, or 9s. 2d. per head.

Next comes the division of constructional work. The order of the Secretary of State requires returns to be made in respect of the construction of railways, tramways, canals, harbours or docks, bridges, tunnels, water-works, sewers, roads, and other works of engineering. The construction of buildings (except when forming part of an engineering work) was excluded. The intention was to cover as nearly as possible the large body of men engaged on what are known as "engineering works." However, neither the number of employers nor the number of workmen engaged in this industry is definitely known. The number of fatal accidents reported was 129, with total compensation paid of £15,065, or an

average of nearly £117 per case; while the number of cases of disablement was 7221, and the amount of compensation £53,376, or an average of £7 8s. Compensation was paid to the amount of £342 in respect of industrial disease. Thus the total charge for compensation was £68,783, which works out, on the number of employees returned, at nearly 15s. per head.

Returns were obtained from all railway companies except the Great Eastern, who have a contracting-out scheme. Among the clerical staffs there were 3 fatal cases and 43 disablements—in respect of 70,908 employees—which involved a total compensation of £954. In connection with the 366,844 other railway workers, there were 358 fatal accidents, with £55,575 compensation, or an average of £155 per case; and 20,245 disablement cases, with £97,646 compensation, or an average of £4 16s. The compensation paid in respect of disease amounted to only £263. During the year, the total compensation paid for railway servants (other than clerical staffs) works out at 8s. 4d. per head of the number employed. Taking the Board of Trade figures as to the average weekly earnings of railway servants, and excluding the clerical staffs from the total of persons employed, the compensation charge for the year works out at about 13s. 8d. per £100 of wages paid.

No less than 24 kinds of industrial diseases are now included under the Workmen's Compensation Act. As to the duration of compensation for accidents, it may be remarked that cases lasting for two weeks and less than three accounted last year for close upon 29 per cent. of the whole number.

TRANSPORT OF COMPRESSED GAS.

In the current number of the "Journal de l'Éclairage au Gaz," M. André Grebel deals with the subject of the supply of compressed gas delivered in cylinders. Rather more than two years ago, the author discussed at length, in the same publication, the question of the supply of gas at a distance by compression. The drawbacks to the introduction of this system are the cost of the plant (for, as shown by the author in his previous article, a compressing station would be required at the works and a gasholder at the point of delivery), and the outlay of capital for laying down the distributing pipes—an outlay which it would be desirable to avoid. But how? The idea has occurred to some that for the supply of high-pressure gas in the ordinary way through mains may be substituted a supply in cylinders—portable gas, in fact—an attempt at which was made by M. Hugon, in association with the Portable Gas Company, about half-a-century ago. After some twenty years' struggle for existence, the scheme was abandoned; and M. Grebel thinks no one will entertain for very long the idea of reviving it. At the same time, he points out that there are circumstances in which a supply of gas in the way named might be afforded—indeed, we learn that a French Company actually have the matter under consideration; and therefore he thinks the subject well worth attention by gas engineers and managers. He proceeds to put before them the following considerations.

Supposing a gas company to be in possession of a compressing station (say, for the supply of gas for the lighting of railway carriages), and there were on the outskirts of their area certain isolated mansions or country seats in which gas was consumed only in the summer, when the owners were in residence—where, consequently, the total gas consumption would not be sufficient to justify the laying of a special main—it would not be altogether absurd to consider the possibility of supplying these places by means of portable cylinders filled with gas compressed to (say) 20 kilos., or about 44 lbs., per square inch, and changing them when empty. M. Grebel thinks it would not be difficult to induce the owner or the tenant of such property, in which there is often an installation of piping for the conveyance of carburetted air, and which would be all ready for the gas, to adopt this illuminant. Even supposing it would cost him as much as his supply of carburetted air, the price of which is continually going up in company with the market prices of extra light petroleum spirit, M. Grebel is of opinion that he would not hesitate. With regard to heating and culinary operations, he must bear in mind that these can be performed quite as well with gas as with carburetted air. Apart, however, from isolated mansions and country seats, there are some small towns and villages which are supplied from works established for the production of air gas. These undertakings are not very flourishing; and, owing to the lack of consumers, a large quantity of business cannot be expected. Here there seems to the author to be an opening for the introduction of "portable" gas. These places are generally served by light railways or some inexpensive system of tramways, which it is suggested should be made the vehicles for the carriage, at a cheap rate, of the cylinders of compressed coal gas, which would be substituted for the carburetted air. If the gas-works possessed an equipment of horses and carts, these could be utilized for the carriage of the cylinders. M. Grebel thinks the system might also be applied to isolated high-power lights served with compressed gas; thus avoiding the expense of starting small compressing stations.

Having considered the possible uses of "portable" gas, the author proceeds to deal with one of the drawbacks to its supply—viz., the high cost of the containing vessels in relation to the selling price of the product within them. This is equally the case with the cylinders used for the conveyance of carbonic acid, oxygen, and hydrogen. Indeed, there are some industries in which the packing is worth more than the goods packed; the result being to hamper their sale by retail. This is less so, however, in the case of the sale of compressed gas to small works or to large ordinary consumers. The thorough utilization of the costly special receptacles required is nevertheless the troublesome feature of the problem. To it the author gives attention later. Meanwhile, he deals with an objection which he anticipates will be raised to the system—the diminution in the lighting and heating power of the gas resulting from its great compression. According to figures supplied to him by the Northern of France Railway Company, 100 cubic metres (rather more than 3500 cubic feet) of coal gas compressed to 20 kilos. lose by condensation 5 litres (0·177 cubic foot), of which 3 litres (0·106 cubic foot) consist of hydrocarbons. These 3 litres, or 2·7 kilos. of liquid hydrocarbons, having an average heating power of about 10,000 calories, represent a loss of $(2{\cdot}7 \times 10{,}000) \div 100 = 270$ calories per cubic metre (35·3 cubic feet). The vapour density of these hydrocarbons being 3·5, the volumetric loss is insignificant—*i.e.*, 0·008 per cubic metre. The gas after compression, measured at atmospheric pressure, has only 4768 calories, assuming that previously its calorific power was 5000. The author points out that the difference is not enormous, and cannot affect the value of the gas very much for heating and culinary purposes. Unfortunately, the temperature of combustion may be lowered to a greater extent than the calorific power, and the consumption in incandescent burners notably increase.

In order that his readers may form an idea of what a compressing station should be, M. Grebel gives a short description of the one at the terminus of the Northern of France Railway in Paris; and he then passes on to deal with the financial and technical sides of the question of organizing a service for the sale of compressed gas. He acknowledges at the outset that the vessels to contain it call for the first consideration. It is of importance that these—whether one or more—should not remain too long with the consumers; neither, on the other hand, should it be necessary to change them too frequently on account of their rapid exhaustion. Taking into account the relative dead-weight of the various forms of receptacles and of the carriage of them, their capacity should be proportioned to the requirements of consumers. But here considerations of interchangeability and convenience of manipulation come in. In order to arrive at something definite on this matter, M. Grebel puts the following question: "From the point of view of carriage and purchase price, what are the most advantageous dimensions to give to a cylindrical vessel in which the gas is compressed to 44 lbs. pressure?" As the result of a number of calculations which are fully set out in the article, he arrives at the conclusion that a receptacle 4 metres (13 feet) long, 1 metre (3 ft. 3 in.) diameter, and, consequently, having a capacity of 3 cubic metres (106 cubic feet) would have a dead-weight of 1100 lbs. He shows by one of his formulæ that it is advisable to make the length of the vessel as great, and the diameter as small, as the necessities of transport permit. Provision would also have to be made for a tap, connecting-piece, and pressure-gauge, as in the case of the cylinders used for railway carriage lighting.

The author next passes on to consider the question of the net cost of compressed gas to the consumer; and he prefaces his remarks with the statement that his figures must not be taken as being anything more than approximate. Assuming it is necessary to provide for each service two receptacles of 3 cubic metres capacity, worth 1000 frs. (£40) apiece, and allowing 10 per cent. for maintenance, interest, and sinking fund, he arrives at the following figures as the price of a cubic metre of gas for an annual consumption of 1000 cubic metres (35,300 cubic feet):

Maintenance, interest, and sinking fund	20·0c.
Compression expenses, in the case of a station serving railway carriages	7·5
Carriage and manipulation of the receptacles	7·5
Price of gas before compression	20·0
Total	55·0c.

This is equivalent to 12s. 4½d. per 1000 cubic feet. If the annual consumption reached 2000 cubic metres, the price would decrease (other things being equal) to 45 c. per cubic metre, or 9s. 9½d. per 1000 cubic feet—a figure which M. Grebel regards as more admissible. If, on the other hand, it fell to 500 cubic metres, the price would go up to 75 c., or 16s. 18½d. He says it is scarcely necessary to point out that the figure would not be so high in the case of a similar supply of gas if furnished under the high-pressure system.

In conclusion, the author says that in the case of isolated supplies of the nature of those he has been considering, it would scarcely be wise to sink, for example, 20,000 frs. (£800) in laying down mains, irrespective of the eventual installation of a small pressure station at the works and a small gasholder at the residence of the consumer. In these cases, therefore, the question of the supply of compressed gas would, in his opinion, deserve very serious consideration. But he recognizes that the stumbling-block in the way of the economical working of the system proposed would be the thorough utilization of the receptacles, to which he alluded in the course of his article. Some system of charging for them a hire-rate on a progressive scale depending upon the time they are upon the consumer's premises, as is done in the case of oxygen, hydrogen, and carbonic acid cylinders, should, he thinks, be adopted, so as to obviate the disadvantages resulting from their non-utilization.

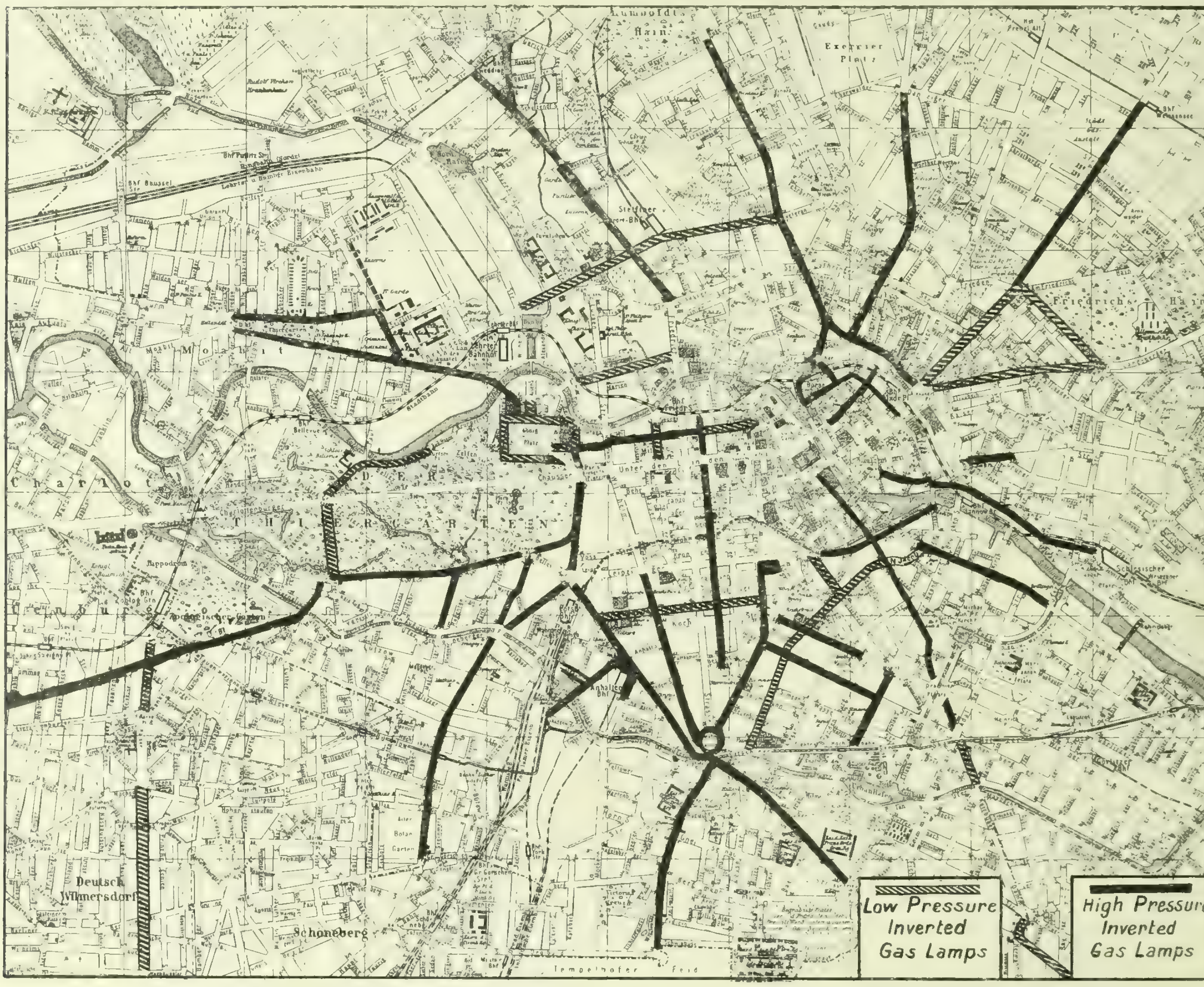
PUBLIC GAS LIGHTING OF BERLIN.

By Richard Hentze.

Your readers will probably remember that on the occasion of the recent visit of members of the German Gas and Water Association, reference was made to the public lighting of Berlin; and the city was spoken of as being the best lighted one in the world. It may therefore be of interest to place on record in the "Journal" some facts in regard to the present condition of Berlin's public lighting, and of the place gas occupies in it.

The total length of the streets lighted by the Municipality amounts to about 332 miles, of which 19 miles only are lighted by electricity. The remaining 313 miles are lighted by low-pressure and high-pressure gas-lamps of varying candle power, according to the requirements of the traffic prevailing in the different parts of the city. It is well understood that, with the marvellous growth of the German capital, the requirements of better-lighted streets grew in proportion; and it is interesting to know that while in the last five years high-pressure gas lighting has gained about 27 miles of streets, the electric light was extended on no more than about $1\frac{1}{2}$ miles. This is certainly a marvellous victory the gas industry has won over electricity; and it will be worth while to investigate the reason why the gas lighting of the city has extended so considerably. In doing this, it will soon be discovered that it is entirely due to the inverted system of incandescent lighting that this marvellous progress could have come about.

The first inverted lamp—a two-burner Graetzin low-pressure



Map of Central Berlin, Showing the Streets where Low-Pressure and High-Pressure Gas Lighting has been Installed.

one—was introduced in Berlin in 1906; and the following figures will show how quickly it conquered the ground. At the end of this year, in the city alone, there will be gas-lamps with a lighting power of upwards of 8,000,000 candles, of which more than 5,200,000 candles, or 62 per cent. of the total, is produced by inverted low-pressure and high-pressure gas-lamps. The accompanying map of the city shows the streets lighted by inverted gas-burners; those marked with black lines being lighted with high-pressure and those with broken lines with low-pressure gas. The extent to which inverted gas-lamps have been brought into use can be seen at a glance.

It may also be remembered that some time ago the Municipality of Berlin, being so highly satisfied with the installation of inverted gas-lights used up to date, decided to convert all the remaining upright lamps to the inverted system, as announced in the "Journal" at the time. With regard to the lamps mostly sed, it will be interesting to mention that upwards of 90 per cent. are Graetzin—a lamp which is well known throughout the United Kingdom, though, strange to say, little used for street-lighting purposes.

Up to the present, the highest illuminating power has been obtained with lamps burning under high pressure. However, recently new lamps have been invented from which from 600 to 1000 candle power can be obtained, burning under low pressure; and there is reason to believe that still higher candle powers will be produced in the lamps. It is therefore quite on the cards that in the near future it will be possible for the lighting of almost any city to be adequately carried out by the use of low-pressure inverted gas-lamps, without the necessity of laying high-pressure mains, which in the past has been a great drawback to a more extended use of gas for public lighting. It is again the city of Berlin which is the first to make experiments with these high candle power low-pressure lamps, of which about 500, each of 600-candle power, will be erected in the course of next month.

WATER LEGISLATION FOR 1910.

In preceding issues of the "Journal," the principal features of the Gas Acts of the present session have been noticed. We now deal with the measures relating to water supply; taking first those applying to companies.

The Cambridge Water Company have obtained authority to construct new works in the rural district of Chesterton, in the county of Cambridge. They consist of a reservoir on land in the vicinity of the existing reservoir in the parish of Cherryhinton, a well and pumping-station adjoining the one at present there, another on land adjacent to Fleam Dyke, two adits, and two lines of pipes. The Company are to complete the second of the above-named pumping-stations within five years from the passing of the Act; on the expiration of which period, or on the completion of the station if this should first happen, the Company are to cease to draw water from the lower chalk formation by means of the existing works at Cherryhinton or Fulbourn, or of the pumping-station at the former place authorized by the Act. Five years are allowed for the other works, except the two adits, which are

to be completed within ten years from the passing of the Act. Additional capital of £150,000, including premiums, is authorized, or £30,000 less than the figure in the Bill; and the Company are not to issue preference shares or stock to a greater amount than £75,000, compared with £90,000 applied for. The new capital is to be sold by auction or tender; and the dividends upon it are limited to 7 and 6 per cent. per annum upon the two classes. Borrowing powers to the extent of one-third of the additional capital are granted. The Act contains a section altering the rates to be charged by the Company for a domestic supply of water. From and after the quarter-day following the granting by the Board of Trade of a certificate that the Company have raised and expended not less than £50,000 in the construction of the well and pumping-station at Fleam Dyke and the two adits and pipe-lines, they are to be entitled to charge rates ranging from 8s. 8d. per annum where the rateable value of the premises supplied does not amount to £6; 7½, 7, and 6½ per cent. where it does not exceed £30, £50, or £100; and 6 per cent. where it is above the last-named figure. Authority is given to purchase or take on lease houses, cottages, and other buildings for persons in the Company's employ, as well as offices and other buildings for the purposes of the undertaking; and also to erect, maintain, and let any such building upon any lands for the time being belonging or leased to the Company. The Act contains clauses for the protection of certain wells, the inhabitants of Fulbourn and Great and Little Wilbraham, the Corporation and County Council of Cambridge, Trinity and Jesus Colleges, and the Great Eastern Railway. [*Parliamentary Agents: Messrs. Rees and Freres.*]

By the Act obtained by the East Grinstead Gas and Water Company, they have obtained confirmation of the construction of their works at Hackenden, and authority to extend and improve them. These works consist of wells, an adit, and a pumping-station, situated partly in East Grinstead and partly in Lingfield, and two aqueducts or pipe-lines in connection therewith. The Company have also been given power to make new works, comprising a well and pumping-station in the parish of Forest Row, a service reservoir and a water-tower in the parish of East Grinstead, and three aqueducts or pipe-lines in connection therewith, to be completed in five years; also to acquire from Mr. A. Hepburn Hastie the well and water-works now in course of construction on the estate known as Place Land, and, by agreement with him, complete them for the purposes of the undertaking. The Company may raise additional capital to the amount, including premiums, of £40,000, but not more than £20,000 (nominal) of it is to be issued as preference capital; and the two stocks are to be entitled respectively to 7 and 6 per cent. per annum dividend. Power to borrow to the extent of one-fourth of the additional capital, as well as to create debenture stock, is granted. The Act contains provisions in regard to the protection of the Company's works and supply, the Local Authorities of the district, the London and Brighton Railway Company, and the Mariott Estates; also others relating to the sale of water to or by outsiders. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Slough Water Company have been authorized to extend their limits of supply so as to include a portion of the parish of Fulmer, in the county of Buckingham. The construction is confirmed of the existing works, comprising a pumping-station in the parish of Datchet, three wells or boreholes in the same parish, a storage reservoir and pumping-station and other works in the parish of Stoke Poges, a water-tower and other works in that parish, a line of pipes commencing at the pumping-station and terminating at the wells or boreholes at Datchet, and other works for the distribution of water. After Jan. 1, 1911, the Company may charge up to 7s. 6d. per annum for a fixed bath capable of containing not more than 50 gallons of water, and for a larger one such sum as they may think fit. For supplies by meter, the charges range from 1s. 6d. down to 8½d. per 1000 gallons, with an additional charge of 2d. in any portion of the limits of supply which is more than 140 feet above Ordnance datum. The Company may make contracts for the supply of water in bulk. The Act gives protection to the Middlesex and Buckingham County Councils, the Conservators of the River Thames, and the Eton Rural District Council. At the end of the Act is a section providing for the acquisition of the Company's undertaking by the Slough Urban District Council. It is set forth that if the Council introduce a Bill in the next available session, and "*bonâ fide* promote the same for an Act for the purchase of the undertaking of the Company," the latter are not to oppose, except in so far as may be necessary to secure the insertion of clauses to protect their interests. The Bill is to make provision for the purchase price being determined by agreement or by arbitration; and in the event of the latter mode being adopted, 10 per cent. is to be added to the price as compensation for compulsory purchase and the cost of reinvestment. The Directors and officers are to be compensated in accordance with specific directions contained in the section. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

By the Southend Water Act, the Water Company obtain parliamentary sanction for the construction of the existing works and power to make others, consisting of thirteen pumping-stations, which are to be completed within fifteen years. In addition to the lands which are now in the possession of the Company, or which they have the right to purchase, authority is given for the acquisition of others in the parishes of Downham and Wickford. Further capital not exceeding £200,000 is sanctioned, the dividend on which—whether issued as ordinary or as preference—is limited to 5 per cent. The new capital is, of course, to be sold by auction or tender. Power to borrow to the extent of one-third of the additional capital is given, as well as to create debenture stock, which is also to be sold by auction or tender. Other provisions in the Act relate to the supply of water in bulk, the sale or letting on hire of meters, the acquisition of dwelling-houses for persons in the Company's employ, &c. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

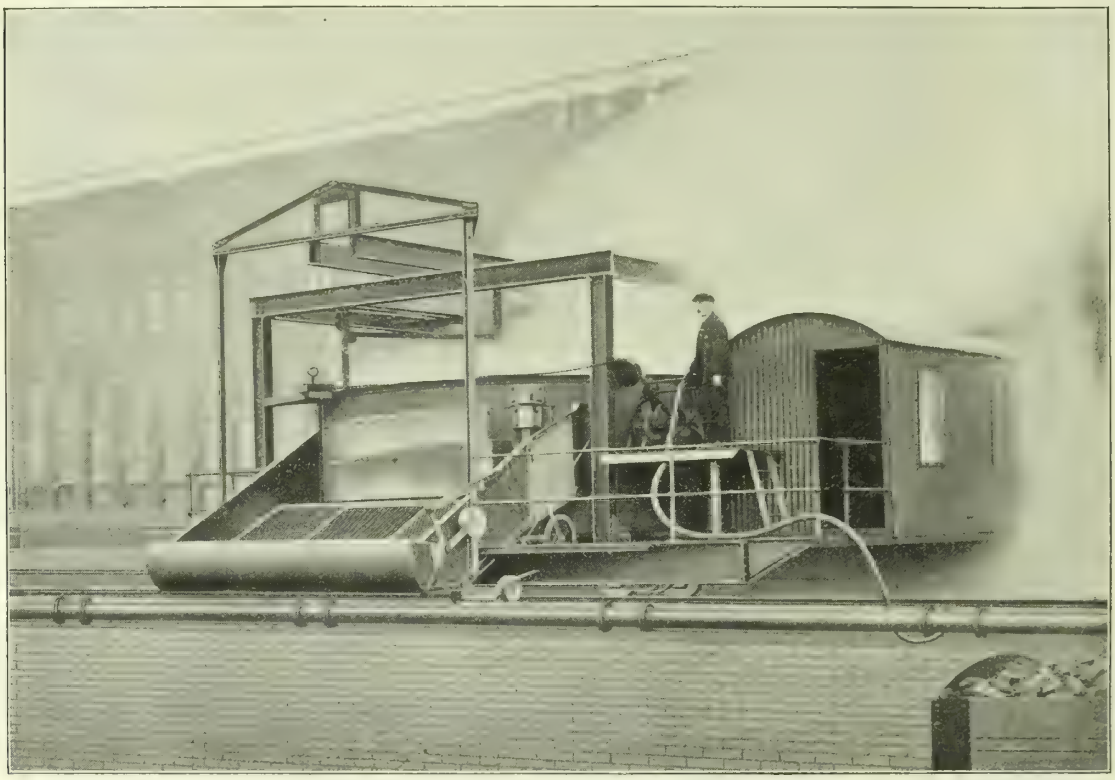
The Act of the South Hants Water Company confirms the construction of the existing works, and gives the Company authority to make others, consisting of two covered service reservoirs, one in the parish of West End, and the other in the parish of Hedge End, both in the rural district of South Stoneham, and five aqueducts or pipe-lines in connection therewith; and a period of seven years is allowed for their completion. The Bill contained a proposal to extend the Company's limits so as to include portions of the parishes of Owslebury, Upham, and Minstead, in the rural districts of Winchester, Droxford, and New Forest respectively; but it does not appear in the Act. Permission is given to raise additional capital not exceeding in the whole £60,000 (half the amount applied for) in £10 shares, to be sold by auction or tender, and to be limited to a dividend of 5 per cent. per annum if issued as ordinary capital. The Company may borrow to the extent of one-fourth, and create debenture stock. By section 9 of the Act, protecting the Southampton Corporation, the quantity of water to be drawn by the Company from their wells and pumping-station at Twyford is not to exceed 2½ million gallons in any 24 hours, under a penalty not exceeding £50 per day. [*Parliamentary Agents: Messrs. Bircham and Co.*]

The South Lincolnshire Water Act authorizes the extension of the limits of supply of the South Lincolnshire Water Company so as to include what is known as the town district of the parish of Holbeach, in the county of Lincoln. An agreement, dated June 19, 1906, and made between the Bourne Company and Alfred Robert Blanchett, on behalf of the South Lincolnshire Company, is annulled; and certain sections of the Company's Act of 1906, giving protection to the Bourne Council and the Bourne Water Company, are repealed and others are substituted. These specify that the Company are not to sink any well, boring, shaft, adit, or other work, within a distance of a mile from any part of the urban district of Bourne, or take water therefrom, or apply for power to do so, without the consent in writing of the District Council; nor are they to supply water within the urban district. Authority is given to increase the capital to £42,000 in £5 shares; and the borrowing powers granted by the Act of 1906 are altered in proportion. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Thorne and District Water Act incorporates a Company for the supply of water in the parishes of Thorne, Hatfield, Stainforth, and Fishlake, in the West Riding of York. The capital is to be £25,000, in £5 shares; and authority is given to borrow to the extent of one-third, as well as to issue debenture stock. The Company may construct a pumping-station and a water-tower, with a conduit connecting them, in the parish of Thorne; also a line of pipes commencing at the water-tower, and ending at a point in the Thorne-Marshland Road. Similar works are to be carried out in the parish of Hatfield; but in this case the pipe-line from the water-tower will end at a specified point in the Doncaster Road. Five years are allowed for the completion of the works. The rates to be charged for water range from a minimum of 8s. 8d. up to 5 per cent. per annum on the rateable value of the premises supplied, with an additional 5s. for each closet beyond the first, 5s. for a 50-gallon fixed bath, and such sum as may be thought fit for a larger one. The charge for water supplied by meter is not to exceed 1s. 6d. per 1000 gallons. The Act contains various protective provisions, and the others are of the usual character. [*Parliamentary Agents: Messrs. Baker and Co.*]

At the opening of the session, authority was sought for the incorporation of a Company with power to acquire the undertaking of the Kingswood Water Company, Limited, which was established on July 9, 1908, for the purpose of supplying water within the parish of Kingswood, in the county of Surrey; but the Bill was rejected. Other proposals for the incorporation of Companies referred to one for the supply of water to Maltby, the urban district of Tickhill, and certain adjacent parishes in the West Riding of York; and to another for the supply of Wells-next-the-Sea and a number of parishes in the rural district of Walsingham, in the county of Norfolk. Both of the proposals named, however, were dropped. The Pontypridd Water Company promoted a Bill to obtain (*inter alia*) an extension by two years of the period limited by the Pontypridd Water-Works and Tramroad Act, 1908, for making a substantial commencement with the works connected with the construction of the Llia reservoir, and the purchase of land for the purposes of the reservoir, and other works sanctioned by the Act, except the tramroad and works authorized to be abandoned by the Act of last session. The Bill passed through the House of Commons and was committed in the House of Lords; but it was withdrawn towards the end of July. The Staffordshire Potteries Water Company introduced a Bill to obtain confirmation of their existing works, enable them to construct a number of additional ones, and raise more capital. It was introduced in the House of Commons, but was withdrawn at quite an early stage. The Whitland Water and Gas Bill, promoted with the object of supplying water in certain parishes in the counties of Carmarthen and Pembroke, was another measure which was not proceeded with.

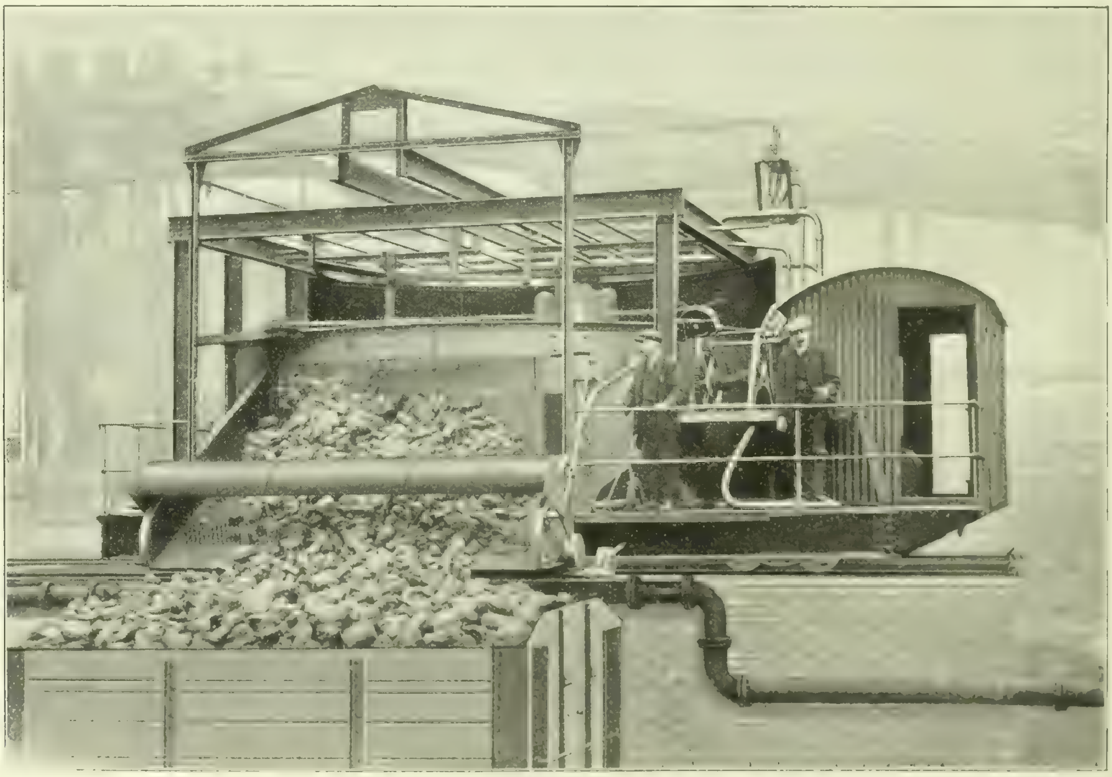
GOODALL'S PATENT COKE QUENCHING, SCREENING, AND LOADING MACHINE.



Goodall's Coke Quenching, Screening, and Loading Machine at the Weardale Company's Spennymoor Coke-Ovens.

The problem of economically dealing with hot coke is one which has for a long time occupied the attention of gas engineers; but this problem is not confined to them alone. The same question arises in the case of modern coke-oven plants where large quantities of hot coke have to be dealt with daily. Various forms of conveyors and other mechanical arrangements have been tried, but have not been altogether successful; and the usual method is to discharge the coke on to the bench in front of the ovens by means of a ram, and then to quench and load the coke into waggons by hand. The coke must be thoroughly quenched, or it will set fire to the waggons; but it must not contain more than a very small percentage of moisture. The breeze and small coke must be loaded separately; and the coke must be loaded into a waggon anywhere along the bench, as, under ordinary working conditions, it is not always possible to have the waggon just where it is required.

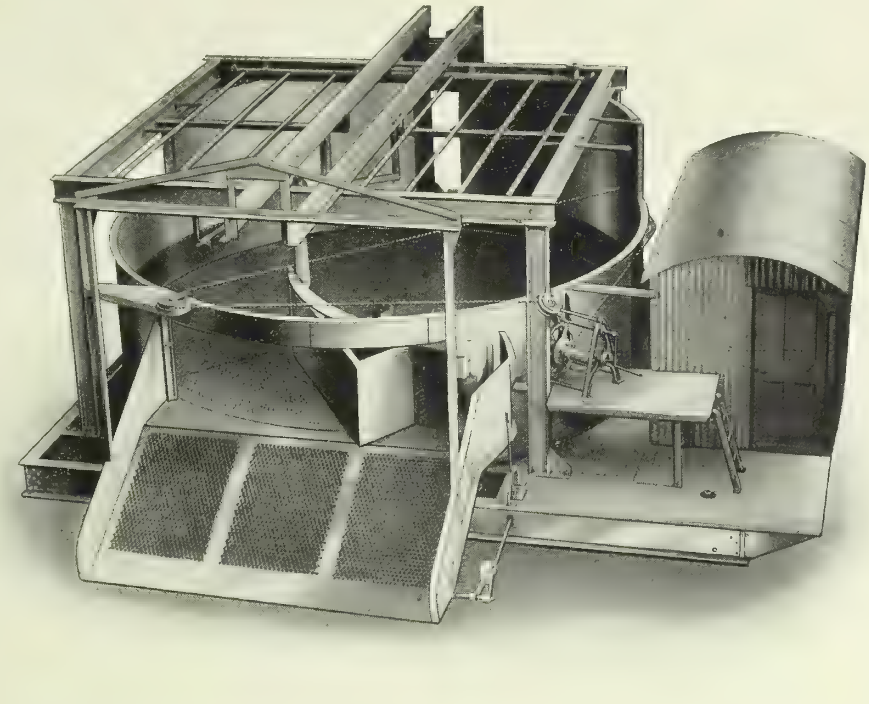
A new machine, known as Goodall's patent coke quenching, screening, and loading machine, has recently been brought out to meet the conditions mentioned above, and has been found in actual working to save more than two-thirds of the cost of hand working. The importance of this is too obvious to need comment. The machine consists of a large circular table, about 20 feet diameter, carried by a heavy steel framework, which runs on rails in front of the line of ovens in the position usually occupied by the discharging-floor. The travelling frame also carries a screen, and is fitted with motor or steam engine and boiler and gearing, to propel the machine and revolve the quenching-table. The table is supported by a footstep, or pivot bearing, at the centre, and a ring of rollers near the outer edge. The renewable cast-iron plates forming the bottom are perforated with small holes, to allow the water and breeze to drain through. A ring of plates surrounds the table, with an opening on the side nearest the ovens, and another, filled by a hinged door, at the other side of the table. Above the revolving table, and at certain points in the



The Coke Quenching, Screening, and Loading Machine Discharging and Loading Coke into Railway Waggons.

sides, perforated pipes are arranged for spraying quenching water on to the hot coke. The hinged door is operated by a winch and chains; and, when opened, it projects inwards, and acts as a plough to remove the quenched coke on to the screen. This consists of a shoot or other suitable arrangement fitted with a screen; and in passing over this into the waggon, the breeze is removed, and falls into a small hopper fixed underneath.

The machine is operated as follows: It is first set with the opening in the side plates opposite the oven to be discharged; and the ram on the other side of the bench commences to push out the charge. As soon as the cake of coke enters the machine, the water is turned on; and when the coke is well on to the table, this begins to revolve. The action of the revolving table and the forward motion of the coke cause the latter to be laid gently and evenly over the floor of the table.



A Better View of the Details of the Machine, from a Photograph taken at the Makers' Works.

The machine is moved out of the way, so that the oven-doors may be replaced, the water is shut off, and the coke is allowed to steam and dry; the surplus water draining away through the holes in the bottom plates. When the quenching is complete, the machine is moved along to the railway waggon to be filled, the discharging door is opened slightly, and the table revolved, so that the coke is brought against the edge of the door, which acts as a plough, and pushes the coke over the screen into the waggon. The breeze falls through into the small hopper, from which it can be emptied from time to time into a separate waggon.

The whole operation takes about twenty-five minutes; and one machine deals with a battery of sixty ovens. By the use of this machine, a considerable saving has been effected in the quantity of breeze made, owing to the gentle handling of the coke; and a further saving is effected by the reduction in the time required to close the oven doors after discharging. All the work on the coke-bench is accomplished by three men per shift, against nine required before the installation of the machine.

Two of the illustrations are views of the machine at work; while the third is a reproduction of a photograph of the machine taken in the works of the makers (Messrs. W. J. Jenkins and Co., Limited, of Retford); and this shows more clearly its construction. It is unnecessary, having mentioned the names of the makers, to say anything as to the practical character and excellence of the work put into the machine, nor as to the substantial nature of the design of the constituent elements in view of the heavy work that devolves on them.

THE PIPE SUBWAYS IN KINGSWAY.

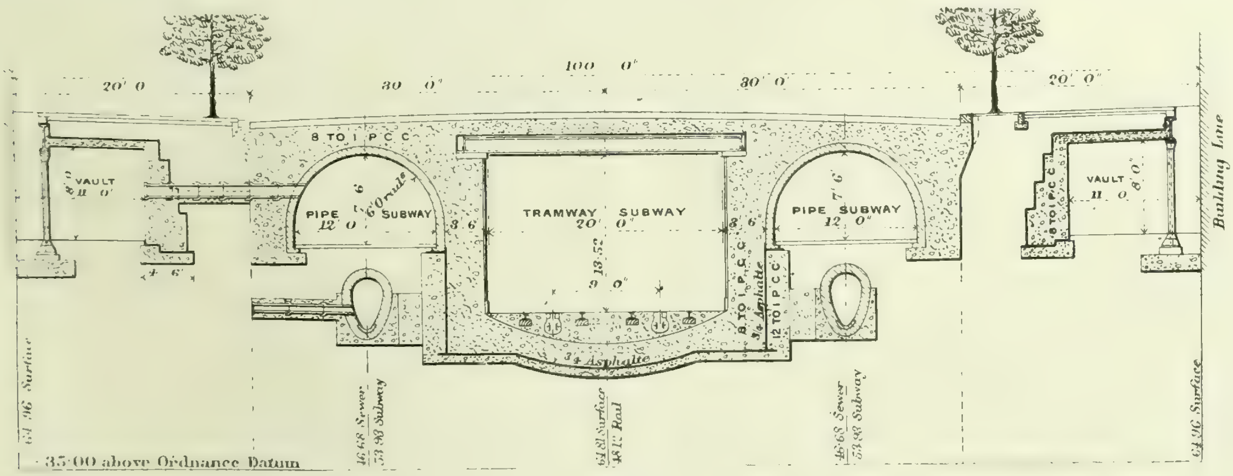
At the Institution of Civil Engineers last Tuesday week, a paper was read on "The London County Council Holborn to Strand Improvement and Tramway Subway," by Mr. George William Humphreys, M.Inst.C.E. The paper, as its title implies, dealt with the works involved in the great London street improvement of cutting a new thoroughfare from Holborn to the Strand. This is the largest street improvement since the making of Regent street in 1820, and furnishes the first—(one is tempted to ask, will it be the last?)—example in England of a shallow tram-subway. Here, however, we are only concerned with the portion of the paper which deals with pipe-subways and gas-mains.

By the L.C.C. Subways Act, 1893, where there are subways, gas, water, and other companies can be required to lay their pipes in such subways and pay a rent for so doing. Both in Kingsway and in Aldwych, pipe subways have been placed. They are semi-circular in shape—as was shown in the illustration in the "Journal" for Oct. 24, 1905, p. 231—generally 12 feet across (but sometimes only 10 feet) by 7 ft. 6 in. high; being constructed in two rings of brickwork with a backing of concrete. The pipes and cables are laid either on the floor, which is covered with 3 inches of gravel, or rest upon iron brackets fastened to the brickwork. Cross communication between the two subways is provided at suitable points by subways which are 7 ft. 6 in. wide, and the same in height, and are carried underneath the tram-rails. Ventilating covers are placed about every 75 feet.

To allow of the easy effecting of gas connections from the mains to the buildings, 12-inch diameter stoneware pipes are used at distances of about 10 feet. One end of these pipes runs into the vaults of the buildings, as shown; and so the breaking-up of the pavements is avoided. All these vaults were made at the same time as the road improvements were being carried out; the later style of constructing them being to have a continuous space, 11 feet deep and 8 feet high, quite independent of, and outside, the building-line of any future buildings.

The average cost of these pipe-subways per lineal foot varied from about £4 5s. to £6, according to the foundation required; the general average cost amounting to £5 4s. per lineal foot.

All that the author says about the lighting of the thoroughfare is: "The lighting is by means of high-pressure gas, each lamp being of 700-candle power, and the standards, 26 feet high, are placed 80 to 100 feet apart." This bare statement has, however, been supplemented from time to time by much fuller details in our own columns.

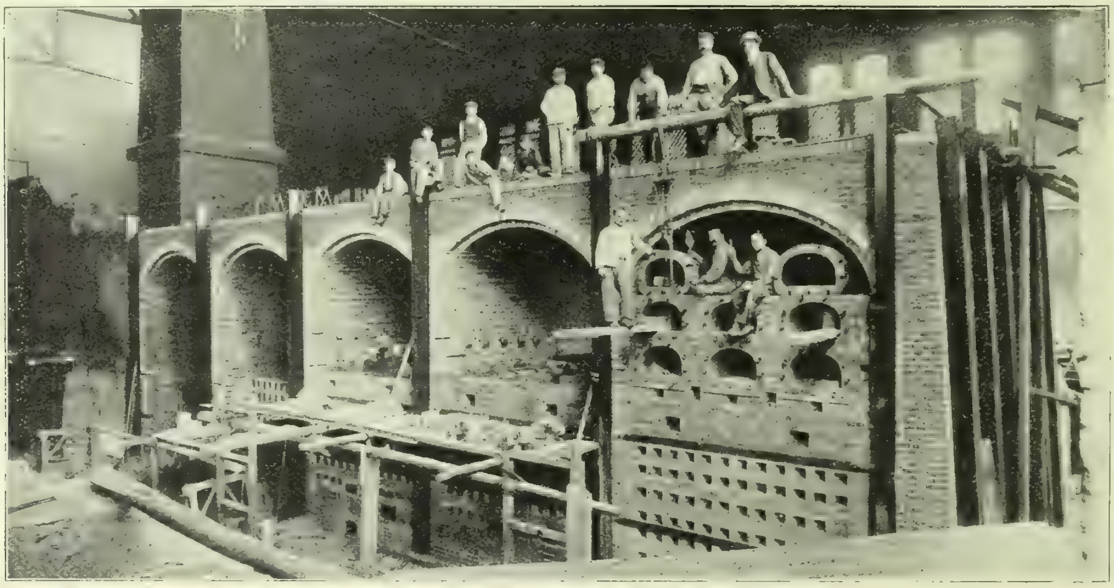


Pipe Subways in Kingsway—Holborn to Strand—London.

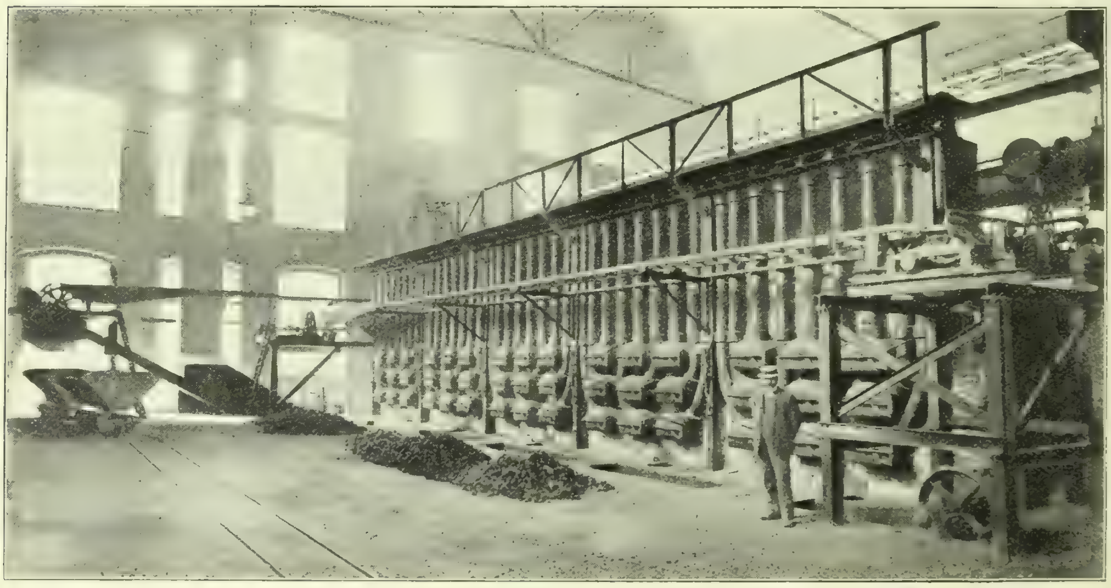
A YEAR'S GAS PROGRESS AT TURIN.

Interesting Annual Report.

As year follows year, it is of interest to observe how in some gas companies, both abroad and at home, there is a regular record of quiet progress, accompanied by gradual reorganization of plant, and judicious addition of new machinery, all with a view of efficiently meeting the public needs of the community to be served. Such a gas company—as our columns from time to time bear witness—is the Società Consumatori di Gas-Luce of Turin. Their last report, containing the figures of their undertaking up to the end of June last, is no exception to the rule. The enlightened, progressive, and frank policy adopted by the directorate of this Italian Company has for some time past marked them out as distinctly in front of many other gas undertakings in the same country, notwithstanding that the latter have the advantage of larger works supplying greater populations.



The New Retort-Bench at Turin under Construction.



Coal and Coke Conveyor in the Turin Retort-House.

The Gas Consumers' Company sold to their clients, in the year 1909-1910, 18,692,902 cubic metres of gas, or rather over 660 million cubic feet. This is an increase on the previous twelve months of 678,097 cubic metres, or nearly 24 million cubic feet, of gas. As usual, this output is divided into percentages under the following heads of consumption: Ordinary meters, 90·79; prepayment meters, 0·53; industrial purposes, 2·12; public lighting, 5·41; motive power, 0·89; and for aeronautics, 0·26 per cent. This last heading constitutes an altogether new category for the output of gas, thanks to the good relationship existing between the Company and the local section of the Società Aeronautica Italiana. One cause of the satisfactory increase in the gas sold is to be found in the cultivation and supply of the needs of the less well-to-do, in providing them with the means of economically using gas. The total number of gas-meters is now 35,958, being an addition of 2715 during the year. Converted into cash, the gas sales realized 3,094,762 lire (or about £123,790), of which only 2277 lire (or about £91) was not actually received—an excellent collection of accounts.

Close attention has continued to be given to the state of the mains, with the result that the unaccounted-for gas has been reduced from a former 6 per cent. to a present 5 per cent., representing a saving of about 200,000 cubic metres, or over 7 million cubic feet. New mains, to the extent of 14,093 lineal metres, have been laid, bringing up the total length of gas-mains to 316 kilometres, or 196 miles.

Turning from the gas made to the coal used, we find that its price, c.i.f. Savona, has been steady, varying from 16s. 6d. to 19s. No large purchases have had to be made, as this year's supply had been all but covered by previous contracts; so that only small consignments of American coal, and some 20,000 tons of English coal, were all that were required. The amount carbonized was 65,790 tons, which gave 19,738,150 cubic metres of gas, or the equivalent of a make of about 10,800 cubic feet per ton. The coke produced was happily all disposed of under the contracts entered into; and only some 200 tons, or hardly two days' production, remained in stock at the end of the year.

As to the large constructional works and alterations that have been going on during the last two or three years, it may be said that they have been carried to successful completion within the last twelve months. A new bench of five arches, each of nine retorts, has been built by the firm of P. Picard, of Paris, who is the successor to the late M. Derval, whose furnaces were so well known in Continental gas-works. Adapted to these arches has been installed a Fiddes-Aldridge charging and discharging machine, together with accessory coal and coke conveying plant, erected by Messrs. Cutler and Sons. As to all this machinery, the report speaks in terms of high praise. "The splendid results obtained from first being put into work up to to-day prove to us that we were fortunate in selecting this plant, and especially the Fiddes-Aldridge charging and discharging machine, which, in our opinion and given our special local conditions, solves better than any other means the serious problem of retort-house work." This was the first adoption in Italy of this type of retort stoking

machine; but the example has since been followed in two important instances. To provide the necessary current, a handsome electricity station has been erected on the works.

As a matter of suggestive contrast, it may be noted that this Gas Company has subscribed the sum of 50,000 lire (£2000) towards a fund for the building of a stadium in Turin, on the ground that it will aid the physical education of its people, bring visitors to the town, and add beauty to its buildings. One can hardly imagine a British gas company contributing such a generous (or any) sum to a local sports' ground, or indeed even to objects more directly and indisputably educational. But the close and sympathetic identification of the Turin Gas Company with the local affairs and aspirations is pleasing—and, it may be, profitable.

A well-deserved tribute to the energy and industry of the staff and employees, and praise of the management and control of Sig. Rag. Giacomo Beria are properly and naturally included in this review of a year's successful working.

DIFFERENTIAL PRICES AND DISCOUNT METERS.

EXPERIENCE OF A SMALL GAS-WORKS.

By H. J. Woodfine, of Wellington.

In a recent editorial in the "Journal" on this subject, reference was made to the Aldershot experience, and you were good enough to say that "new concrete experiences of this sort" would be welcome.

When I came to Wellington (Salop) in June, 1905, I was much concerned to find only 75 gas-cookers on hire, out of some 450 ordinary consumers. Gas-fires, radiators, and wash-boilers, also, I found to be very rare. The prices then ruling were as follows: For lighting, 3s. 6d. per 1000 cubic feet; for cooking and heating, 3s.; and for power, 2s. 10d. It will be seen that the differential price system was in operation, and had been for some years; but it would be a stretch of the imagination to term it in any way successful.

After much thought, I arrived at the conclusion that, in adopting the differential price system, it had not been carried sufficiently far, and that the rebate of 6d. per 1000 feet was not inducement enough to overcome the obstacles in the way—viz.:

(*a*) The necessity for having fitted on rent a second large (comparatively) meter, in order to secure the rebate.

(*b*) The fondness of the people for the old "Shropshire" cooking-range, combined with some prejudice against gas-cookers.

(*c*) The moderate price of good coal—16s. to 17s. per ton delivered.

Further consideration led me to believe that the following conditions were necessary to success.

1.—A rebate large enough to appeal strongly consumers.

2.—A measuring instrument which would take up little room and could be fitted to cookers, fires, radiators, &c., so advantageously as to enable a close and constant check to be kept on the consumption.

3.—Easy terms for the use of same.

Accordingly, I recommended to my Directors that the differential price system should have a fresh start under new conditions, viz.: For lighting, 3s. 6d. per 1000 cubic feet; for cooking and heating, 2s. 6d.—rebate, 1s. Rotary meters as the rebate recorder were fitted free of rent to cookers, and at a charge of 6d. per quarter to fires, wash-boilers, &c. This recommendation was approved, and put into operation at once.

It would, perhaps, be as well at this stage to say that when deciding upon the 1s. per 1000 feet rebate, it was not my intention that this should be permanent. I had in mind the likelihood of a reduction of the lighting price in the near future; but it seemed to be quite the best thing to give this strong inducement right away. By so doing there was every probability of securing a sufficient number of satisfied consumers to disseminate the benefits of the system throughout the town; while there was little chance of a drop in the rebate (to be brought about by a reduction in the lighting price) causing those who had once availed themselves of the system to give it up, as I have always found that cookers and fires satisfactorily fitted and looked after do not come out.

Late in 1905, the system was given a fresh start; and the following figures, taken from the rental, will convey at a glance the splendid aid which the rotary meter has been to this Company in increasing the output for cooking and heating purposes.

Consumption.

	Cubic Feet.	Increase. Cubic Feet.
1905	1,789,000	—
1906	2,219,100	430,100
1907	3,393,000	1,173,900
1908	4,841,200	1,448,200
1909	5,491,700	650,500

Increase in four years, over 200 per cent.

It will be observed that the largely increased output of 1907 and 1908 has been well maintained to date; and I look upon this as proof positive of the favour in which the system is held by our consumers and of the permanency of the business.

Wellington is a town of small growth in an agricultural district; so that the credit for the increased consumption for cooking and heating must be given to the discount meter and differential price, *plus* activity in the shape of constant advertising, and not to any great increase in the number of consumers.

Managers in charge of works supplying small towns, especially of an agricultural character, will appreciate my remarks when I say how difficult it is to persuade consumers that gas is so much better than coal for cooking and heating. They cling to the coal fire and range very tenaciously; and I am well convinced that something in the shape of a big rebate is necessary to bring them to the stage when they agree to a trial, after which, if cooker-rents are low, and fires are put in on advantageous terms, they are converts.

As demonstrating the uphill fight which managers of small works have to make on behalf of the cooking and heating load, the figures of 1906 need only be compared with those of 1907 and 1908. Notwithstanding the large rebate, nearly two years had to roll by ere it could be confidently stated that the system was a real success; and during that time every possible means was adopted to bring heating and cooking appliances before consumers. The fact is our system had to stand the test of a small beginning, and to rely upon its success for its inherent benefits and advantages to gas users.

It is held by some managers that the differential price system is not an equitable one. I do not propose to enter into any discussion as to this, but simply to say that the fact that a large proportion of our consumers have ascertained from experience that they can save money and have greater convenience in the house by adopting gas as fuel in preference to coal, while at the same time the Company have been able to reduce the price for lighting from 3s. 6d. to 3s. 2d. per 1000 cubic feet, and for power from 2s. 10d. to 2s. 3d., and disburse larger dividends, is pretty strong evidence that differential prices are mutually satisfactory to consumers and shareholders.

In conclusion, let me say that success is not achieved without constantly bringing before consumers the merits of the various gas appliances. I have found that the best results follow short, crisp advertisements; and there is no better field than the magazines of churches and chapels. But the advertisements must be changed frequently, and should be original.

The advertisement reproduced below, inserted on the bottom half of the front cover of the Wellington Parish Magazine—a position secured only after a good deal of trouble—was the means of bringing in quite a flood of orders for cookers, and represents the type favoured by me.

HOME TRUTHS.

One Swallow does not make a Summer, nor one bucketful of Coal a Hot Oven.

Every bucketful of Coal costs you at least twopence.

30 cubic feet of Gas, costing one penny, will cook you a good dinner.

COOKERS ON HIRE FROM 1D. PER WEEK. FIXED UP FREE OF COST.

The Wellington (Salop) Gas Company.

Detection of Nitrogen in Coal Gas.

Writing from Amiens over the signature "Albert Nitrogène," a correspondent in the last number of the "Journal des Usines à Gaz" questions the accuracy of certain figures given in the third table in the report by Mr. J. Ferguson Bell on his investigations with respect to carbonizing coal in horizontal retorts, carried out by him as a member of the Carbonization Committee of the Institution of Gas Engineers, and presented at their last annual meeting. The table referred to appeared on p. 837 of the "Journal" for June 21, and the figures questioned are the 6·60 and 11·10 per cent. put down for the nitrogen content of gases produced with twelve and eight hour charges. The correspondent points out that, according to Dr. Letheby, the quantity of nitrogen in ordinary gas is 0·5 per cent.; to Mr. Lewis T. Wright (16 to 17 candle gas), 2 per cent.; to the "Lancet," 2·50 per cent.; and to Professor Lewes, 2·50, 4·23, and 5·10 per cent. respectively for the Gaslight and Coke, South Metropolitan, and Commercial Companies. These analyses show a nitrogen content ranging between 0·5 and 5·1 per cent.; but generally about 2·5 per cent. The writer is, consequently, at a loss to understand how Mr. Bell found the figures he recorded, and rested satisfied by merely saying they were obtained "by difference." He says nitrogen in this way becomes responsible for all the errors made in analyses of heavy hydrocarbons, carbonic acid, oxygen, carbonic oxide, methane, &c.; and the publication of such analyses helps to give the general public false notions in regard to the average composition of illuminating gas. When gas-works are not in possession of an exhauster, the gas may contain from 0·5 to 1 per cent. of nitrogen; but if there is one, and the revivification of the purifying material is effected *in situ* by means of air, the gas may contain normally from 2·5 to 3 per cent. The writer's conclusion is that what is still called "nitrogen" is some other constituent which analysis has failed to detect, and which passes as nitrogen in the "difference."

THE "PERMANENT" GAS-LIGHTER.

In these days, nothing is required to be said to emphasize the advantage that will accrue to gas-lighting, in certain of its phases, when a really reliable lighter is available; and many self-lighters and automatic lighters are on the market and already in extensive use.

Attention has recently been directed to another lighter—named as above—for which much superiority is claimed; requiring, it is said, less power to work it than many other devices, and no lubricating at all. As shown in the section of the lighter and sketch of the lamp arrangement, when an electric current is passed through the apparatus, the positive pole of the battery being connected to the contact screw T, and the negative pole to the gas conduit (which is placed in contact with one of the magnet coils), the armature, which also forms the valve body, is actuated, and opens the valve. The armature, made of soft iron, is polarized by the permanent magnet P; and this holds the armature in the position shown when no current is flowing through the coils. When the valve is to be closed, the direction of the current is reversed so that the negative pole of the battery is connected to T, and the positive to the conduit. These reversing impulses of the current

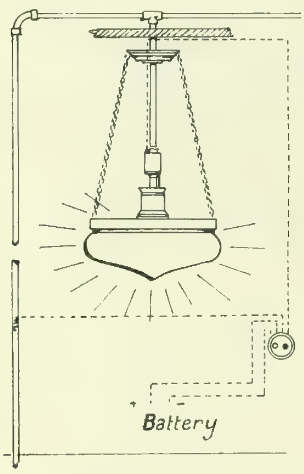
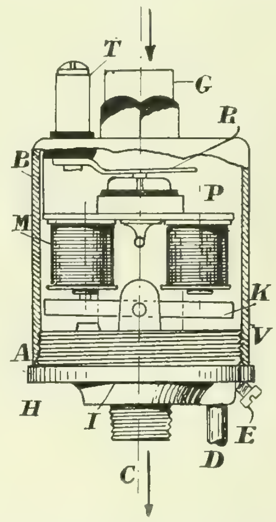


Diagram of Connections.



are obtained by pressing the buttons alternately. The arrangement is used in connection with a pilot flame, and allows the fixing of the gas-fittings to be higher and closer to the ceiling, where they are more protected from damage, and at the same time distribute the light more evenly over the room. In the words of the patentee: "The combination of the 'Permanent' gas-lighter and the inverted mantle gives us the neatness and convenience of the electric light with economy in the use of gas."

The illustration shows an electrically actuated valve. A is the valve casing (of brass); B, the cover; C, the burner; D, the pipe for the igniting flame; E, a set-screw for the pipe; G, the inlet for the gas; H, the valve seat; I, a channel for the gas from A to C; K, the valve body and armature; M, the magnet-coil; P, the permanent magnet; R, the contact plates; T, a contact screw; and V, the pivots on which K turns.

The Kerpely Gas-Producer.

We have received from Messrs. Appleby and Co., of No. 10, Victoria Street, S.W., a pamphlet containing particulars of the Kerpely gas-producer, of the manufacture and sale of which in this country they have the control. Among other purposes to which the producer can be put is the recovery of ammonia; and we learn that a large number of them are in use and in course of erection. The makers put forward the following as the special features of the producer: Continuous and automatic working, with the minimum of labour; greater gasifying power and better quality of gas produced; effective gasification of every kind of fuel, thus securing economy in cost of material gasified; continuous production of dry gas of uniform quality, having continuously the same calorific and heating power; and uniformity of production in the furnace. In the pamphlet is a comparison of the analysis of gas obtained in a Kerpely and an ordinary producer from the same fuel, which bears out the claim for economy in the fuel bill; and a letter from a manager of steel works, who lately placed an order for some of these producers, sets forth his reasons for preferring them to others. The pamphlet is illustrated; the frontispiece showing an installation of producer plant with bunkers and overhead electric crane.

For surfacing concrete pavements at Ann Arbor (Mich.), a mixture of tar and sand is used. According to the specifications of Mr. E. W. Groves, the City Engineer, the pavement consists of a 5-inch bottom layer of 1 to 8 concrete and a 2-inch mortar surfacing. After the concrete has thoroughly set, a thin coating of tar is spread on the street; and before this is dry, a coating of sand is applied.

AMMONIA RECOVERY.

Discussion on Mr. Johns' Paper.

The following is a report of the discussion which took place on the paper read by Mr. W. H. Johns, of Birmingham, at the last meeting of the Midland Junior Gas Engineering Association. The paper, which was entitled "Ammonia Recovery, with Special Reference to the Apparatus employed therein," was published in the "Journal" last week—pp. 489-496.

The President (Mr. R. S. Ramsden, Burton-on-Trent) remarked that the paper dealt with a subject with regard to which everyone actively engaged on a gas-works had some experience; and he therefore hoped they would have a good discussion. They would particularly like to hear Mr. Pickering with reference to the Feld washer, with which he had had experience.

Mr. W. J. Pickering (Birmingham) said that Mr. Johns had given them an interesting list of ancient and modern washers and scrubbers; and he thought the Feld apparatus could claim a very fair place among the modern types. First of all as to the working of the apparatus, Mr. Johns said the central shaft was fitted vertically, working in roller bearings. That was to say, at the top there were ball bearings; and the entire weight of the shaft and cones depended from these ball bearings. The washer could be started from rest simply by hand. The Feld washer at Saltley was of 7 million cubic feet nominal capacity; and the horse power needed was about 7—working at a speed of about 120 revolutions per minute. The speed of the washer depended chiefly on the size—the smaller the washer employed, the greater the speed requisite to obtain about the same speed on the periphery of the cones, and thus get the proper spraying effect. Mr. Johns mentioned this fact with regard to the Kirkham centrifugal washer. Then, the Feld washer lent itself very easily to cleaning out; and it was found the best plan to do this regularly. The perforated plate at the top required attention to keep down back-pressure. The back-pressure was taken regularly every shift; and they found about 1 inch. Among the advantages claimed for this apparatus was that it gave no back-pressure. He believed that Feld himself claimed at the outset that the back-pressure would be even less than nothing. It might be so in some cases; but, as he had said, it was not their experience. However, when the back-pressure was down to 1 inch, he did not think that there was much to trouble about. Of course, it depended upon the solution employed. No doubt, such washers would play an important part in schemes of wet purification. As to the working of the washer for ammonia extraction, Mr. Johns had said no doubt much better results could be obtained if arrangements had existed for pumping the liquor over and over, or if two washers had been worked in series. He also made some remarks earlier in the paper about the time of contact between water and ammonia in order to get proper efficiency. He quite agreed with Mr. Johns. He thought if they had had more chambers in their washer, they would have found it work better for ammonia, as it would have given them a stronger liquor. They did make arrangements for pumping the liquor over again, as a matter of fact; and this gave them a little higher Twaddel. It was not, however, anything like the result that they would have obtained if the washer had had more chambers, or if they had had two washers.

Mr. W. S. Smart (Saltley) remarked that the paper just read created a record as regards length; and its interest and value to the members, he thought, would cause it to occupy an extremely high position in the proceedings of the Association. Mr. Johns described or mentioned about 28 different types of washers and scrubbers, each possessing certain advantages, and also, of course, disadvantages. The manufacturers interested in the sale of any particular plant were never backward in bringing into prominence the merits of their apparatus; but its faults and failings could only be found out in actual working. This, of course, referred specially to the newer types of plant. Therefore a paper such as this—particularly when illustrated by drawings and by working models—was exceedingly instructive. In the paper, the Young washers at Saltley were favourably spoken of; and it might be of interest to mention that they were put down in the year 1862, and had been working more or less continuously ever since. In referring to heavy first cost, he thought some allowance should be made for the small annual depreciation charge which was necessary in the case of plant having such a long life. There was no doubt in his own mind that for filling tower scrubbers the adoption of wooden boards paid in the long run. He was round a works some time back where they were putting in 7 in. by ½ in. boards, with a ⅝-inch space between each, and a 3-inch space between each tier. They cost six times more than coke filling, and gave a wetted area of 16 square feet per cubic foot, which was very much less than the figure used for comparison in the paper. Other sizes of boards and spaces had previously been tried; but these particular dimensions they had found from experience to be the best. Mr. Johns having both arrangements under his control, he would be glad to hear if he had found any difference in efficiency between washing and scrubbing plant working under vacuum and the more usual method of putting this apparatus after the exhauster. He would also like to have the opinion of Mr. Johns or any other member as to the necessity of placing washers and scrubbers under cover in that part of the country. It added, of course, considerably to the capital expenditure, if they had to provide large houses for such plant; and

personally he did not think it necessary for works of large capacity in the Midland Counties. It would, however, be re-called that Dr. Davidson recently mentioned that it had been found necessary to do this in the case of the coal-testing plant; but there the units were smaller than in the Birmingham gas-works proper. Most of the mechanical washers and scrubbers described in the paper were direct-driven by a small engine; but in the case of the larger works where plant of this character was employed, it seemed to him it would be much better to put down one or two (keeping one for reserve) large engines to drive it all, instead of having a lot of isolated small engines, which were not under control as one engine was in a central engine-house. The great difference between ¾d. and 4d. as the amount received from ammonia products per 1000 cubic feet of gas sold by various undertakings, and the difficulty experienced in comparing working costs, had been mentioned; and a further example of this difficulty might be noted in connection with the estimated saving in sulphate of ammonia manufacture given at the end of the paper. He presumed that Mr. Johns had made this estimate of saving from the working costs of some particular installation; and yet in the paper read before this Association some time ago by Mr. Owen Evans, the actual cost of production for the items mentioned by Mr. Johns only came to £1 15s. per ton, as against an estimated saving of £2 per ton by Mr. Johns; and the costs from a 2000-ton per annum plant at Edinburgh had been published, giving the wages, fuel, and repairs at 14s. 5d. per ton, whereas the estimate in the paper showed a saving of £1 3s. on these three items only, which was a very great difference.

Mr. P. C. Balcon (Birmingham) said he did not see the object in a small works of admitting strong liquor or liquor at all in a scrubber. He took it that by the time the water got into the position of half-way down the scrubber, it became sufficiently strong liquor to do its work, though he knew little about the matter, as he had not had much to do with scrubbers in small works. Where could the advantage come in in putting liquor into a scrubber, say half-way down? Mr. Johns did not make sufficient of the spraying effect of the Livesey washer. It depended entirely upon this effect. It was the third contact of the gas with the spray that formed the efficient extractor, more especially of ammonia, and also of tar. There were one or two points in connection with the extraction of ammonia which, to his mind, were not quite clear. In speaking of any particular washer—especially of the centrifugal type—one could not compare efficiencies by simply taking tests of ammonia at the inlet and outlet, because the stronger the liquor that left the washer, and the higher the temperature, the stronger was the ammonia in the gas. The vapour tension of ammonia was so great that it was absolutely impossible by means of water to remove it. It was, therefore, essential that the quantity of water passing, and the strength of the liquor, should be given.

Mr. F. Shewring (Droitwich), referring to Mr. Smart's mention of washing plant in the open, said that from what little experience he had had, he did not think, speaking in a general sense, that there was any advantage to be obtained by having such apparatus under cover. Perhaps during the summer months, when the sun was very intense, the temperature of the water would be very high; but if they depended on well water, as the author said, in the summer, and town's water in the winter, they should have no difficulty in getting the greater portion of the ammonia out which was necessary for the purification of the gas. Of course, it was very necessary that Livesey washers should be occasionally cleaned; but it was not always possible in small works to do this, because they had not invariably a reserve force. He found, however, that, by occasionally shutting off twelve hours and giving a thorough steaming, it would assist the efficiency considerably, and melt out the tar which accumulated on the perforated sieves. He had also had to do with one of Walker's purifying machines, which was worked under a vacuum; but in this particular case it was really erected to take out the tar prior to going through the exhausters. For this purpose the machine had been working ten or twelve years, and was perfectly satisfactory.

Mr. A. R. Warnes (Birmingham) said that, as to the use of strong liquor, Mr. Balcon had almost taken out of his mouth what he had intended to say. It struck him that if they got very strong liquor, the equilibrium which Mr. Balcon mentioned would be set up, and they would lose ammonia rather than recover it. If a solution of a soluble gas was placed in an atmosphere of a less soluble gas, the dissolved gas would continue to leave the liquid until equilibrium was established between the pressure exerted by the leaving gas and the amount remaining in solution. With reference to the various materials which were used in scrubbers, he had had a good deal of experience in connection with coke packing, and found it very inefficient indeed. It necessitated in his case, where they had naphthalene to deal with, steaming out every few months for two or three days. To the figures given by Sir George Livesey, he might add, on the authority of Mr. George E. Davis, the following: 3-inch bricks with 1½-inch spaces, gave 5·6 square feet surface per cubic foot of tower space; 3-inch solid clay balls, 12·5 square feet; 4-inch clay tower rings, 16·3 square feet; and ½-inch boards with ½-inch spaces, 24·5 square feet. Then he had had experience of balls made of wood and also of fire-clay material. Three-inch balls with ½-inch hole gave 14·5 square feet; 2-inch balls with ½-inch hole, 23·29 square feet; and 1-inch balls with no hole, 37·32 square feet. In a tower which he had for purifying gas, he found considerable difficulty in getting out the sulphur dioxide. There were simply perforated plates; and to these he added small granite chips about 1 in. by ½ in. by ½ in. approximately. This gave him a surface of about 100 square feet per cubic foot of tower space, or perhaps rather more; and by this means he took out practically all the sulphur dioxide in the gas. Whether this plan would be applicable for washing gas, he would not like to say. Probably naphthalene would be a source of trouble unless the apparatus was steamed out regularly. As to deep well water being of lower temperature in summer, he could confirm this.

The Hon. Secretary (Mr. G. C. Pearson, Nechells), alluding to the point raised by Mr. Smart as to the covering-in of gas apparatus, said that, of course, they had all their plant covered in at the coal-testing works; and they found that they derived very considerable advantage from this. The question of covering-in depended, in the first place, to a great extent on how exposed the apparatus might be. If it was right out in the open, it was almost essential for good results to have it covered, because in winter the outlet of the scrubbing apparatus would go down below 40°; and this meant that a great deal of the lighter hydrocarbons would be removed from the gas, and its quality would be deteriorated considerably. In the summer, too, the covering-in of the apparatus was useful, because it kept the sun off, and made it cooler than it would be in the open.

Mr. Shewring: That difficulty can be overcome by the use of a cold water.

The Hon. Secretary: If you get the apparatus covered in, and use water that is not quite so cold, you get an advantage.

Mr. Shewring: Then, of course, capital expenditure has to be considered.

The Hon. Secretary (continuing) said that they also went to the extent of having steam services round the coal-test plant, so as to keep the temperature constant, and prevent the gas falling below 60° Fahr. Steam round a gas-works was very useful as a means of removing blockages of tar, naphthalene, &c. Mr. Johns mentioned measuring the flow of liquor through the scrubber. It was a very nice thing to know how much liquor was being used; but he thought a measuring apparatus of this kind would be likely to lead to erroneous results, as it would soon get out of order. To his mind, the best method of measuring the water going into a scrubber was by means of an ordinary glass jet made to deliver so much water per minute. They would have to make a small apparatus to give it a constant head. He was glad to see Mr. Johns had described the Burstall washer; and he would write to the University before their visit to ask Professor Burstall if he would kindly arrange for them to go round this portion of the buildings. There was little doubt that washers of this type would come greatly into prominence in the near future, especially as tar-extractors. The extraction of tar by a contact process, and not by the cooling process, was a thing which was wanted; and if the tar could be extracted directly it left the retorts in a heated state, they would derive considerable advantage.

Mr. A. Hancox (Great Malvern) suggested that, in the case of tees and bends being underground, it would be a great advantage when the ground was open to put a manhole in. This would enable them, in case of a stoppage, to get to the hand-holes or blank flanges provided for the purpose of cleaning out.

Mr. R. A. S. Browning (Saltley) thought that the recovery of ammonia and its subsequent disposal had not had the attention from gas engineers that it should. It had been left very much to contracting engineers. It seemed to him that the elimination of ammonia from gas by washers and scrubbers had always been such an expensive process, when they reckoned out the initial cost, the upkeep, and everything else. Just to save 0·7 per cent. by volume of ammonia, it did not seem to him worth while. This was specially felt in small country gas-works, where they were a long way from a large town, and had no plant for the working up of the ammoniacal liquor for conversion into sulphate of ammonia. The conversion of ammonia into sulphate direct was a very good idea; and it would be well to give more attention to the perfecting of a plant of this kind. Turning to present-day washers, Cockey's seemed to him to be a very handy little apparatus; but he thought the Feld washer had a great future before it. It required very little motive power, and was easily got at and cleaned out. He would like to know the pressures thrown by the different apparatus named. It was a considerable item in some cases.

Mr. H. P. Morley (Nechells) said he would give protection to condensers, especially where exposed to the sun. On a small works there was a great deal of trouble from tar going forward in the summer with condensers that were close to the retort-house, the exhauster, and other plant. He agreed that it was worth while covering-in the scrubbers, the washers, and even the condensers.

Mr. W. Ault (Saltley) thought greater emphasis should be laid on the fact that the tar should be extracted a little more than was done at small works. This was necessary, as any tar going forward with the gas brought about a poor efficiency of the ammonia recovery plant. Mr. Johns stated that the Livesey washer would extract all the tar; but he (the speaker) thought it was a known fact that tar was at times found at the inlet of the purifiers. In connection with efficiency tests, they should state the quantity of gas passing and the capacity of the washer, and also the length of time the scrubbing material had been in action. Again, the amount of tar fog that had been passing during the time the washer had been in action. As to the horse power required for the Feld washer, he did not know whether the one stated

was practical. The makers said they only needed 1½ horse power for 3 million cubic feet; but he supposed it depended upon the washing medium to a great extent—whether thin or thick.

Mr. SMART proposed a hearty vote of thanks to Mr. Johns for his paper.

The PRESIDENT, in seconding, said he had had the same experience as Mr. Johns with well water causing incrustation in the connections of the washer and scrubber outlets; but it had never occurred to him to get over this difficulty by substituting town water. What was the difference in the action of the two? A somewhat similar trouble had been met with in a Cockey washer which they had at Burton. After it had been at work for a few weeks, the glass windows at the sides got made-up with tarry matter. He did not know of any satisfactory means of keeping these clear.

Mr. JOHNS, after acknowledging the vote of thanks, replied at length to the discussion. He said he was very pleased at the way in which the paper had been received. Mr. Pickering had given them a good account of the Feld washer as erected at Saltley. Of course, as they would understand, it was impossible for him (Mr. Johns), dealing as he did with so many particular pieces of apparatus, to go very thoroughly into any special washer. He had tried to frame his paper in such a way as to convey to the members, and to others who might at any time read the paper, sufficient information to enable them to grasp the principles. He was much obliged to Mr. Pickering for coming forward and supplying further information. Probably no one had had more experience of the working of this particular plant than Mr. Pickering had. As Dr. Davidson's assistant, the cyanogen plant at Saltley was practically under his control; and thus the Feld washer came under his personal supervision. In regard to the horse power, Mr. Pickering said that required at Saltley was 7-horse power, and Mr. Ault, he believed, remarked that it was a question as to whether the washer was to be worked for ammonia recovery, or in the extraction of cyanogen. At Saltley, as mentioned in the paper, the Feld washer was actually employed for the extraction of cyanogen; but he had been able to give tests of ammonia efficiencies, which were carried out to ascertain the capabilities of the washer for ammonia recovery. When a more sludgy mass was used, of course, the vanes and cones had to travel through a liquor which offered more resistance to them, and so an engine of higher horse power was necessary. Then Mr. Pickering stated that the back-pressure was usually about 1 inch. This was so; but he might say that the great advantage of the Feld washer with regard to pressure was that, with an ordinary scrubber, they expected to get 3 or 4 inches. The mere fact of a Feld washer throwing ½ or 1 inch pressure was nothing on a large gas-works. But there was a considerable difference between 3, 4, 5, or 6 inches, which some vertical scrubbers threw, and the ½ inch to 1 inch thrown by the Feld washer. This washer was worked under vacuum at Saltley. As to Mr. Smart's remarks on the cost of repairs. In connection with the Young's washers at Saltley, he (Mr. Johns) did not know when they spent any money on them last, except in the renewal of the water-spray at the top. In the inside, there was practically nothing to renew. There was no engine, no gearing, or anything of this sort. Mr. Smart also referred to the figures given in the paper for board spacing. It was simply a question as to how many boards should be put in a particular space. As to the relative efficiencies obtainable by working scrubbing plant under vacuum or pressure, the late Mr. Mann, who was, he believed, the inventor of tower scrubbers, said they should most certainly be worked under pressure. He (Mr. Johns) had some figures which showed the difference between two sections of the works at Saltley. One was capable of dealing with about 5½ million cubic feet in 24 hours, and the other with about 6 millions. On one section they had four tower scrubbers, 15 feet diameter and about 75 feet high, working under vacuum. At the outlet of the fourth scrubber, they had a Kirkham scrubber at work under vacuum. On the other section there was a Walker machine followed by a 20 feet diameter tower scrubber; and this plant was worked under pressure. The tests referred to the amount of ammonia which had been passing from both sections during the last six months. The average of fourteen tests on the section under pressure showed 0·6 grain of ammonia passing per 100 cubic feet of gas; and the average of twenty-one tests on the section under vacuum showed 1·1 grains of ammonia passing per 100 cubic feet of gas. This indicated that it was undoubtedly better to work at a pressure than a vacuum. The greatest amount of ammonia passing at any time during the period to which he referred was, on the plant under vacuum, 2·9 grains; and on the plant under pressure, 1·8 grains. The minimum figures were: On the pressure plant, *nil* in several tests; and on the vacuum section, 0·1 grain in one test, but generally about 0·5 grain. This was a further proof of pressure being better than vacuum. With reference to the point about strong liquor giving up ammonia to the gas, he was aware of this. It depended, as he had stated in the first part of the paper, on the tension of the liquor and the ammonia. It was practically impossible to have the gas always entirely freed from ammonia; but it could be brought down to a very fine point, as the figures he had given showed. He had hoped to give efficiency tests; but was unable to do so. Although they did not expect to get 100 per cent. efficiency for ammonia, they managed to obtain 98·8 per cent. at the tower scrubbers at Saltley in the hottest time of this year. On the point of cleanliness, he might mention a test that he had made on a certain apparatus which he need not name. He had the efficiency taken in the summer months; but they must, of course, bear in mind that it was a liquor washer, and not a clean water one. Before the apparatus was cleaned out, an efficiency of 62 per cent. was obtained. After it had been cleaned out and put to work again, an efficiency of 79·8 per cent. was secured. This showed, of course, that when using clean plant better results could naturally be obtained. It paid them to clean scrubbers out periodically. On the Continent, they knew, it was customary to cover-in washers and scrubbers; and even in this country, it was getting a more usual practice. At Edinburgh and at Croydon, they would find that the whole of the washing apparatus was under cover. He himself during the last few days had also put a Livesey washer under cover. It need not be an expensive matter. It was absolutely necessary to keep washing plant well under control as regarded temperature. He quite agreed with Mr. Pearson as to "nursing" plant, and maintaining the gas at a proper temperature of about 60° Fahr. They all knew that if the temperature of gas was reduced below this, most valuable hydrocarbons were deposited. So far as possible, condensers, washers, and rotary washer-scrubbers should be under cover. The question raised as to the driving power for various plant on a gas-works could be overcome by having a central station and small electric motors. Mr. Smart had referred to his figures estimating the cost of direct sulphate manufacture. This was a thing which he had had to estimate. At blast-furnace works, plants had been in operation for some considerable time using strong sulphuric acid for washing the gas, which contained only a very small quantity of ammonia. This was impossible at gas-works. The hydrocarbons would be simply swept out of the gas; and they would hear something about candle power. At smaller works, the tendency was now, as illustrated in Mr. Moon's paper read a day or two ago before the Southern District Association, to use dilute sulphuric acid of 142° in what was practically an ordinary washer. Such a washer he had had in mind when writing the paper; and he had had some thoughts of putting it on the market. Unfortunately, however, he had been forestalled. It was a washer which brought the strength from about 3° or 4° Twaddel to between 40° and 50° Twaddel at the finishing stage. The liquid was then run off and evaporated by means of a steam-coil, and crystals of sulphate of ammonia were formed. Mr. Smart had quoted figures from a paper read by Mr. Owen Evans, of Wrexham. He (Mr. Johns) had not seen these figures; but no doubt they referred to a new installation. In the present paper, he was not alluding to new installations, but to every-day working. He could give them the actual working costs of a sulphate of ammonia plant of which he some few years since had charge. For the manufacture of a ton of sulphate, acid cost £2 1s. 10d.; fuel, 10s. 0·24d.; wages, manufacture, 9s. 0·85d.; stores, manufacture, 6·31d.; stores, repairs, 13s. 11·35d.; wages, repairs, 6s. 10·69d.; lime, 2·66d.; and bags, &c., 1s. 5·6d. This was a total cost of £4 4s. 0·3d. per ton of sulphate made. He said in his paper that there would be a saving in fuel of 10s.; no fuel would be necessary. Manufacturing wages should certainly be reduced 3s. per ton; and he put the figure at 6s. Stores he took at half the figure just given. No machinery was necessary; and therefore not so much oil or waste would be required. The figures above quoted were actual working results—they produced sulphate at £4 4s. a ton, and sold at £12 12s. Mr. Balcon did not quite follow the remarks as to admitting liquor mid-way in the tower scrubber. He had, however, had considerable experience of this in small gas-works. As a general rule in small works there would be one scrubber; and an advantage was obtained by admitting the liquor half-way down. Water for finishing was admitted at the top, and gradually became stronger and stronger; but it was not perhaps sufficiently strong for taking out the carbon dioxide and sulphuretted hydrogen, which the stronger liquor would do. He would advise Mr. Shewring to try a light oil or solvene for clearing out stoppages; then he would not have to shut his washer off for steaming purposes. It would not, from his point of view, be advisable to use a scrubber filling so small as Mr. Warnes mentioned. Gas engineers when working scrubbers had not only to look at the purifying effect, but at the pressure the apparatus would throw. Granite chippings would be packed too close together. Mr. Browning asked for the pressures thrown by all the apparatus he had described. This was rather a "tall order;" but he would oblige him as far as he could. The back-pressures thrown by washers, &c., varied from: Young's washer, 0·5 inch to 1 inch. Livesey washer, 2 inches to 3 inches. The 15-feet scrubbers, 1½ inches to 3 inches. Walker's purifying machine, 1½ inches to 2½ inches. Rotary washer-scrubbers, ½ inch to 1½ inches. Feld washer, ½ inch to 1 inch. The 15-feet scrubbers and Feld washer were worked under vacuum at Saltley.

This concluded the discussion.

In the reference to the will of the late Mr. John Birch Paddon which appeared in the "JOURNAL" for the 15th inst., it should have been mentioned that his son, Mr. Arthur Matthews Paddon (to whom probate has been granted) is the Chairman of the Brighton and Hove Gas Company, with which his late father was connected for so many years. Mr. Paddon is also Chairman of the North Middlesex Gas Company, and a Director of the South-gate Gas Company and several other companies; but not of the Brentford Gas Company as was stated by inadvertence last week.

CONSTANTS AND VARIABLES IN THE DESTRUCTIVE DISTILLATION OF COAL.

By Professor A. H. White and Mr. B. M. Ferguson.*

[A Paper prepared for the Michigan Gas Association.]

Introduction.

The present paper is the tenth to be presented to the Michigan Gas Association as a result of your support of a fellowship in Gas Engineering at the University of Michigan. The paper presented last year gave a description of the experimental station for gas manufacture and of the method of conducting tests. The general scheme of the experimental plant has not since been altered; but details of arrangement have been greatly changed. The building has been enlarged to double its former size, and the apparatus rearranged so as to be more accessible and more readily controlled. The same retort has been used throughout the two years of the tests. The most important addition to the equipment has been a Lloyd control, for constant retort pressure—a gift from the Lloyd Construction Company; but it was installed too late to be used in the work reported here. The technologic branch of the United States Geological Survey has co-operated in the work by making chemical analyses and determining the heat value of the coals and cokes used in the tests, as it did last year.

The paper presented last year reported eighteen tests on eleven different coals of widely different composition from all sections of the United States. It was recognized that it was unsafe to draw conclusions from so few tests, and the paper was almost entirely descriptive. The work of the present year has been an extension of that of last year; but it has been confined to a smaller number of coals, and an attempt has been made to determine the effect of variables in operating conditions. The samples of coal were portions of the identical lots used last year. Most of them had been stored in sacks under cover; but two of them had been stored in open bins exposed to the weather. This effect of weathering furnished one variable to be studied. Another was introduced by substituting for the 400-lb. charge, uniformly used last year, charges of 300, 400, 500, and even 600 lbs. These were the only two variables purposely introduced; but the retort temperature was unavoidably a variable, and, as will be shown later, so was the pressure on the retort. The results of the tests failed to show any definite effect due to weathering. This is an important question, and it is planned to inaugurate during the coming year a weathering test which shall extend over a period of five years.

Results of Coal Tests.

The five coals on which report is made come from the States of Illinois, Kentucky, Pennsylvania, Tennessee, and West Virginia. At least one test on each of the coals, except those from West Virginia, was reported last year. There were then presented full data and curves showing the composition of the coals and the changes taking place during distillation. The curves obtained this year were similar to those of last year, and are omitted from this report. There are here presented summarized data showing the average composition of each coal and the data of the tests which are used in the discussions. Tests 18 to 35 belong to last year's series; those with higher numbers to this year's. There is also presented a more detailed discussion and representation of the tests on an individual coal to serve as an introduction. The coal chosen is that from Hellier (Ky.), the tests of which afford a wide range of conditions.

Coal from Hellier (Ky.).—A carload of this coal was received in January, 1909, and a portion of it was stored in a bin exposed to the weather. Five tests were made of it—two on charges of 400 lbs., and one each on a charge of 500, 360, and 300 lbs. Tests Nos. 21 and 30 were made in the spring of 1909. Tests Nos. 54, 55, and 56 were made consecutively in one day on the same coal a year later; it having been exposed all this time to the weather. Tests Nos. 21 and 30 were made in a retort heated to upwards of 2000° Fahr.; while the other three were made at about 1850° Fahr. There were thus many variables which might affect the results. Condensed data are given in Table I.; and a graphic representation of the changes in the quality and quantity of the gas evolved is given in Diagram 1. The average composition of the coal and the result of the five tests are given below.

	As Charged.	Moisture Free.	Moisture and Ash Free.
Moisture	2·45	—	—
Volatile matter	33·31	34·40	35·55
Fixed carbon	60·29	61·80	64·45
Ash	3·95	4·06	—
Sulphur	0·54	0·55	0·57
Calorific value, B.Th.U.	14,312	14,680	15,290

Materials.	Quantities.
Coke, per cent.	63·9
Gas, cubic feet per pound of coal	5·05
Candle power	14·7
Candle-feet	74·4
B.Th.U. per cubic foot of gas	642·0
B.Th.U. in gas from 1 lb. of coal	3261·0
Ammonia, pounds per ton of coal	4·17
Tar, gallons ,, ,,	11·2

* Mr. White is the Professor of Chemical Engineering in the University of Michigan; and Mr. Ferguson is the holder of the Michigan Gas Association Fellowship in Gas Engineering in the University.

The figures of Table I. show a great lack of uniformity. The yield of gas per pound of coal varies from 4·72 to 5·29 cubic feet. Eliminating ash and moisture, and calculating the weight of coal to a moisture and ash-free basis, do not bring the figures into much closer agreement; the variation being 5·15 to 5·60 cubic feet. The yield is not apparently a function of temperature nor of the weight of charge. The question will be taken up later; but the variation may be considered provisionally as due to some unknown cause.

The illuminating power of the gas varies from 14·1 to 15·5 candles, and the candle-feet from 69·7 to 78·9, without any adequate explanation being apparent. The heating value of the gas is only slightly more constant; varying from 622 to 662 B.Th.U. per cubic foot. The number of heat units in the gas derived from 1 lb. of coal varies from 3110 to 3320. There is an apparent relation between this value and the retort temperature—a point which will be taken up more fully later. The yield of ammonia per ton of coal varies from 4·02 to 4·44 lbs., with no evident explanation.

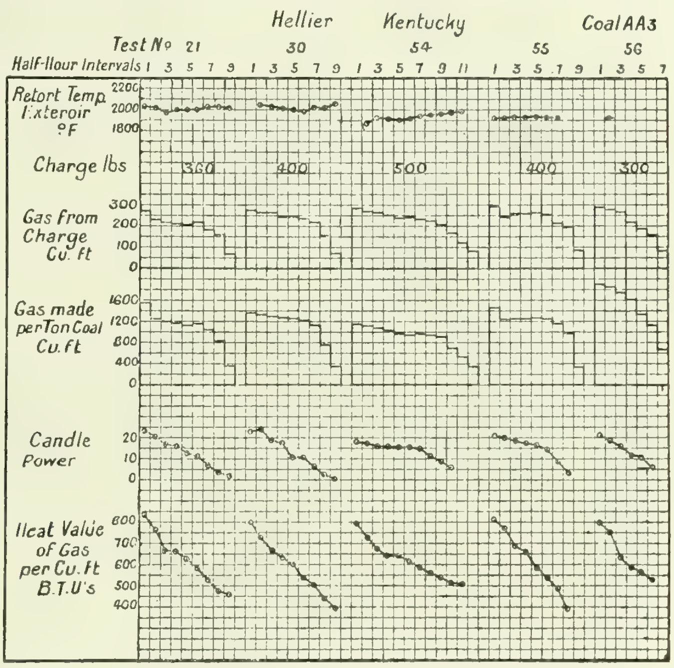


Diagram 1.

Typical Curves Showing Amount and Quality of Gas Evolved from a Charge of Coal in Successive Half-Hour Intervals.

The curves of Diagram 1 indicate a much greater uniformity. The curves of candle power and heat value decrease with reasonable regularity; and the gas yield is regular. The curves are introduced mainly to show these points, which are characteristic of all the tests on all the coals—the results on which the various tests agree rather than those on which they differ. Particular attention is drawn to the evenness of the quantity of gas evolved from a retort during half an hour, independent of the weight of the coal contained in it. Attention is also directed to the corresponding set of curves showing the rate of gas evolution per half hour, referred to a ton of coal as a basis. This last series of curves shows a systematic difference with the weight of charge. They are characteristic of the tests on the other coals which are not so fully set forth. These points are taken up more fully further on in the paper.

Coal from Harrisburg (Ills.).—This coal was from Harrisburg, Saline County (Ills.), and was given one test (No. 35) last year under very favourable conditions; the interior of the retort being badly coated with carbon, and its temperature very low. Three tests on charges of 500, 400, and 300 lbs. each, made consecutively, have been added this year. The average composition of the coal used for the various tests is given below, and the condensed data for each test will be found in Table II.

	As Charged.	Moisture Free.	Moisture and Ash Free.
Moisture	4·64	—	—
Volatile matter	35·62	37·38	40·10
Fixed carbon	53·08	55·73	59·90
Ash	6·66	6·89	—
Sulphur	1·78	1·85	2·01
Calorific value, B.Th.U.	13,011	13,510	14,510

TABLE I.—*Data of Tests on Coal from Hellier (Ky.).*

	Test No. 21.	Test No. 30.	Test No. 54.	Test No. 55.	Test No. 56.
Coal charged, pounds	360*	400	500†	400†	300†
Average temperature, exterior of retort, deg. Fahr.	2036	2020	1864	1841	1851
Yields per pound of coal as charged—					
Gas, cubic feet corrected	4·72	5·0	5·29	5·17	5·09
Candle power, average	14·50	14·1	14·20	15·30	15·50
Candle-feet	69·70	70·5	75·20	77·60	78·90
B.Th.U. per cubic foot gross	650·00	622·0	630·00	649·00	662·00
Total B.Th.U. in gas from 1 lb. of coal	3126·00	3110·0	3340·00	3360·00	3370·00
Yields per pound of coal, moisture and ash free—					
Gas, cubic feet corrected	5·15	5·39	5·60	5·47	5·37
Candle-feet	74·70	76·00	79·50	83·90	83·40
Total B.Th.U. in gas	3340·00	3350·00	3530·00	3550·00	3560·00
Ammonia, pounds per ton of coal—					
As charged	4·02	4·07	4·25	4·44	4·80
Moisture and ash free	4·39	4·25	4·49	4·70	4·32
Yields per hour—					
Duration of carbonization, hours	4·08	4·50	5·92	4·33	3·42
Total cubic feet of gas from charge	1696·00	2003·00	2646·00	2067·00‡	1524·00
Average cubic feet of gas per hour from charge	416·00*	451·00	447·00	477·00	446·00
,, ,, ,, ,, ,, pound of coal per hour	1·15	1·13	0·89	1·19	1·49
,, ,, ,, ,, ,, ,, ,, moisture and ash free, per hour	1·27	1·20	0·95	1·24	1·57
Weight balance—products per cent. by weight—					
Coke	69·4	64·5	66·0	62·0	57·7
Gas	15·9	15·0	15·8	15·7	15·8
Tar	4·9	8·3	4·5	4·5	4·5
Ammoniacal liquor	4·4	5·9	6·7	7·7	7·2
Unaccounted for	5·4	6·3	7·0	10·0	14·9

* Retort badly coated with carbon. † Coal had been weathered fifteen months, but was approximately air-dry when charged. ‡ The meter readings for ten minutes of this test are interpolated.

TABLE II.—*Data of Tests on Coal from Harrisburgh (Ills.).*

	Test No. 35.	Test No. 46.	Test No. 47.	Test No. 48.
Coal charged, pounds	400·0	500·0	400·0	300·0
Average temperature, exterior of retort, deg. Fahr	1777·0	1979·0	1954·0	1819·0
Yields per pound of coal as charged—				
Gas, cubic feet corrected	4·4	4·59	4·70	4·83
Candle power, average	15·2	15·3	15·8	14·4
Candle-feet	65·3	68·8	74·3	69·7
B.Th.U. per cubic foot, gross	632·0	623·0	608·0	611·0
Total B.Th.U. in gas from 1 lb. of coal	2780·0	2860·0	2860·0	2950·0
Yields per pound of coal, moisture and ash free—				
Gas, cubic feet corrected	4·94	5·07	5·30	5·45
Candle-feet	75·10	77·60	83·80	78·50
Total B.Th.U. in gas	3120·00	3160·00	3220·00	3330·00
Ammonia, pounds per ton of coal—				
As charged	6·38	4·90	5·23	5·66
Moisture and ash free	7·20	5·52	5·90	6·31
Yields per hour—				
Duration of carbonization, hours	4·67	5·08	4·58	3·50
Total cubic feet of gas from charge	1741·00	2248·00	1880·00	1448·00
Average cubic feet of gas per hour from charge	373·00	444·00	412·00	415·00
,, ,, ,, ,, ,, pound of coal per hour	0·93	0·89	1·03	1·38
,, ,, ,, ,, ,, ,, ,, ,, moisture and ash free, per hour	1·05	1·00	1·16	1·56
Weight balance—products per cent. by weight—				
Coke	62·3	63·0	62·5	61·0
Gas	14·3	14·0	14·6	15·2
Tar	8·6	7·5	6·5	6·7
Ammoniacal liquor	6·8	7·7	7·6	8·1
Unaccounted for	8·0	7·8	8·8	8·9

TABLE III.—*Data of Tests on Coal from Scott Haven (Pa.).*

	Test No. 18.	Test No. 19.*	Test No. 20.†	Test No. 32.	Test No. 43.	Test No. 44.‡	Test No. 45.‡
Coal charged, pounds	404·0	400·0	400·0	400·0	500·00	400·00	300·00
Average temperature, exterior of retort, deg. Fahr.	1994·0	1925·0	1922·0	1844·0	—	—	—
Yields per pound of coal as charged—							
Gas, cubic feet corrected	4·84	4·93	5·27	5·14	5·22	5·15	5·26
Candle power, average	14·3	15·2	16·00	15·4	15·00	16·30	14·30
Candle-feet	69·3	75·0	84·3	79·2	78·30	84·00	75·30
B.Th.U. per cubic foot, gross	602·0	649·0	611·0	664·0	614·00	635·00	610·00
Total B.Th.U. in gas from 1 lb. of coal	2940·0	3200·0	3230·0	3410·0	3200·00	3265·00	3210·00
Yields per pound of coal, moisture and ash free—							
Gas, cubic feet corrected	5·28	5·34	5·79	5·56	5·68	5·61	5·75
Candle-feet	75·5	81·2	92·60	85·8	85·20	91·60	82·30
Total B.Th.U. in gas	3180·0	3460·00	3540·00	3690·0	3480·00	3560·00	3510·00
Ammonia, pounds per ton of coal—							
As charged	—	5·79	5·17	5·32	4·56	4·30	4·88
Moisture and ash free	—	6·43	5·67	5·75	4·97	4·69	5·31
Yields per hour—							
Duration of carbonization, hours	4·48	4·83	4·55	4·70	5·83	4·67	3·50
Total cubic feet of gas from charge	1952·00	1974·00	2110·00	2055·00	2606·00	2060·00	1578·00
Average cubic feet of gas per hour from charge	436·00	408·0*	464·00†	438·00	447·00	441·00	451·00
,, ,, ,, ,, pound of coal per hour.	1·08	1·02	1·16	1·09	0·89	1·10	1·50
Average cubic feet of gas per pound of coal, moisture and ash free, per hour	1·18	1·14	1·27	1·15	0·98	1·20	1·65
Weight balance—products per cent. by weight—							
Coke	67·1	67·5	64·7	68·5	69·0	66·0	66·7
Gas	14·7	16·3	15·4	14·7	16·2	16·0	16·3
Tar	8·1	5·2	—	12·4	7·0	6·5	6·6
Ammoniacal liquor	—	4·2	4·2	4·3	5·6	5·2	5·8
Unaccounted for	—	6·8	—	0·1	2·2	6·3	4·5

* Retort badly coated with carbon. † Retort recently cleaned and free from carbon. ‡ Coal had been weathered two winters, but was approximately air-dry when charged.

The average result of all the tests in Table II. is as follows.

Materials.	Quantities.
Coke, per cent.	62·2
Gas, cubic feet per pound of coal	4·63
Candle power	15·2
Candle-feet	69·5
B.Th.U. per cubic foot of gas	618·0
B.Th.U. in gas from 1 lb. of coal	2862·0
Ammonia, pounds per ton of coal	5·54
Tar, gallons ,, ,,	14·5

Coal from Scott Haven (Pa.).—A carload of this Pittsburgh coal was received in October, 1909; and it was used in tests Nos. 18, 19, 20, and 32 reported last year. A portion of it which had been weathered two winters was used for the consecutive tests Nos. 43, 44, and 45; the charges being 500, 400, and 300 lbs. respectively. The condensed data for the various tests will be found in Table III.; and the following is the average composition of the coal.

	As Charged.	Moisture Free.	Moisture and Ash Free.
Moisture	2·21	—	—
Volatile matter	33·66	34·43	36·78
Fixed carbon	57·94	59·24	63·22
Ash	6·19	6·33	—
Sulphur	1·12	1·15	1·23
Calorific value, B.Th.U.	15,411	15,780	16,830

The average result of the seven tests is as follows.

Materials.	Quantities.
Coke, per cent.	67·1
Gas, cubic feet per pound of coal	5·12
Candle power	15·2
Candle-feet	77·9
B.Th.U. per cubic foot of gas	626·0
B.Th.U. in gas from 1 lb. of coal	3208·0
Ammonia, pounds per ton of coal	5·0
Tar, gallons ,, ,,	14·5

It is not safe to ascribe to weathering any of the changes in the results.

Coal from La Follette (*Tenn.*).—This coal was used for test No. 31 of last year. It was submitted to a series of three consecutive tests this year on charges of 298, 400, and 500 lbs. It gives a large amount of gas of good illuminating power and heat value, but yields a poor grade of coke, which is physically weak. The following is the average composition of the coal.

	As Charged.	Moisture Free.	Moisture and Ash Free.
Moisture	2·70	—	—
Volatile matter	37·48	38·53	39·40
Fixed carbon	57·68	59·27	60·60
Ash	2·14	2·20	—
Sulphur	0·79	0·81	0·85
Calorific value, B.Th.U.	14,303	14,700	15,030

Table IV. contains the data of the four tests, the average result of which is as follows.

Materials.	Quantities.
Coke, per cent.	64·5
Gas, cubic feet per pound coal	5·51
Candle power	15·7
Candle-feet	85·1
B.Th.U. per cubic foot of gas	645·0
B.Th.U. in gas from 1 lb. of coal	3555·0
Ammonia, pounds per ton of coal	6·42
Tar, gallons ,, ,,	17·3

Coals from Monangah and Holden (*W. Va.*).—Two coals which had been obtained from West Virginia were tested this year which were so closely alike in chemical composition that they are here treated together, and, indeed, were actually mixed together on two tests, when there was an insufficient amount of either one alone for the purpose. The coal from Monangah, Marion County, was only submitted to one successful test. The coal from Holden, Logan County, was used on two successful tests. It is worth recording that the only genuine naphthalene trouble which the experimental plant has ever encountered came while running a test on a 300-lb. charge of this coal. The trouble was serious enough to make it necessary to discard the results of the test. These two coals were also used mixed in approximately equal amount, to secure material for two consecutive tests on charges of 600 and 500 lbs. It is hardly fair to average these tests; but the data of each test will be found in Table V., where also is given the average composition of the coals.

Rate of Evolution of Gas from One Retort.

One of the striking facts shown by the curves of the five tests on the Hellier coal is the uniformity of the rate at which the gas is evolved from the retort, irrespective of the size of the charge of coal and the temperature of the retort. When conducting an experiment, meter readings are taken every five minutes, and the test is stopped when the production of gas falls to about one-fourth of the average rate. The rate of evolution of the gas falls off very rapidly at the end of the test, and the time for closing the test is readily told.

With the Hellier coal, though the weight of charge varies from 300 to 500 lbs., and the retort temperature from 1841° to 2036° Fahr., the greatest variation from the mean rate of 447 feet per hour is only 7 per cent. The most discrepant figure is the low value of 416 feet on test No. 21, where the log of the test reports that the retort was badly coated with carbon. This fact

Table IV.—*Data of Tests on Coal from La Follette* (*Tenn.*).

	Test No 31.	Test No. 40.	Test No. 41.	Test No. 42.
Coal charged, pounds	400·0	298·0	400·0	500·0
Average temperature, exterior of retort, deg. Fahr.	1938·0	—	—	—
Yields per pound of coal as charged—				
Gas, cubic feet corrected	5·5	5·68	5·29	5·59
Candle power, average	15·9	13·8	16·3	16·8
Candle-feet	81·9	78·4	86·3	94·0
B.Th.U. per cubic foot, gross	641·0	631·0	652·0	655·0
Total B.Th.U. in gas from 1 lb. of coal	3530·0	3580·0	3450·0	3660·0
Yields per pound of coal, moisture and ash free—				
Gas, cubic feet corrected	5·79	5·97	5·55	5·87
Candle-feet	92·10	82·50	90·50	98·80
Total B.Th.U. in gas	3710·00	3770·00	3620·00	3840·00
Ammonia, pounds per ton of coal—				
As charged	7·39	6·21	5·79	6·30
Moisture and ash free	7·82	6·52	6·08	6·62
Yields per hour—				
Duration of carbonization, hours	4·67	3·83	4·58	5·75
Total cubic feet of gas from charge	2190·00	1693·00	2114·00	2795·00
Average cubic feet of gas per hour from charge	470·00	442·00	462·00	486·00
,, ,, ,, ,, ,, pound of coal per hour	1·17	1·48	1·16	0·97
,, ,, ,, ,, ,, ,, ,, moisture and ash free, per hour	1·24	1·56	1·22	1·02
Weight balance—products per cent. by weight—				
Coke	66·8	63·4	63·8	64·0
Gas	16·8	17·7	16·4	17·0
Tar	9·5	8·2	8·2	7·3
Ammoniacal liquor	5·8	6·6	6·2	6·4
Unaccounted for	1·1	4·1	5·3	5·3

Table V.—*Data of Tests on Coal from West Virginia.*

	Monangah.	Holden.		Mixed Monangah & Holden.	
	Test No. 36B.	Test No. 49.	Test No. 50.	Test No. 52.	Test No. 53.
Coal charged, pounds	400·0	500·0	400·0	600·0	500·0
Average temperature, exterior of retort, deg. Fahr.	2188·0	1889·0	1899·0	1825·0	1857·0
Yields per pound of coal as charged—					
Gas, cubic feet corrected	5·36	5·24	5·14	5·26	4·86
Candle power, average	14·9	15·5	15·9	13·8	15·2
Candle-feet	80·0	81·3	81·8	72·7	73·8
B.Th.U. per cubic foot, gross	615·0	642·0	645·0	620·0	649·0
Total B.Th.U. in gas from 1 lb. of coal	3300·0	3420·0	3320·0	3260·0	3152·0
Yields per pound of coal, moisture and ash free—					
Gas, cubic feet corrected	5·74	5·65	5·54	5·71	5·27
Candle-feet	85·50	87·60	88·10	78·90	80·10
Total B.Th.U. in gas	3520·00	3630·00	3570·00	3540·00	3420·00
Ammonia, pounds per ton of coal—					
As charged	4·48	3·87	3·88	4·51	4·37
Moisture and ash free	4·79	4·17	4·20	4·90	4·73
Yields per hour—					
Duration of carbonization, hours	4·47	5·08	4·08	7·00	5·08
Total cubic feet of gas from charge	2146·00	2621·00	2056·00	3157·00	2428·00
Average cubic feet gas per hour from charge	480·00	516·00	504·00	451·00	479·00
,, ,, ,, ,, ,, pound of coal per hour	1·20	1·03	1·26	0·75	0·96
,, ,, ,, ,, ,, ,, ,, moisture and ash free, per hour	1·28	1·11	1·35	0·82	1·06
Weight balance—products per cent. by weight—					
Coke	65·5	66·0	65·7	65·3	63·4
Gas	—	16·3	15·9	16·3	15·1
Tar	6·9	8·8	8·2	8·2	8·1
Ammoniacal liquor	5·6	5·5	5·3	5·9	10·9
Unaccounted for	—	3·4	4·8	4·2	2·5

	Monangah.			Holden.			Mixed Monangah and Holden.		
Average Composition of the Coal.	As Charged.	Moisture Free.	Moisture and Ash Free.	As Charged.	Moisture Free.	Moisture and Ash Free.	As Charged.	Moisture Free.	Moisture and Ash Free.
Moisture	1·91	—	—	1·87	—	—	2·00	—	—
Volatile matter	36·40	37·11	39·27	36·42	37·11	39·24	36·24	36·97	39·25
Fixed carbon	56·31	57·41	60·73	56·37	57·45	60·76	55·99	57·14	60·75
Ash	5·38	5·48	—	5·34	5·44	—	5·77	5·89	—
Sulphur	0·88	0·90	0·96	1·16	1·18	1·25	0·83	0·85	0·90
Calorific value, B.Th.U.	14,088	14,340	15,190	14,143	14,413	15,220	13,964	14,249	15,130

seems to have a bearing, as will be shown later. Rejecting this figure, and averaging the other four tests, the greatest deviation from the mean drops to less than 5 per cent. The seven tests on Pittsburgh coal, made at intervals during eighteen months, under whatever retort conditions happened to be present on the day of the test, show a mean rate of 441 cubic feet of gas per hour, with a maximum variation of 7·5 per cent. The conspicuously low figure of test No. 19 may be accounted for by the memorandum in the log that the retort was badly coated with carbon, while the high figure of No. 20 may be explained by the memorandum that the retort had been recently decarbonized, and was free from carbon. If these two tests are omitted from the average, the greatest variation from the mean of the five tests, including three 400-lb., one 500-lb., and one 300-lb. charge, becomes 2 per cent. on an average of 443 cubic feet per hour.

In the same way the average rate of yield on the four tests with La Follette (Tenn.) coal was 465 cubic feet per hour, with a maximum deviation of 5 per cent., though the charges varied from 300 to 500 lbs. With the Harrisburg (Ills.) coal, the average rate was 411 cubic feet per hour, with a maximum deviation of 9 per cent. on four tests of charges varying from 300 to 500 lbs., including one 400-lb. charge tested in an extremely cold retort, which was badly coated with carbon. If this test were eliminated, the maximum variation from the average would be less than 5 per cent. The two closely related West Virginia coals, from Monangah and Holden, were tested six times, either alone or mixed with each other, on charges varying from 300 to 600 lbs. The average yield of gas on these six tests is 491 cubic feet per hour, with a maximum variation of 8 per cent. The greatest deviation from the average is shown by the 600-lb. charge in a rather cold retort. These results are summarized in Table VI.

TABLE VI.—*Comparison of the Rate of Evolution of Gas from One Retort with Different Charges.*

Coal Used.	Number of Tests Averaged.	Range in Weight of Coal Charged. Pounds.	Average Yield of Gas per Hour. Cubic Feet.	Range in Mean Retort Temperature. Deg. Fahr.	Maximum Deviation from Aver. Per Cent.
Hellier	5	300–500	447	1841–2036	7·0
Scott Haven	7	300–500	441	1844–1994	7·5
La Follette	4	298–500	465	[?]	5·0
Harrisburg	4	300–500	411	1777–1979	9·0
Holden and Monangah	5	300–600	491	1825–2188	8·0

The variation in the mean rate of gas evolution as shown by these tests is so disproportionately small, when compared with the difference in the size of the charge and the temperature, and there is such a lack of systematic effect of these variables, that it must be concluded that the rate of gas evolution for a given retort is a constant quite independent of the size of charge, and to a less degree independent of variations in retort temperature, within working limits.

Let us consider the phenomena taking place within the retort, and see if there is any theoretical ground for expecting this result. A charge of coal, low in moisture (as all our coals were) is thrown into a retort, where destructive distillation at once commences. It is held by some that the destructive distillation of coal is an exothermic process, and that the only function of the hot retort is to start the reaction. If this were the case, the rate of reaction, after it is started, should be entirely independent of the external temperature, and practically independent of the size of the charge. There is evidence to support the view that, at certain stages of the distillation, heat is evolved; but it can hardly be said to apply to the process as a whole.

If we hold the more tenable theory that destructive distillation is accompanied by an absorption of heat, then it is evident that the rate of distillation must be regulated by the amount of heat transmitted through the wall of the retort. The transmission of heat should, for any given retort, be a function of the difference between the temperature outside the retort and that prevailing within it at the point where distillation is taking place. It was shown, in a paper presented before your Association two years ago,* that coal, when gradually heated, lost most of its volatile matter below a red heat. The process taking place in the retort must be considered as a gradual heating; the external shell of coke transmitting heat slowly to the layer of raw coal next to it, which absorbs the heat, and converts it into the potential energy of the gas. The temperature of this zone of coal undergoing distillation must, therefore, be approximately a constant; and its location must be steadily advancing from the neighbourhood of the wall towards the centre of the retort, so that the heat is transmitted to it through a constantly thickening wall of coke. The rate of progress would not be materially different for a 300-lb. charge than for a 500-lb. charge; and hence the rate of gas evolution will be independent of the weight of the charge.

The same line of reasoning demands that there should be a more rapid transmission of heat, and hence a more rapid evolution of gas, when the gases surrounding the retort are at a high temperature than when they are at a low one. This only holds, however, for a retort which is always in the same condition. A retort in operation builds within itself an insulating layer of carbon, which is periodically stripped off. We have before alluded to the apparent effect of this insulating layer, and quote specifically the two tests on the Pittsburgh coal, which are the extremes of the series as regards rate of gas production. Test No. 19, with its retort badly coated with carbon, showed the low figure of 408 cubic feet of gas per hour. Test No. 20, with a freshly decarbonized retort, gave the high value of 464 cubic feet. The temperature in the two tests was practically the same. The effect of temperature change would probably be almost proportional to its extent expressed as a percentage. A variation of 200° is a large one, but it is only 10 per cent. of the average temperature; and we believe that a change of this magnitude would be readily masked by the effect of the condition of the retort, and also by the variable which we have not yet mentioned—viz., pressure on the retort.

If it be granted that the rate of gas production is a function primarily of the rate of heat transmission to the charge, it becomes very evident why silica retorts, for example, give results differing from those of ordinary fire-brick, and why some kinds of fire-clay may be better than others.

Though the rate of gas production is fairly constant for any one coal, it differs with different coals; the extremes in our tests being the Illinois coal with its average of 411 cubic feet per hour, and the West Virginia coal with 491 cubic feet per hour. There does not seem to be any systematic variation in the chemical analysis of the coals to give the reason for this different rate of gasification. It may lie in the physical properties of the coal.

Rate of Evolution of Gas per Pound of Coal.

It was shown in the preceding section that the rate of evolution of gas from a retort was fairly constant for a given coal, independent of the weight of the charge. It follows, as a conclusion, that the rate of evolution of gas per pound of coal must be a direct function of the weight of the charge; being more rapid for light than for heavy charges. The variation is shown graphically for half-hour periods in Diagram 1 for the Hellier coal, where there are plotted under each other the yield by half-hour intervals per retort and per ton of coal. The rate per half-hour per ton of coal is lowest with the heavy charge, and highest with the light one. The shape of these curves is characteristic of all the tests.

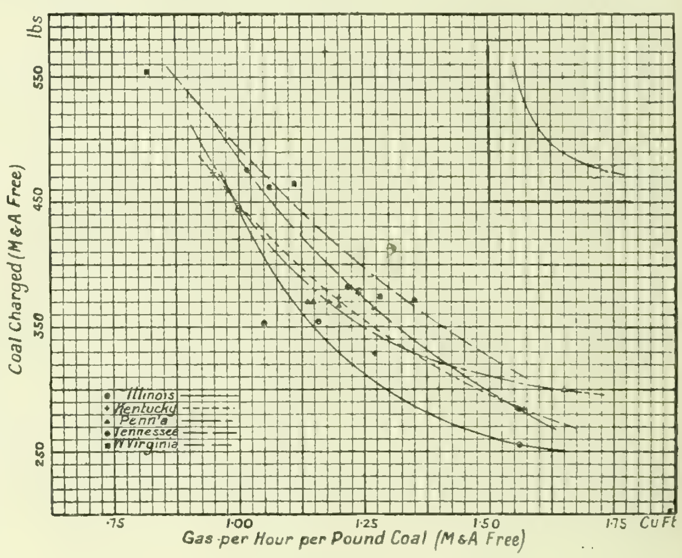


Diagram 2.

Relation between Weight of Coal in Charge and Gas per Hour from a Pound of Coal.

The ash of the coal is an inert constituent, and the moisture exerts only a slight influence on the amount of gas made; so that an exact comparison is best made on a basis of coal free from moisture and ash. The relation between the rate of evolution of gas per pound of coal and the weight charged, both figured to a moisture and ash free basis, is shown graphically in Diagram 2. The only point which is far off the curves in any test is the one for No. 35, made on the Illinois coal with a retort heavily coated with carbon and at an extremely low temperature.

If it be granted that the yield of gas from each retort is a constant which is the product of the weight of the charge and the rate of gas evolved per pound of coal, the equation becomes of the form $xy = c$, which gives a hyperbola of the general form shown by the small curve in the upper corner of Diagram 2. The range of our experiments covers only a small portion of this hyperbolic curve; but the data as plotted in Diagram 2 show five roughly parallel curves, the general direction of which indicates a harmony with the mathematical expression. The data are not accurate enough to make it worth while to try to determine the extent of the deviation. There is not sufficient evidence to show whether a rapid or a slow rate of gas evolution per pound of coal is better for commercial purposes.

Influence of Weight of Charge.

A special effort was made to determine the influence of the size of the charge. Each of the five coals mentioned in this report was tested on a charge of 300, 400, and 500 lbs.; the three tests being made consecutively on a single long working day, in order that variables due to the condition of the retort and to the firing might be eliminated as far as possible. It is unfortunate

* See "JOURNAL," Vol. CIV., p. 348.

that pyrometric troubles, mentioned elsewhere, prevented temperature measurements being taken on some of these tests; but it is not unreasonable to assume that ordinarily the temperature of the retort remained fairly constant during the day. The results are given in figures in Table IV., and are summarized graphically in Diagram 3.

The percentage yield of coke is largest for the heavy charge, and decreases for the light charges, except in the case of the Pittsburgh coal, where the 300-lb charge is reported with a higher percentage yield of coke than the 400-lb. one. The difficulty of raking the retorts perfectly clean, the danger of spilling in drawing the coke, and the necessity of using the less sensitive scales on the retort-house floor for weighing the hot coke introduce a considerable probable error into these figures for coke; but the evidence is sufficiently in one direction to make it probable that the heavy charges give a higher percentage of coke than light ones. This may be due to reactions within the retort, but is perhaps more probably to be attributed to the fact that the loss in drawing, &c., is a relatively constant weight, and hence appears as a higher percentage on the light charges.

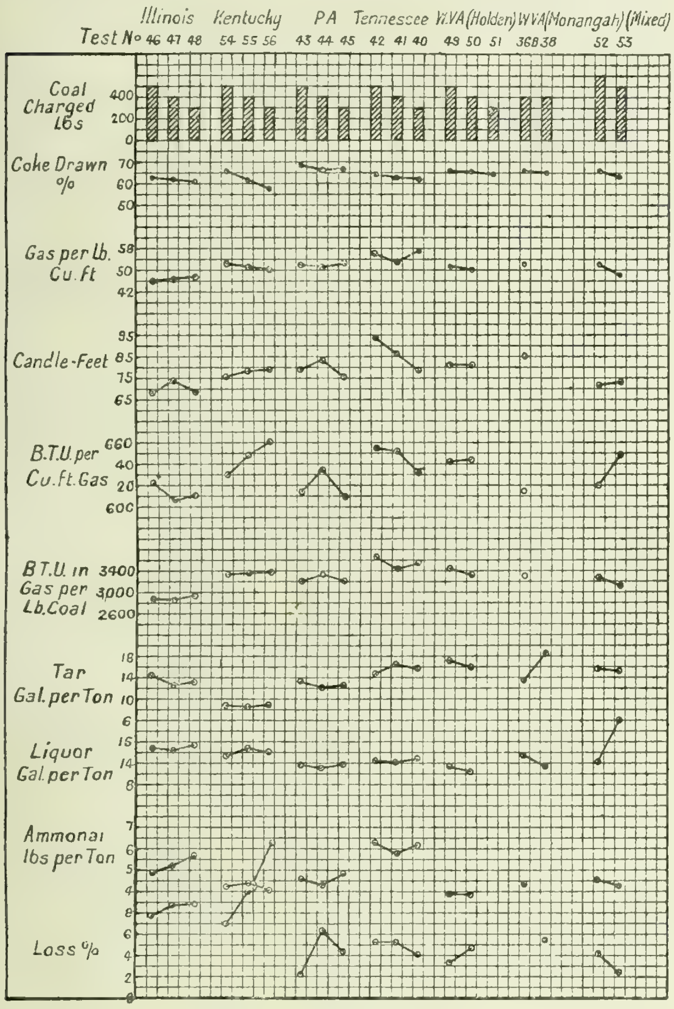


Diagram 3.

Curves Showing Lack of Relation between Weight of Coal Charged and Quality and Quantity of Products.

No constant effect of the size of the charge can be traced in the quantity of gas produced, nor in its candle power or heating value. The curves of Diagram 3 show simply a haphazard variation in yield of gas, candle power, heating value, candle-feet, and calorific power in gas from 1 lb. of coal. The yield of tar, ammoniacal liquor, ammonia, and unaccounted-for loss varies also without any uniformity. It is apparent that there is some other variable much more important than the size of the charge.

INFLUENCE OF VARIATIONS IN PRESSURE ON THE RETORT.

In our tests, we have desired to keep the retort under a back-pressure which would not be over 1-10th of an inch of water. The gauges were closely watched, and every effort was made to keep the pressure constant; but we are free to confess that the results were not altogether satisfactory, though we believe that our control of the pressure was much better than is usual in retort-house practice. We have no means of estimating quantitatively the mean variation in pressure for one test as compared with another; but there is evidence that it has been an important unaccounted-for variable. Our reasons, which are purely theoretical, are as follows: A retort has a porous body readily permeable to gases. Under the usual manufacturing conditions, where a slight pressure is kept on the inside of the retort, some of the gas is forced out into the fire space and lost. This gas becomes badly cracked as it strikes the hot wall of the retort, and builds up the dense wall of carbon which accumulates on the inside of the retort. Conversely, the presence of this dense coat of carbon is proof that gases are being forced out of the retort. If they were being sucked in, the inside of the retort would be clean. If there were no interchange in either direction, at the most only a thin scale of carbon could form.

Let us consider how much variation from the mean amount of gas there is to be accounted for, and, to eliminate the influence of ash and moisture, calculate the figures on a basis of coal free from moisture and ash.

Name of Coal.	Number of Tests Averaged.	Cubic Feet of Gas per Pound of Coal. Moisture and Ash Free.	Maximum Deviation from Aver. Per Cent.
Illinois	4	5·19	5·0
Kentucky	5	5·30	5·6
Pennsylvania	7	5·57	7·5
Tennessee	4	5·79	4·1
West Virginia	5	5·64	7·3

This shows that, in any of our tests, a loss of 7·5 per cent. of gas through the retort wall, or a gain, through sucking 7·5 per cent. of smoke gases into the retort, would have been sufficient to account for all the variation from the average yield of gas. It s not probable that 7·5 per cent. of smoke gases were sucked into the retort in any test; but it is entirely possible that more than 7·5 per cent. may have been forced out. We have no data on which to base an estimate of the amount of gas which might be forced through a retort by a pressure of 1-10th of an inch of water; and our conclusion as to the probable importance of this variable is reached mainly because it seems to be the only cause of which the unknown variation is sufficient to account for the results. Indirect evidence of the correctness of our view is afforded by the close agreement of the figures for heat value in the gas from 1 lb. of coal—a value where the retort pressure is of less importance. This will be discussed in a subsequent section.

MEASUREMENT OF RETORT TEMPERATURE.

The question of the influence of temperature must be treated with many reservations. It is extremely difficult to measure retort temperature. The readings of a thermocouple placed inside the retort are almost valueless, since they record only the immediate local surroundings of the couple, which may be cooled by contact with a projecting piece of coal or be unduly heated through proximity to the roof of the retort. We have found the temperature of the outside of the retort to give the most reliable indications, but have had vexatious and expensive experiences in attempts to measure it. The retort-setting we use is in the end of the bench, and there is a 1-inch hole in the masonry opposite the middle of the retort, designed for the insertion of a thermocouple. The temperature to be measured runs as high as 2200° Fahr. A platinum thermocouple must be protected absolutely from the furnace gases; and it is difficult to find a satisfactory protective covering for continuous service. The Hoskins thermocouple has been equally unsatisfactory on account of the tendency to break when the wires contract on cooling. It was difficult to use optical pyrometers, on account of the presence of smoke in the sight-hole; but this was overcome by luting into the brickwork a 1½-inch iron pipe terminating in a T-piece, which carried on one branch a cap drilled with a 1-inch hole closed by a plate of glass. Through the other arm of the T-piece air was blown in just sufficient quantity to keep the smoke back. This device proved very satisfactory. The Wanner pyrometer is unfitted for this work, because of the small aperture of the sight-hole. It is unsatisfactory also because it is inaccurate unless its storage battery is charged to the proper voltage.

The instrument we have come to rely upon is the Morse thermogauge. This consists of a telescope in the tube of which is a small incandescent electric lamp. A portable storage battery, a mille-ammeter, and a small rheostat, fastened to the telescope, complete the equipment. In operation the telescope is pointed at the retort, and the current flowing through the lamp is adjusted by the rheostat until the colour of the filament blends with that of the furnace. The readings of the mille-ammeter give the temperature, by reference to the calibration table. The telescope is made with a large objective, so that there is no trouble in locating the object desired—a feature which will be appreciated by those who have worked with the other forms of optical pyrometers. It is, of course, subject to the limitations of all such instruments; the most important being that it cannot be used where there are luminous flames, or where there is thick smoke. It is admirably adapted for taking the temperature of the interior of retorts after the charge has been drawn. Our observations indicate that, if the charge has been thoroughly burnt off, the temperature of the inside of the retort, after the charge is drawn, is almost as high as that of the outside. Here are the results of a few observations:

Exterior of Retort before Drawing Charge.	Interior of Retort after Drawing Charge.
2010° Fahr.	1986° Fahr.
1914° ,,	1908° ,,

It would thus seem that the temperature of the empty retort, as determined by an optical pyrometer, is a reliable indication of the furnace operation.

INFLUENCE OF RETORT TEMPERATURE.

We cannot detect any systematic effect of temperature in the figures for yield of gas, candle power, or heat value. This is probably, as explained previously, due to the disturbing influence

of variations in pressure on the retort. The values for the heat units in the gas from 1 lb. of coal are less liable to disturbance from variations in pressure. This value is obtained by multiplying the heat units per cubic foot by the number of cubic feet of gas per pound. If we assume that the pressure within the retort is high, gas will be lost; but the heat value of the gas not lost will be unaffected. If there is suction on the retort, smoke gases will be pulled in; but it is not likely that any oxygen will get into the retort through the layer of carbon lining it. The effect of this smoke gas will be to lower the heat value of the gas by dilution, and to increase the volume of gas by the same proportion. The product of the two, which is the heat value per pound of coal, will be unaffected by the dilution. Since the heat value in the gas per pound of coal is unaffected by suction on the retort, and as only one of the two factors used in its calculation is affected by pressure, the value thus obtained should be relatively independent of small variations in the retort pressure.

The figures for heat units in the gas per pound of coal, free from moisture and ash, indicate a systematic variation with the retort temperature—imperfectly shown, but nevertheless distinct. There are not so many tests available for this comparison, since, on account of exasperating failures of thermocouples, there are some tests without temperature data. There are not enough points, nor are the data accurate enough, to allow the curves to be drawn; but the general direction is shown by the following figures, which include all the tests for which temperature measurements are available.

TABLE VII.—*British Thermal Units in Gas from a Pound of Coal.*

Name of Coal.	Test No.	Retort Temperature Deg. Fahr.	B.Th.U. in Gas from One Pound of Coal, Moisture and Ash Free.
Harrisburg (I.ls.)	35	1777	3120
	48	1819	3330
	47	1954	3220
	46	1979	3160
Hellier (Ky.)	55	1841	3550
	56	1851	3560
	54	1864	3530
	30	2020	3350
	21	2036	3340
Scott Haven (Pa.)	32	1844	3690
	20	1922	3540
	19	1925	3460
	18	1994	3180
Monangah and Holden (W. Va.)	52	1825	3540
	53	1857	3420
	49	1889	3630
	50	1899	3570
	36B	2188	3520

These figures indicate a maximum value for heat units in gas from a pound of coal at a temperature between 1800° and 1900° Fahr.; the values decreasing for lower and higher temperatures. This general result would be expected from theoretical reasoning. At very low temperatures, the yield of gas falls off rapidly without a correspondingly large increase in the heating value. At very high temperatures, the heating value of the gas falls off without a corresponding increase in the quantity. Temperature cannot be the only variable affecting this value; but it appears to be the important one. It must be emphasized that no quantitative significance can be attached to these figures. They are given merely to indicate the general effect of change of temperature.

SUMMARY.

The present paper presents an analysis of the results of 25 tests on five coals. It is shown that the rate of gas production per hour from a retort is independent of the weight of the charge—in other words, that a given retort will yield a constant quantity of gas per day, irrespective of the weight of the charges, provided the coke is drawn as soon as the gas is off, and the retort is kept in continuous operation. The rate of gas evolution is apparently a function of the rate of heat transmission through the walls of the retort; and this rate of heat transmission is more affected by the thickness of the skin of carbon on the inside of the retort than by ordinary variations in furnace temperature.

Systematic attempts were made to determine the effect of variation in the weight of the charge of coal by running consecutive tests on charges of 300, 400, and 500 lbs. of these coals. There is no constant effect of the difference in weight of charge to be detected, either in quantity of gas, candle power, or heat value. The disturbing factor is believed to be variable retort pressure, causing leakage of gas through the wall of the retort. This variable is considered to have been important enough in our experiments to have also masked the effect of temperature on the quantity of gas and on its candle power and heat value. The effect of temperature can be detected in the values for the heat units in the gas from a pound of coal, which show an apparent maximum at moderate retort temperatures, with decreasing values at higher and lower temperatures.

It is hoped that it will be possible during the coming year to examine more closely the important subject of influence of retort pressure.

We are pleased to learn that Mr. Fred. J. West, the Chairman of the Council of the Society of British Gas Industries, whose meeting will be held this afternoon, was returned unopposed at the recent election of members of the Manchester City Council.

YORKSHIRE JUNIOR GAS ASSOCIATION.

The President of the Association (Mr. Fred. Scholefield, of Dewsbury) promised to embrace the first opportunity of delivering his address to the members; and the occasion presented itself at the meeting held on Saturday at the Bradford Technical College. Mr. W. N. BOOTH, the Senior Vice-President, occupied the chair.

PRESIDENTIAL ADDRESS OF MR. FRED SCHOLEFIELD.

The increasing interest which is being taken in the educational movement in this country is, I think, also reflected in our own particular industry, and in the proceedings and objects of the various Junior Gas Associations, the value of which, to my mind, has never been more apparent. Having banded ourselves together for mutual help, experiences of one member are placed at the disposal of others; and the papers read, and the discussions, all unite in bringing to fruition the seeds of usefulness.

When our Association was formed some seven years ago, not many of us thought of the part it was destined to play in the history of the gas profession. We are naturally proud of the advancement it has made, and are looking forward with no small amount of pleasure to its further success. The ever-increasing duties and exacting requirements of present-day gas engineers are so many and so varied, that it behoves us juniors to put ourselves into a position to be able to render them valuable aid in anything that pertains to the success and well-being of the gas undertakings with which we have the honour to be connected. Associations, therefore, such as ours, are especially valuable to us, in that opportunities are offered for interchange of opinions, and a comparing of notes, on subjects and difficulties which are constantly cropping up in gas-works practice; and I am sure we as juniors have found our meetings an excellent means of acquiring knowledge and of helping each other.

Much interest has been centred in us by many of the leading lights of the gas profession, because, I take it, they see in our endeavours to acquire theoretical, practical, and scientific knowledge that we are desirous of not only making ourselves competent, but of extending our usefulness, and of helping forward the best interests of the great industry to which we belong. At no time have so many facilities been offered to the rising generation of acquiring knowledge as there are to-day; and if we are to make a mark in our profession, we must understand, I take it, that successful practice depends upon knowledge acquired by study, experience, and industry, and, further, we ought to realize that, as opportunities for advancement some time or other come to all, only those who are ready are able to seize upon them.

To-day, no doubt there are a great number of young men working really hard and sacrificing much to succeed; and I feel that I am not out of place in appealing to the senior members of the gas profession to show their kindly interest and encouragement, by doing all in their power to procure for those members of their staff some assistance whereby they may be enabled to avail themselves of the special provisions made at the great University in our midst for gaining further scientific knowledge in matters pertaining to this industry.

The returns given in the annual report of the work of the Department of Technology of the City and Guilds of London Institute Examinations in technological subjects, show very forcibly that the juniors of to-day are fully alive to the value of the privileges offered. This speaks well for the future of the gas industry, which was never in a more flourishing condition, notwithstanding the keen competition to which it is subjected. During the past few years, rapid headway has been made; and as the modern tendency is undoubtedly to introduce scientific knowledge and methods more and more into every phase of our industry, I believe we shall see still greater improvements, which will eventually revolutionize gas-works practice.

I have often been struck with the great variation in the life of retorts at the different works we have visited; and this led me to look up particulars as to the life of the retorts at the works I have the honour of being connected with. Since 1899, several makes of retorts have been put in—some no doubt because they appeared somewhat cheaper than others, although they eventually turned out much dearer.

The following may serve as an illustration:—

Maker	A	B	C	D
Number of beds supplied	6	2	2	7

Maker.	No. of Days Working.	Average Make Per Bed Per Day.	Total Quantity of Gas Made.	
			Per Bed.	Per 20-Foot Length of Retort.
			Cubic Feet.	Cubic Feet.
A	509	130,000	66,170,000	8,271,250
B	718	130,000	93,340,000	11,667,500
C	731	130,000	95,030,000	11,878,750
D	887	130,000	115,310,000	14,413,750

From these particulars, it is obvious that the retorts supplied by maker D have given the most satisfactory results; and although the price of these in the first instance was the highest, yet, when it is considered that the labour charges for setting the retorts of

each make were practically the same, the extra cost incurred for the retorts was more than justified by the increased results obtained. It is, therefore, not always the best policy to accept the lowest tenders for this or any other class of goods. Now that our storage accommodation has been increased, we fully expect the retorts at present running will exceed 1000 days, because we shall be in a position to work them for longer periods without putting them down. We all know that the best results are more likely to be obtained from retorts which can be run continuously, because each time a bed is lit up and then has to be put down, it means a quantity of gas lost, which, if the bed was able to work continuously, would be saved. At the same time, lighting up and putting down is also detrimental to the retorts, and tends to shorten their life.

Now that the fire-brick makers have been aroused to the need of a more scientific method of blending their raw material for gas-works and other purposes, thanks to the very able paper on "Refractory Materials" read by Mr. F. J. Bywater before the members of the Institution of Gas Engineers in 1908, and which will repay members of our Association to digest, there is not the least doubt that before long we shall be able to obtain fire-clay material which will be much better prepared, and more lasting for the purposes for which we require it; and I feel sure with the best workmanship in regard to the setting, it will be possible to show a great increase in the working life of the retorts.

Another matter which has exercised the minds of gas authorities and others for some time is the coal question, occasioned by the unsatisfactory working of the Miners' Eight Hours Act—a frequent cause of discontent and agitation, to the detriment and paralysis of trade. We are now able to see to some extent what effect the Act is likely to have upon our industry. We have already found the price increased; and as probably we may find the production has decreased, there may be a greater difficulty in obtaining supplies in winter time during periods of heavy consumption—especially if the trade of the country be good.

This question may somewhat affect the finances of gas undertakings, unless there is a corresponding, increase in the prices of residual products. With regard to difficulties of supply during periods of heavy consumption, much can be said; but we must allow that colliery people do experience many real difficulties, such as delays to waggons, &c., through bad service, fogs, &c., and also probably owing to poor storage accommodation at some of our works. It would seem therefore that, in order to combat difficulties of supply, we ought to make, wherever possible, some preparation to put ourselves in a position to tide over any emergencies thus occasioned. To do this must of necessity mean increased storage accommodation. No hand-to-mouth coal supplies can be pleasant to anyone, and especially to the manager who has the constant supply of gas to maintain in his district. The public soon cry out when the supply is even temporarily restricted; and it is therefore essential, even at a somewhat increased cost, to be prepared to face any difficulties with regard to one's coal supply.

We at Dewsbury, in close touch with many collieries, have experienced difficulties of supply from time to time (although not of late years) through bad service, fogs, shortage of waggons, &c., during periods of heavy consumption; but, fortunately, we have now ample storage, and take the precaution to get in fairly large supplies during the summer months. This we find most convenient, and we are able to get a much better and cleaner quality of coal—dry, and more free from pyrites and objectionable matter—because the colliery people are not then so pressed, and can, and do, give better attention to the screening and picking of their coal in summer time, when the days are longer and climatic conditions better.

Some may say we are not in that happy position, and that having to stock much coal means extra expense, and loss through depreciation. Granted; but one has first of all to make sure that the maintenance of the gas supply is not jeopardized. Depreciation certainly does take place; and there is a general consensus of opinion that such loss, which amounts to from 2 to 10 per cent., according to the nature of the coal, in about six months, is mainly due to absorption of oxygen from the atmosphere. To my mind, you can make some allowance for this, and still find that the coal is much better than a good deal which is pushed through during the time when much pressure is being put upon the colliery people for supplies during the periods of heavy consumption. In our own case the loss is infinitesimal, as our coal is stored dry and under cover, in a well-ventilated shed, and is practically cleared out each year. By keeping such a stock, we are thus prepared for emergencies, and are in a comparatively safe position; while the manager is relieved of any undue anxiety, and therefore able to concentrate his energies at such times in other directions.

Since Professor Thompson's admirable lecture to our Association in 1905, the smoke problem has been kept pretty well in the foreground; and we are constantly being reminded of our duty to assist in its removal. Gas people to-day are doing a great deal in this direction by pushing the sale of coke and gas-heating appliances. At a good number of works, coke is being graded into different sizes, and so put on the market to meet the various requirements of consumers; and in some localities considerable advance has been made—consumers learning to more and more appreciate this class of fuel, which gives little or no smoke when lighted, and practically none after it is once in active combustion. A drawback perhaps, to its more general use, is the difficulty of lighting, owing to the moistures that it contains. In the neighbourhood of the coalfields, however, it is somewhat difficult to break down prejudices, because coal can be obtained cheaply.

Sir Oliver Lodge, in opening the Smoke Abatement Exhibition at Sheffield some time ago, in the course of his remarks in connection with domestic heating, is reported to have said: "I am convinced that in the future we shall depend upon gas for heating and cooking, and use electricity for lighting." Notwithstanding the progress electricity has made in recent years, it will have to progress much faster, and become much cheaper, before it overtakes, supersedes, or materially affects us. Its progress should stimulate us to fresh exertion and further developments. We have seen during the past few months instances of electricity being displaced by gas in the lighting of the streets of London, on account of its cheapness and more effective lighting.

No doubt, fresh exertion was needed in our industry; and we have seen it during the last few years in the many notable advances that have been made in the construction of burners; so much so that we are now able to obtain a great deal more light from the same quantity of gas than we used to do. Why? Is it not because the type of burner to-day is more scientifically constructed, and with a due regard to the proper combustion of gas? Evidences of this are not wanting. We see them daily in our streets and in our homes, where a brighter and more powerful light is produced. With the ever-improving types of burners, however, it seems to me that it is desirable and more necessary for us to do all in our power to educate the public to the proper use of them, and to warn them against the purchase of inferior types of burners, and of the necessity of keeping incandescent burners clean and free from dust—a point of great importance to secure full illuminating value. Many consumers no doubt sacrifice from 20 to 40 per cent. of the illuminating power of their gas by using ill-contrived and cheap burners, and then complain of poor light and bad gas. No doubt many people in buying incandescent burners take just what is offered them without making any inquiry; and as the cheaper and practically worthless types of burner may leave plenty of profit to the vendor, he will perhaps not hesitate to push their sale. A great deal of gas is thus wasted, because the consumer as a rule looks only at the first cost of the burner, instead of having regard to its efficiency.

It is therefore all the more necessary that gas authorities should use every endeavour to protect their consumers against this sort of treatment by educating them as to the best methods of obtaining the full value out of the commodity they are being supplied with, as by these means we are not only serving our own interests, but those of our customers also. This can scarcely be done unless we extend our responsibilities further than most of our corporations do at present. Up-to-date methods in place of obsolete ones must be employed if we are to retain our hold upon the public. We must advance with the times; otherwise we may find Sir Oliver Lodge's prediction come true. It seems to me therefore that we ought to begin with a systematic oversight of the fitting-up of premises, have stringent regulations (applicable to our own particular districts of supply) as to the size of pipe, fittings and meters, methods of fixing, and supply and maintenance of burners, &c. This, I am convinced, will, in the end, secure more satisfaction to ourselves and to our customers. In the past, too much has been left to private gas-fitters, plumbers, &c.; and while no doubt there are good men among them, capable of doing a thoroughly sound job, there are others employed who are totally unfitted for this class of work, as evidenced from some of the gas-fitting which is daily come across during a course of inspection.

The use of gas for domestic and trade purposes is growing rapidly; and most towns have differential rates for gas used for cooking and heating and motive power purposes, recognizing that in this direction considerable headway is to be made. Gas engines, cookers, fires, &c., are now being more scientifically constructed, and are so economical in their consumption that prejudices are gradually but surely being broken down, and as a consequence these appliances are growing in favour. If the smoke and fog question is to be solved, it must be to a certain extent by meting out the responsibilities among all consumers, whether household or manufacturing. Gas authorities, therefore, by pushing the sale of heating appliances and catering for motive-power purposes, not only benefit themselves, but the public also, by assisting in removing the smoke nuisance from our midst. Since special rates were introduced at Dewsbury, the following figures will give some idea of the progress made. The increased consumption between 1890 and 1909 inclusive (in millions of cubic feet) was: 3, 4, 6, 7, 11, 13, 16, 18, 21, 26, 28, 30, 31, 32, 33, 35, 37, 40, 39, 42.

Month.	Day Consumption.	Per Cent.	Night Consumption.	Per Cent.
	Cubic Feet.		Cubic Feet.	
May	4,834,500	35·79	8,674,500	64·51
June	5,119,500	42·20	7,012,000	57·80
July	5,112,000	40·75	7,433,000	59·25
August	5,429,000	37·72	8,961,000	62·28
September	5,481,000	32·56	11,346,500	67·44

In analyzing the consumption of gas sent out from the Dewsbury Gas-Works during the summer months of (say) May to the end of September, in order to ascertain the proportion of day

consumption to that of night, the foregoing figures will show that there is a good deal to do yet before we can expect to level-up our day load with that of the night.

Mr. P. Ward proposed a vote of thanks to the President for his address.

Mr. W. Cranfield seconded the motion.

The Chairman, in putting the motion, spoke of the wide scope of the address, which, he said, could not fail to start the members' thoughts on some of the lines he had indicated; and he had no doubt Mr. Scholefield would be gratified at finding his address resulting in papers read to the Association, and keen discussions raised thereon.

The President, in responding, said that he had had the too common experiences of those who had to prepare such addresses —first, a depressing realization of the difficulty of making choice of really suitable, and not absolutely threadbare, subjects; and, secondly, when he had at last sketched out a brief outline of his topics, he watched them annexed one by one by presidents and speakers in other Associations.

The Manufacture of Sulphate of Ammonia.

It had been suggested that the members would welcome the opportunity of raising again the question of the manufacture of sulphate of ammonia, with special reference to the Presidential Address delivered last January by Mr. S. W. Shepherd,* which established custom removed from discussion on the occasion of its delivery, even had time been available. Accordingly, the latter part of the meeting on Saturday was thus spent. Mr. Shepherd himself was unfortunately unable to be present; but his Assistant at the Frizinghall Chemical Works, Mr. Percy Ward, undertook to reply, on his behalf, to the questions (often informal) which were freely put.

Mr. Ward said the original address was hardly controversial; and in opening the discussion he might perhaps more profitably supplement than criticize it. He would emphasize the warning given in it as to the too common loss of ammonia due to insufficient precautions. As regards the danger of volatilization of ammonia from the liquor in a storage well or tank, especially when it remained there for any length of time, he had known cases where recourse had been had to solvent naphtha added so as to form a top layer on the liquor. This prevented loss of ammonia, and itself suffered but little loss from evaporation, having so low a vapour tension at ordinary temperatures. A gallon from time to time entailed no great expense, and was undoubtedly effective, as the depth of the liquor was seldom so reduced as to bring the oil within reach of the suction of the pump. Gas undertakings commonly tabulated their ammonia yield in gallons of liquor per ton of coal carbonized. It would be well if they would also record in terms of sulphate of ammonia obtained from the liquor. This was really the more important clue to the efficiency of their working—the working-up of the liquor being more important than obtaining it. It was the point where loss might easily occur, and was, after all, the result that settled the financial aspect of the case. It was a wise precaution to estimate the weight of sulphate theoretically obtainable from the amount of acid used; and if something near this weight was not actually obtained, they were warned that they were losing ammonia, probably in the waste liquor or in the mother liquor. An easily remembered fact was that 2000 lbs. of acid at 146° Twaddel gave 1 ton of 96 per cent. sulphate. It was interesting to try to apportion the various parts of the total loss of ammonia. If not more than 2½ per cent. was lost, the working might be considered satisfactory. As regards the sulphate plant, this loss was shared out among the spent liquor, the "devil" water, and the waste gases. In the spent liquor, the percentage of ammonia certainly ought not to exceed 0·02 per cent., though a word of warning was necessary in connection with this test. If the hot liquor was allowed to cool in the air, as much as 30 per cent. of its ammonia might volatilize; and thus an unduly favourable result of the analytical test might produce a false sense of satisfaction. In the "devil" water, which usually amounted to about 17 per cent. of the volume of the original liquor, the quantity of ammonia varied. Any considerable amount should, of course, provoke close scrutiny of the plant, more especially in seeing if the liquor-pipes of the superheater leaked. The waste gases usually contained very little ammonia—0·1 grain per cubic foot was a satisfactory amount. A useful fact to remember in this connection was that a gallon of liquor usually yielded about a cubic foot of waste gases. An unfortunate feature of many stills was the absence of facilities for clearing a blocked tray. To dismantle the whole still for the sake of one tray was much to be deprecated. It would frequently be found that the two bottom trays of the free ammonia still were inclined to make-up. They were exposed to the spray from the fixed ammonia still, and the deposits on them contained notable amounts of prussian blue—often from 10 to 20 per cent. Frequent checkings should be made of the amount of free lime in the spent liquor, as no more likely source of ammonia loss was to be found on the plant than in the use of insufficient lime. From 12 to 15 per cent. of the total lime used should be found free in this spent liquor. He was convinced that a frequent cause of "blue salt" was the absence of an effectively working baffle-box between the stills and the saturator; and he was especially inclined to lay the blame here when a salt which was white when taken from the saturator slowly went blue as it oxidized in the stores. This baffle or drip box should by preference not be drained off into the still again, but into the storage well. When the box was most needed, the still was not working quite properly; and it was obviously advisable not to return more liquor to it, and perhaps add to its difficulties. They had lately fixed on their stills mercury gauges instead of the ordinary type of steam gauge; and these had proved a great improvement, easy to read, and with nothing to get out of order. Mr. Shepherd had advocated in his address small holes in the ammonia-pipe of the saturator, and plenty of them. He thought a strong case could also be made out for the opposite plan—of few holes and large ones. His point of view was that with small holes the friction of the steam was considerable, and that the chance of the gradual weakening of the lead and eventual splitting between the holes was greater. As the caking-up of the saturator sides and the ammonia-pipe was a frequent source of trouble, and might lead to loss of ammonia, it was advisable to flush the saturator with water whenever operations ceased—certainly when the plant was going to be idle for some days or a week-end.

Mr. W. N. Booth corroborated Mr. Ward's remarks about the caking of the bottom trays of the free ammonia still and the amount of prussian blue found there. He had been interested in the attempt to apportion the losses of ammonia; but he must remind Mr. Ward that the alkalinity of the "devil" water was largely due to pyridine and kindred bases. In an ordinary distillation test with lime or soda, these would be distilled over along with the ammonia, and estimated as such. In testing the original liquor, this source of error was unimportant; but in many tests with the "devil" water he had found that the ammonia was responsible for less than half of its alkalinity. He was convinced that, as a rule, very little ammonia escaped, either in the waste gases or in the "devil" water. If this water was distilled with soda, and the gases led into acid, and the acid afterwards neutralized, a layer, or at least floating spots, of pyridine could easily be obtained, and the well-known smell promptly recognized. An important improvement for many plants would be to take the inlet-pipe for the acid well down the saturator, nearly to the level of the ammonia-pipe. Too often the acid-pipe was only just sealed in the saturator liquid, and sometimes was clear of it altogether. If Mr. Ward or the Association could induce makers to design their stills so as to admit of easy access for cleaning, instead of forcing the users to dismantle the whole still—often at an inconvenient time—a great boon would be conferred. The need and advisability of this ready access was so apparent that one could not help wondering at the persistence of less convenient types.

Mr. Atley raised the question of the size and direction of the holes in the saturator ammonia-pipe. They were frequently turned towards the middle of the saturator; whereas if some at least were turned towards the sides, the rush of gases and steam would tend to prevent the accumulation of caked sulphate behind the pipe, which was so frequently a source of trouble. They often found behind this cake a passage up which ammonia could easily escape because it was out of free contact with acid.

Mr. Ward again recommended the introduction of water-jets at any point where experience showed the need of them. For example, he said he should put one round the top of the saturator and another passing down to the bottom if a steam ejector was used for removing the sulphate.

* See "Journal," Vol. CIX., p. 176.

Presentations to Mr. William Tomlinson.

An interesting gathering of members of the Rochdale Town Council and their chief officials took place recently in the Mayor's Parlour at the Town Hall, when a presentation was made to Mr. William Tomlinson, on his retirement from the post of Water-Works Manager. Twelve months ago, Mr. Tomlinson completed fifty years' connection with the water-works. He entered the service of the old Water Company in 1859, and was Manager from 1884, when he succeeded Mr. Henry Rofe, till the end of last month. In recognition of this long service, members of the Council joined in presenting him with a gold semi-hunter watch and chain, with gold seal and sovereign purse, each bearing his monogram. On the back of the watch was the Corporation coat of arms, and inside the case the following inscription: "Presented to William Tomlinson, Esquire, by members of the Rochdale Town Council, in recognition of 44 years' service, on his retirement from the management of the Water-Works. 31st October, 1910." The outgoing Mayor (Mr. W. Dunning, J.P.) presided. The presentation was made by Alderman W. T. Heap, the Chairman of the Water Committee, who said he hoped Mr. Tomlinson would not value the gifts so much for their intrinsic worth as for the respect which lay behind them. Mr. Tomlinson expressed his sincere thanks for the presents, and for the kindly sentiments by which they were accompanied. He said he never dreamt of this recognition of his services, for all he had done had been his duty. The company were subsequently entertained at "high tea" by Alderman Heap. Mr. Tomlinson was also the recipient of a silver table-lamp from the chief officials of the Corporation. The Town Clerk (Mr. W. H. Hickson) presided, and the gift was handed to Mr. Tomlinson by Mr. Platt (the Borough Surveyor), who spoke of the esteem in which he was held by the donors. Mr. T. Banbury Ball (the Gas Engineer and Manager) and Mr. T. Stenhouse (the Borough Analyst) also spoke in cordial terms of Mr. Tomlinson. Mr. Tomlinson thanked his colleagues for their kindness.

EXTRACTION OF TAR AND ITS CONSTITUENTS FROM GAS.

A patent has been taken out for France by Herr Walther Feld for a process for extracting tar and its constituents from gas. He has also applied for one for England, the application being dated April 14, 1910; but the specification has not yet been issued. The following particulars of the invention are taken from the French one.

Until recently, tar has usually been extracted from gas before it has been cooled to atmospheric temperature; and it has been done by the aid of hot tar. When the temperature of the gas is greater than that of the condensation-point of water, and the tar or tar compounds employed as the means of extraction or for washing do not contain water, the application of the process described in the German patent No. 24,828 taken out by Herr Feld does not present any difficulty. In many cases, however, when it is desired to extract tar or its constituents from gas, the latter is saturated with water. During the process of extracting the tar, there occurs condensation of water, which perceptibly decreases the efficiency of the washing operation. Simultaneous recovery of water and tar prevents the latter from collecting in the form of drops like a mist in suspension in the gas. In this case, the necessary measures must be taken to prevent the simultaneous precipitation of water and tar. This the patentee proposes to do in the following way.

The water-saturated gas is superheated a few degrees before being conveyed into the washer, where it is washed with tar, which is likewise heated to the same or a higher temperature. Operations are conducted in a similar way to recover tar products, such as naphthalene. Dealing first with the extraction of the tar and then the naphthalene from a hot coal gas, the patentee says it is admitted that the condensation-point of the water in gas is about 70° C. (158° Fahr.), and that of the naphthalene about 30° C. (86° Fahr.). The gas arrives saturated with water; but a considerable part of the tar has already been precipitated in the hydraulic main or the condenser, together with a small quantity of water. The gas also contains, besides tar in the form of fog, water in the form of mist. In order to condense the tar, this mist must be removed, and precautions taken to prevent condensation of water during precipitation of the tar. With this object, the gas is heated sufficiently to evaporate again the water present in the form of mist. Though an increase from 70° C. to 72° C. is enough, it is nevertheless advantageous to go to about 80° C., and even higher. To heat the gas from 70° C. to 80° C., there must be a supply of 5 calories per cubic metre of gas. The specific heat of the tar free from water is also about 0·5 of a calorie. Thus, if it is desired to wash gas having a temperature of 70° C. at one of 80° C. with tar at this temperature, it will be necessary to heat the tar to 90° C., and bring it into close contact with the gas at 70° C. The gas is thus heated up to 80° C., and the temperature of the tar falls to that of the gas. As long as water remains in the gas in the form of mist, or there is water in the tar, the results of the extraction will be imperfect. By again utilizing the effluent tar for washing, and only discharging the excess of tar recovered from the gas, a tar is quickly obtained perfectly free from water. Instead of tar, tar oils or analogous substances can be used; the process remaining the same.

Any suitable appliance can be used for washing, or any arrangement permitting intimate treatment of the gas with the washing material. The apparatus described in the patentee's German patents No. 188,636 and No. 218,991, and in his application for a German patent No. 19,610 F, are said to be the best. However, fans can be utilized equally well, with centrifugal power injectors of any type, injectors, and spraying and other similar apparatus. It is a great advantage to place behind the washer a Pelouze and Audouin condenser, or some similar appliance, to collect the last traces of tar. Care must be taken that the gas is not cooled to the condensation-point of water during its passage through this apparatus. It is, therefore, advisable to protect it and the pipes through which the gas passes during the extraction of the tar.

After the separation of the tar, the gas is treated for the recovery of the cyanogen and ammonia with suitable washing ingredients. To avoid the precipitation of tar oils during these various operations, it is preferable to heat the gas again to a degree greater than the condensation-point of the undesirable substances—that is to say, the tar oils still contained in the gas. As the washing ingredients contain water, the heated gas leaving the tar-washer will again be saturated with water. It is therefore advisable to lower the condensation-point of the tar oils by the introduction of gases, or, better still, by the injection of steam into the gas. Extraction of ammonia can be effected with acid or solutions of salts, and, if necessary, simultaneously with hydrocyanic acid—for example, as described in the German patent No. 151,820, or in any other way. After the gases have been freed from tar, cyanogen, and ammonia, they must be cooled. By cooling to below 70° C., there will be, as stated, condensation of tar oils, the quantity of which is proportionally very slight for coal gas.

As already remarked, the condensation-point of naphthalene is about 30° C.; so that it is probable that the small quantity of tar oil condensed owing to the cooling-down from 70° C. to 30° C. is not sufficient to dissolve the naphthalene condensed by cooling below 30° C. As owing to refrigeration there is also condensation of water together with the tar oils, and this in proportion to the fall of tension in the aqueous vapour from 70° C. to 30° C., these condensed tar oils contain water which has a prejudicial effect on their power to dissolve naphthalene. When this is to be feared, the cooling must be at first only to about 30° C., and then the gas is treated by the method previously described, by washing it with a naphthalene solvent. This washing is done in the same way as for the tar. A naphthalene solvent can be adopted as a washing ingredient. The best ingredients are tar oils with a higher boiling-point, or tar free from water previously recovered in the tar-washer. After the recovery of the naphthalene, the gases are cooled to the temperature at which they can be utilized without fear of any inconveniences due to naphthalene. The small quantities which condense are dissolved by the tar oils which are simultaneously condensed.

Extraction of the tar and naphthalene, instead of being effected separately, can be done simultaneously by first cooling the gases, to the condensation-point of naphthalene or below this point, and finishing by the method previously described. If, for the extraction of the tar, tar oils are used containing a high percentage of light or medium oils, and if the washing ingredients are well heated before their entrance into the washer, a corresponding amount of oil in the form of fumes from these substances is admitted into the gas. By the cooling following their exit from the tar-washer, these oils are simultaneously condensed with the naphthalene, and dissolve it. In this case, a special naphthalene washer is not necessary. Instead of recovering the cyanides and ammonia immediately after the tar-washer, these operations may be performed after the naphthalene washer—that is to say, by extracting the ammonia, for example, with acid, solutions of salts, or pure water. In the last case, the small quantity of ammonia in the mother liquor is brought back into the hot gases; and if these are then cooled, in a separate condenser having a large surface, from 55° or 45° to 0° or 20°, the ammoniacal liquor recovered may have a percentage of ammonia depending on the means employed or the greater or less quantity of ammonia in the gases.

MECHANICAL ENGINEERING PROBLEMS IN ILLUMINATING GAS-WORKS.

By J. A. P. Crisfield,

Engineer of Construction to the United Gas Improvement Company, Philadelphia.

[Presented at the Meeting of the Mechanical and Engineering Section of the Franklin Institute, Oct. 13.]

The business of the manufacture and distribution of gas for lighting, heating, and power purposes constitutes one of the most familiar and important examples of the phase of modern civilization in which private capital, enjoying public privilege, undertakes to supply one of the conveniences or necessaries of living. With the gradual recognition of the mutuality of the relations between the gas company and the community which it serves, has come a clearer conception of the obligations of both parties to the unwritten, but none the less binding, contract between them; and to-day it would be difficult to find a gas company whose officers do not feel in duty bound to render its customers the best service in its power at the lowest rate consistent with a fair return upon the capital invested. To accomplish this result, it is essential that the management of the gas company, in its various departments, be expert, each in its particular duty, and that the work in hand shall be performed by specially educated and carefully trained men. In no department of the business is this more apparent than in the gas-works itself, where technical problems of the most intricate character are continually offering themselves for solution. It is here that the young mechanical engineer begins to realize for what his course at school was intended to fit him; and gradually—as he learns to recognize the principles of efficiency, economy, and the conservation of energy through their numerous and most cunning disguises—he takes up his work of eliminating waste, extravagance, and engineering fallacies.

The modern illuminating gas-works is a highly specialized plant, designed for the duty of gasifying coal, either by distillation in an enclosed retort, or else by making from it hydrogen and carbonic oxide by the action of steam, and adding thereto the light-giving vapours of liquid hydrocarbons. The former method is known as the coal-gas process; the latter as the water gas process.

Before discussing the mechanical engineering problems which are met with in the design and operation of a gas-works, it might be profitable to define the branch of engineering which is called mechanical. In the best-known schools of mechanical engineering, the course of instruction includes, among other things, the following subjects: Mathematics, to and including thermodynamics; modern languages; mechanical drawing and machine design; physics; general chemistry, and special engineering chemistry, including combustion engineering; engineering practice; structural engineering; electrical engineering. Hand in hand with instruction in the theory of the foregoing subjects, the scholar is given practical work in physical, chemical, and mechanical laboratories. It will be seen that this course of instruction prepares the mechanical engineer for all branches of industrial concerns

in which success mainly depends upon the efficiency of the means and methods employed and upon other economies of operation. He is trained to save; to do work with the least expenditure of energy; to consider no economy too small to be worthy of attention—knowing that in the aggregate many small economies may determine the success or the failure of the enterprise as a whole. The system of instruction which instils the theory of an operation, and at the same time illustrates the theory in practice, enables the mechanical engineer to foresee the direction in which success may be attained; and at the same time the practical instruction in the laboratories and shops saves him from the pitfalls in which the pure theorist is certain to flounder, with fatal result.

In the treatment of the coal through the various stages of manufacture to the completed product, the gas manager is confronted with problems of efficiency and appropriate design; the phenomena of combustion; the handling of heavy and bulky materials; with chemical reactions of the most complicated nature. In order to insure good service, continuity of the supply of gas both as to quantity and quality, and a stable, profitable business, it is necessary so to design the plant that it possesses entire reliability, and so to operate it that the greatest net profit is obtained. With extravagance in first cost or wasteful operating methods, whether due to design or to bad management, what might have been a highly attractive undertaking, in which capital would readily seek investment, soon degenerates into an over-capitalized and unprofitable operation, with a reduction, or entire loss, of credit—meeting finally the expensive process of a reorganization. It is, therefore, at the very outset that mechanical problems are met, and must be correctly solved, before we may intelligently determine how to build the plant so that the high efficiencies and rigid economies necessary to success may be obtained. It is not alone sufficient to know that a given piece of apparatus performs its function with the highest efficiency; the questions must be asked: What does the efficiency really cost? Will it pay to make the investment? Will it pay, for example, to purchase machinery to unload the coal, and, if so, what kind of machinery? What is the cost of operating this machinery, for steam, repairs, depreciation, and attendance? Would it not be wiser to avoid locking up so much money in coal-handling machinery, which may be obsolete in a few years, and rather rely upon common labour, which, though costing a little more perhaps, all things considered, does not rust, carries with it no interest charge, and is so flexible that it may be employed in numerous other operations besides the unloading of coal? All the above are mechanical engineering problems.

While the construction of the foundations of the buildings in a gas-works and the strength and other characteristics of the materials employed may very properly be the business of the civil engineer, and while the chemical reactions involved in the generation and purification of the gas may strictly fall within the province of the chemist, still it will not be denied that the appropriateness of the design of the structures, both as to first cost and the facilities offered for economies in labour, the efficiency with which the chemical reactions are produced, and the thermal and mechanical efficiencies of the apparatus employed, are purely mechanical engineering problems.

One of the first problems of the mechanical engineer in the gas-works is the receipt and storage of the coal for gas-making and for boiler fuel. He must decide as to whether the amount of material to be handled will warrant the installation of mechanical unloading devices. Upon his knowledge of the cost of operating, and the durability of this class of machinery, depends the wisdom of the decision; and without special knowledge of this subject a mistake would probably be made, which would materially affect the cost of a unit volume of the product. For example, it would not pay to invest $5000 in machinery to handle from the car to the bin the 1000 tons of anthracite coal that will be needed in a carburetted water-gas plant supplying a city of 25,000 inhabitants. The steam and labour of attention necessary to operate the machinery will cost 5 c. a ton, and the interest (5 per cent.) and depreciation (10 per cent.) will add 75 c. more. Utilizing a simple hydraulic elevator costing $1000, a labourer, at 25 c. for his wages, will put up one ton per hour, and the interest and depreciation at 10 per cent. on $1000 will bring the cost up to 35 c. If to this we add 5 c. a ton for operating the elevator pump, we find that by the adoption of the second method we have saved 40 c. a ton in handling the coal. But the $5000 elevator will handle 5000 tons at the same cost for interest and depreciation as it did the 1000 tons. Its installation, therefore, in a plant of five times the size of the one first assumed, will be justified, for then the comparison would be:

FOR THE $5000 ELEVATOR:	
Interest and depreciation	15 c.
Operating expenses	5
Total cost of coal handling per ton	20 c.
FOR THE $1000 ELEVATOR AND COMMON LABOUR:	
Interest and depreciation	2 c.
Labour of operating	25
Steam for elevator pump	5
Total cost of coal handling per ton	32 c.

The above example will serve to illustrate one phase of mechanical engineering in receiving and storing coal in a gas-works yard. The manager will make mistakes unless he always asks himself the question, Will it pay? Does the proposed investment bring the greatest return upon each dollar of capital? Is there not some other way of accomplishing the purpose which, during the assumed life of the apparatus employed, will show a greater net return?

Of less magnitude, but none the less necessary to the smooth running of the plant, are the mechanical engineering problems encountered in selecting the moving machinery required, and in maintaining these machines in an efficient condition. For instance, the ratio of the water cylinders to the steam cylinders of the elevator pump should be the inverse of that for the oil-unloading pump, if the work in each case is to be done with good efficiency. The engines which drive the blowers for furnishing blast to the generators should be chosen after giving due consideration to reliability, thermal efficiency, first cost, and durability. The volume of business done by some particular gas company may be so small that it cannot afford the best apparatus in the market; the interest item outweighs all others combined; and the mechanical engineer recognizes this, and buys a cheap 10-H.P. blowing outfit that will last long enough, or until the business has grown sufficiently large to afford something better. But in large stations, when the horse-power involved may, often does, reach several hundred, the cost for interest and depreciation (even for the best that money can buy) is of less importance, compared with the cost of steam for operation; and the most efficient blowing unit obtainable should be installed—due consideration being given to the questions of durability, possible obsolescence or inadequacy in the near future. This suggests one of the most puzzling problems of the mechanical engineer in the gas-works—namely, that of selecting the right-sized unit, whether it be an installation of coal-gas benches, a water-gas set, or a combination of both; whether he should recommend an increase of storage holder capacity or instal greater generating capacity; and whether, in case greater holder capacity is decided upon, it should be located near the generating plant or at a distance—in the latter case supplemented with a pumping plant and high-pressure mains. It is true that the solution of these questions involves also business judgment—for instance, in making extensions of plant. This can be done in small successive instalments, each sufficing for a short time in the future, as growth of business shall demand. This, while conservative and safe, may result in ultimate high total capitalization, due to greater cost of successive small extensions and changes. On the other hand, extensions may be made on a large scale, sufficing for a long time, at a much lower cost for a given capacity. But this subjects the business to the risk of heavy interest charges if its growth is not rapid, or to heavy replacement costs if improved apparatus be substituted for old. Sound judgment as to business prospects is here required; but after its exercise there is equally important use for the knowledge and judgment of the engineer, even if much that is ordinarily called business judgment is not itself the application of mathematical or of engineering principles.

Having designed and built a gas plant, with constant consideration of the result to be obtained, with an eye to thermal, mechanical, and labour efficiencies, with the least expenditure of money compatible with the utmost reliability and fair durability, the mechanical engineering problems of operating must be met. One of the most important of these is the quality of the raw materials. Since it is the business of the mechanical engineer to secure the greatest possible quantity of heat units and light units in the finished product for each dollar expended for raw material, it is important that he does not handicap himself at the start by purchasing inferior raw materials. Although there is a growing tendency towards the purchase of coal on the basis of its heat value, still this practice is not by any means general; and it is customary for the engineer to purchase coal regardless of the percentage of fixed carbon, volatile combustible, ash, sulphur, and water. How important a matter this is may be seen by reference to two analyses given below of samples of coke which, when good, is an excellent gas-making fuel. Two analyses of bituminous steam coal are also given.

—	COKE.		STEAM COAL.	
	No 1.	No. 2.	No. 3.	No. 4.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture	15·0	1·5	0·73	12·71
Volatile combustible	5·0	3·0	17·43	28·62
Ash	15·0	5·0	4·63	20·78
Sulphur	1·0	0·5	0·62	3·09
Fixed carbon	64·0	90·0	77·71	34·87
	100·0	100·0	101·12	100·67
B.Th.U.			15,178	8,840

Sample No. 1 had been exposed to heavy rains, or it had been flooded when quenched, was badly burnt off in the first place, and was the product from a seam of coal containing much ash and sulphur. From a mechanical engineering standpoint, only the fixed carbon is of certain value for making carburetted water gas. Consequently, the gas manager has actually paid 40 per cent. ($0·9 \div 0·64 = 1·4$) more for his fuel in purchasing sample No. 1 than in purchasing sample No. 2. Although he may not be able to control the dealers in the matter of the analysis of their coal, he is to some extent in command of the situation, owing to the fact that he may restrict his purchases to certain

coalfields where the quality is good and uniform. He may also insist upon proper methods of quenching, and upon the shipment of the coke in covered cars, or, failing to be able to keep the coke dry *en route*, he may find it will pay to build sufficient storage at the works to permit a partial drying-out under cover.

One of the most troublesome problems to be met with in a gas-works is that of labour. It might be said that this is not particularly a mechanical engineering problem, since all employers of labour must encounter it. Still, it is more the problem of the mechanical engineer than of any other, because he is, by education and experience, best fitted to reduce the amount of human labour required; and this is what he is continually attempting to do by the adoption of labour-saving appliances—such as bucket elevators, belt conveyors, hydraulically operated valves and lifts, compressed-air drip-pumps, and mechanical stokers for coal-gas retorts and for the boilers. In this field of endeavour he has no competitor. In common with many of his mates in other industrial enterprises, the mechanical engineer in the gas-works has the problem of boiling water for making steam. No one will admit that this is, as a rule, intelligently and efficiently done to-day. And yet, knowing this, our practice and methods are not greatly different from what they were two thousand years ago. It is still believed that in boiler practice 50 per cent. excess air of combustion is necessary for best results; whereas, in almost every other form of combustion with which we are familiar science has reduced the necessary quantity of air to the theoretical amount. As illustrating the waste due to 50 per cent. excess air in the ordinary boiler efficiencies, it may be calculated that such a percentage of excess means an increase of 10 per cent. in the total fuel consumed. In the year 1909, there were used in the United States under boiler furnaces for producing steam approximately 340 million tons of coal. If this steam could have been produced by the combustion of coal with the theoretical amount of air, the saving would have been 34 million tons, which, at an average price of $3 per ton, would amount to $100,000,000. Which of our young mechanical engineers, who are now earning their spurs at their chosen profession, will undertake to stop this waste, and show us how to advance in the art of producing steam?

In a gas-works a large percentage of the cost of the finished product is incurred in the generator of the water-gas plant, or in the furnace of the coal-gas bench. Here the problem is the apparently simple one of the combustion of carbon at temperatures above 2000° Fahr. However, owing to impurities in the fuel—such as ash of variable fusion temperatures—extra complications are introduced, which make the operation extremely difficult. Clinkers (the bugbear of everyone who burns coal, sooner or later, as the operation continues) upset all nicely calculated adjustments; and, unless means and methods are adopted to vary the air and steam of combustion so as to bring about a readjustment, serious losses will result, both in efficiency of production and in the quality of the finished product. It is now that we find the mechanical engineer hard put to it; and it is only by combining his knowledge of the theory of combustion with his practical experience in doing things, that he is able to supply the demand for gas, and render the good service the community expects of him. Lack of such knowledge and practical resourcefulness must be compensated for by increased investment for spare machinery, making it still more difficult to obtain the desired profit.

Many other interesting and important mechanical engineering problems might be mentioned, but enough has been said to indicate that the business of gas-making is largely the work of the mechanical engineer. Even the abstruse reactions within the coal-gas retort and the water-gas carburettor are not entirely outside his field. Although they properly belong to the chemical engineer, still the education of the mechanical engineer of to-day fits him for such work, should he care to specialize in it. Indeed, so satisfactorily does the young mechanical engineer attack and master the work in a gas plant, that some gas companies have restricted additions to their engineering forces to this class.

When we consider the immense amount of intelligent work which has been expended upon the engineering problems in a gas-works, it is not to be expected that any very great economies in manufacture will be made. What reductions in the cost of the finished product will be made will be accomplished by close attention to the small savings possible in increasing thermal and mechanical efficiencies and in the substitution of mechanical appliances for human labour. These are problems which will be solved only by the trained mechanical engineer.

A reinforced concrete well lining 46 feet deep and 43·3 inches inside diameter, was recently sunk in Munich as a monolith. The concrete, it is stated in "Beton und Eisen," was 6·88 inches thick, except for the lowest 3·28 feet, in which the thickness was gradually increased to 8·8 inches at the base. The cutting ring was made of oak timber 4 inches thick and of the same size as the bottom of the concrete. The reinforcement consisted of five vertical channels in the centre of the concrete, banded with rings of ¼ in. by 2⅜ in. bars placed at intervals of 4 ft. 11 in. and bolted to the channels. This iron frame was put together exactly above the well site, and the concrete was moulded around it in layers 3 ft. 3 in. high. The cylinder was then lowered by excavating the soil below it. As each succeeding lift of concrete was added, more earth was excavated. The entire operation occupied 160 working days.

COMPARISON OF BOLLING'S, HARDING'S, AND DREHSCHMIDT'S METHODS FOR DETERMINING SULPHUR IN ILLUMINATING GAS.

By H. P. Harding and Carl Taylor.

[**From the "Journal of Industrial and Engineering Chemistry," September, 1910.**]

Randolph Bolling, the Chief Chemist of the Nova Scotia Steel and Coal Company, Sidney Mines, N.S., in suggesting the advisability of ascertaining the total sulphur in suction producer gas, used a wet oxidation method, in which he assumed that all the sulphur in the sulphur compounds is oxidized to sulphur dioxide. Bolling states that Bunte's method could be used in analyzing illuminating gas which has been more or less purified; but that, with unpurified producer gas which contains sulphur in other than simple combinations (like hydrogen sulphide and carbon bisulphide), the method would fail to give all the sulphur. He also states that Drehschmidt's method gives accurate results by completely oxidizing all the sulphur; but he objects to the method on account of the complexity of the apparatus used, and the difficulty of keeping the gas burning continuously in the Drehschmidt burner.

The principle of Bolling's method is the oxidation to sulphuric acid of the sulphur in the sulphur compounds present by means of a saturated solution of bromine in hydrochloric acid, and a gravimetric determination of the sulphur by precipitating and weighing it as barium sulphate. The apparatus consisted of a 5-litre aspirator bottle, a thermometer, a barometer, and two 500 c.c. capacity absorption bottles.

The method, in detail, is as follows: The aspirator is filled with water and connected with the absorption bottles which are connected to the producer-gas main by means of a short length of pipe packed with loose asbestos fibre. The water is allowed to flow slowly from the aspirator, thereby drawing gas through the bromine solutions. The temperature and pressure are taken during the process. The contents of the absorption bottles are transferred to a 750 c.c. beaker, and the bromine completely removed from the bottles by washing with distilled water. Two grammes of sodium carbonate are then added to the solution, which is heated to boiling so as to drive off the excess of acid and water. The sulphur is precipitated as barium sulphate by adding to the diluted hot solution a 10 per cent. solution of barium chloride and boiling vigorously for thirty minutes. The barium sulphate is then dried, ignited, and weighed, and the sulphur determined by the following formula:

$$S = 200{\cdot}0\,p\,0{\cdot}013748 \times \frac{750{\cdot}8}{283} \times \frac{273\ t}{B - f} = p\,729{\cdot}47 \times \frac{273 + t}{B - f},$$

in which the temperature of the gas f, the tension of water vapour at the temperature t, B the barometric pressure, p the weight of the barium sulphate, and S the amount of sulphur in 100 cubic metres of the gas.

The writers of this paper believed that purified coal gas contains more complex sulphur compounds than suction producer gas made from hard coal in a continuous automatic feed producer; they believed Bunte's method to be more efficient for determining the total sulphur in such producer gas than in purified coal gas; and they doubted the efficiency of Bolling's method as applied to purified coal gas. This doubt led to determinations of the total sulphur in Minneapolis illuminating gas by both Bolling's method and Harding's modification of Drehschmidt's method, and to a comparison of the efficiency of the two methods.

Harding's method and the apparatus used were those described by him in the "Journal of the American Chemical Society," Vol. 28, p. 537, with the exception that only 0·5 c.c. of bromine was used, instead of 4 c.c. Drehschmidt's original method was given in the "Chemiker Zeitung" (1887). The principle of the method, as modified, is the combustion of the gas in a specially-constructed gas-burner within the body of a large retort, in the presence of bromine vapours; the aspiration of the products of combustion with some bromine vapours through a 5 per cent. solution of potassium carbonate; and the precipitation of sulphur as barium sulphate.

The apparatus, with the exception of the burner, is of the simplest construction, and can be set up at once in any working laboratory. The burner eliminates one of Bolling's objections to the original Drehschmidt method. The Bolling process was slightly modified, so that it was possible to run under the same conditions as in the Harding method. Four cylinders of 150 c.c. capacity were used, in each of which were placed 120 c.c. of bromine water and 15 c.c. of concentrated hydrochloric acid saturated with bromine. This gives the gas a longer column of solution to bubble through. The gas was aspirated through by means of a suction pump, after first passing through a wet meter and governor. Gas was drawn through till the first three solutions were nearly decolorized, leaving the fourth only slightly affected. This required about ¾ cubic foot of gas.

In the Bolling method, as described, only 5 litres of gas were used. As the Minneapolis illuminating gas is low in sulphur content, and as it was found that in using this amount a milligram difference in the weight of barium sulphate obtained made a 2 per cent. error, it was believed that better results could be obtained by using larger amounts of gas and more absorbent.

In each method the gas was passed through the same wet meter which had been used for several years for measuring the illuminating gas for analysis, and through which gas had been passed several days so as to ensure complete saturation of the water.

The amounts of gas used were reduced to standard conditions of temperature and pressure by the following formula:

$$V = V \frac{b - e}{760 (1 \times 0{\cdot}003635\ T)}$$

The results obtained were as follows:

Date.	Temperature.	Pressure in Millimetres.	Obs. Vol.
Jan. 20, 1909	20°	748	$\frac{3}{4}$ cubic foot.
Jan. 30 ,,	22°	745	$\frac{3}{4}$,, ,,
Feb. 9 ,,	20°	741	$\frac{3}{4}$,, ,,
Feb. 18 ,,	21°	743	$\frac{1}{2}$,, ,,
Feb. 27 ,,	21°	744	$\frac{3}{4}$,, ,,
Mar. 2 ,,	23°	744	$\frac{3}{4}$,, ,,

Grammes of Sulphur per 100 *Cubic Feet.*

Harding.	Bolling.	Ratio.
9·0360	5·2884	1 : 1·709
10·2302	5·6843	1 : 1·801
7·9555	5·2824	1 : 1·506
8·9620	5·4467	1 : 1·647
8·3041	5·5886	1 : 1·485
9·3067	5·7635	1 : 1·615

Two tests were made, using the original Bolling method to observe if the oxidation was complete in the modified process, with the following result:

Date.	Temperature.	Pressure in Millimetres.	Obs. Vol.
Feb. 10, 1909	24°	745	$\frac{3}{4}$ cubic foot.
,, 10 ,,	24°	745	$\frac{1}{6}$,, ,,
,, 11 ,,	22°	743	$\frac{3}{4}$,, ,,
,, 11 ,,	22°	743	$\frac{1}{6}$,, ,,

Grammes of Sulphur per 100 *Cubic Feet.*

		Ratio.
Harding	10·5978	1 : 1·371
Bolling	7·7329	
Harding	11·0433	1 : 1·264
Bolling	8·7352	

These results, as compared with the above, are within the limits of experimental error—showing complete oxidation.

The sulphur content of the sodium carbonate and bromine was not determined; but as much more of each was used in the Bolling method than in the Harding method, if sulphur was present as impurities it would be in favour of the Bolling process.

The same wet meter was used in each process, and the same amount of gas was employed in each determination, so that the error of absorption of any sulphur compounds was eliminated.

The solution from the Bolling process gave considerable trouble in concentrating and precipitating the barium sulphate. It was difficult to remove the last trace of bromine, and the large amount of bromine present produced bumping difficult to control. It was necessary to evaporate nearly to dryness, and dilute the residue very much; and it was often necessary to reconcentrate and redilute, in order to precipitate the barium sulphate. Carrying the evaporation too far, decomposed some of the organic bromide compounds, and liberated bromine. During the process the bromine vapours attacked the rubber connections and tubing; and bromine products were deposited to such an extent in the suction-pump as to impair its efficiency.

From these observations, it appears that Bolling's process is insufficient for determining the total sulphur in a gas of such composition as Minneapolis illuminating gas.

Association of Water Engineers.

The Winter Meeting of the Association is to be held in the rooms of the Geological Society, Burlington House, Piccadilly, on Friday and Saturday, the 9th and 10th prox., under the presidency of Mr. W. H. Humphreys, Assoc.M.Inst.,C.E., Engineer, Manager, and Secretary of the York Water Company. The proceedings will commence at two o'clock on the former, and at half-past ten on the latter day. We learn from the circular issued by the Secretary (Mr. Percy Griffith), that the following papers have been promised for reading and discussion: "Gauging and Recording the Flow of Streams," by Mr. S. C. Chapman, M.Inst.C.E., Water Engineer to the Torquay Corporation; "The Advantages of Co-operation in Rural Water Supplies," by Mr. F. Graham Fairbank, M.Inst.C.E., of York; and "The Eliminating Effect of Chlorine on the Bacteria of a River Water," by Mr. Leslie C. Walker, Water Engineer to the Reading Corporation. On the first day, the paper submitted by Mr. E. Young Harrison at the summer meeting, on "The Wellingborough Water-Works and Softening Plant," will be discussed; and on the second day there will be the usual ballot for the election of the Council and officers for next year and for the admission of new members.

Sterilization of Water by Ultra-Violet Light.—In a recent communication to the Paris Academy of Sciences, this subject was dealt with by MM. Urbain, Scal, and Feige. The water is caused to circulate spirally round a source of light in such a manner that with a flow of about 4500 gallons per hour it is exposed for three minutes to the rays. With this device, complete sterilization of water has been obtained with an expenditure of 20 watts per 220 gallons.

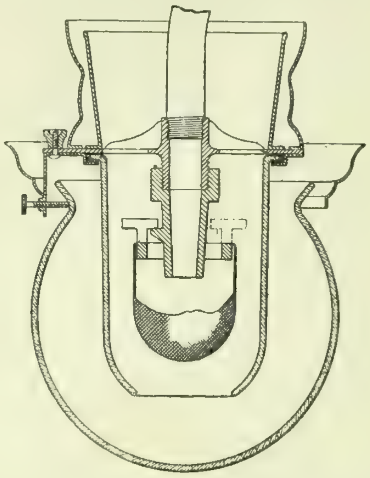
REGISTER OF PATENTS.

Inverted Incandescent Gas-Burners.

ALEXANDER, A. E.; a communication from Fischer, M. H., of New York City.

No. 22,074; Sept. 28, 1909.

The principal object of this invention is "to so construct and arrange the lamp as to ensure a steady light and avoid all flickering."



Alexander's Inverted Incandescent Gas-Burner.

To this end the lamp comprises (as shown) an arrangement of outer globe entirely closed except at the top, and an inner globe surrounding the mantle and open at the bottom; the inner globe extending below the mantle and having its lower end restricted so that it is of less area than any other part. In conjunction with this arrangement, above the inner globe, there is a chimney having its smallest area at its lower end, and with its upper end or outlet sufficiently unobstructed to ensure a greater area there than at any other portion of the chimney. The parts are all so constructed and arranged as to give the air and gases a substantially unobstructed passage from the point of ingress to the point of discharge.

The patentee utilizes what may be called an injector principle at the bottom of the inner globe, and again at the junction of the top of the inner globe and the superimposed discharge chimney. As a result, when the lamp is in operation outside air is being sucked into the outer globe, injected at an accelerated speed into and through the inner globe, and then the resulting mixture of gases is ejected from the top of the inner globe and out through the discharge chimney, also at an accelerated speed.

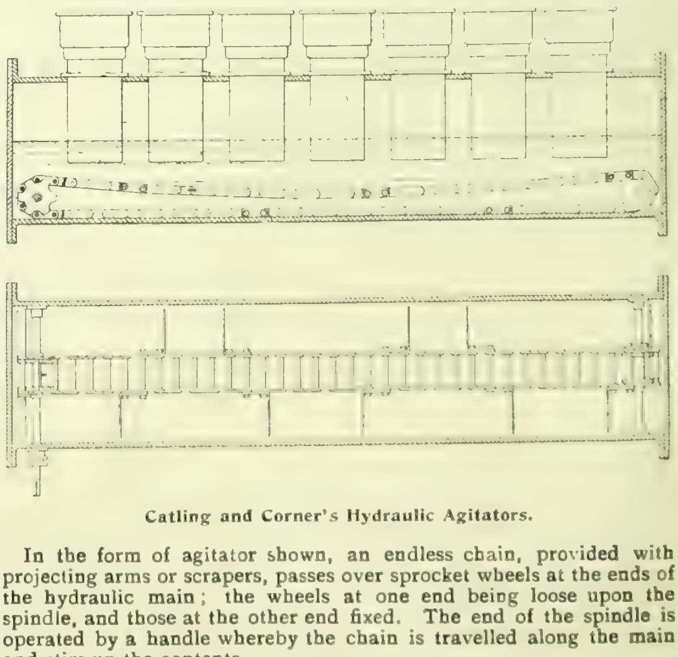
The illustration, which embodies a preferred form of the invention, will be understood without further explanation.

Preventing Deposits in Hydraulic Mains.

CATLING, J. T., of Plaistow, and CORNER, F., of Poplar, E.

No. 24,816; Oct. 28, 1909.

The object of this invention is to prevent a permanent deposit of carbon, tar, or the like in the hydraulic main by combining with the hydraulic an agitator in the base adapted to be actuated at suitable periods for the purpose of stirring up the contents and thus preventing any permanent settlement.



Catling and Corner's Hydraulic Agitators.

In the form of agitator shown, an endless chain, provided with projecting arms or scrapers, passes over sprocket wheels at the ends of the hydraulic main; the wheels at one end being loose upon the spindle, and those at the other end fixed. The end of the spindle is operated by a handle whereby the chain is travelled along the main and stirs up the contents.

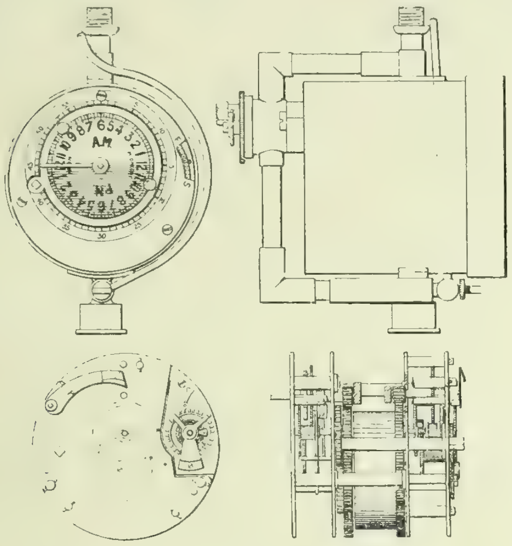
In the case of a group of hydraulic mains, the projecting spindles would be provided with sprocket wheels coupled together by an endless chain whereby all the agitators of the group would be actuated at one operation.

Regulating the Lighting and Extinguishing of Gas.

Harris, H. W., of St. John's, Kent.

No. 25,101 ; Nov. 1, 1909.

This apparatus is said to have been devised for regulating the lighting and extinguishing of gas supplied to a street-lamp or to a group of burners, "to reduce the cost of manufacture by means of a construction wherein the parts may be assembled with greater facility than heretofore, to simplify the arrangement of the mechanism whereby to facilitate adjustments and repairs, and generally to render the sections of the apparatus more accessible than in previous constructions."



Harris's Street Lamp Lighter and Extinguisher.

The mechanism employed is of the kind in which a time-movement section and a motor-mechanism section are controlled by a single driving spring common to both sections ; and instead of mounting the two sections together with their common driving spring between a single pair of frame plates, the sections are mounted between independent pairs of frame plates, and the common driving spring is arranged in a barrel between the pairs of plates which are removably supported upon pillars.

The apparatus is substantially of the class described in patent No. 9552 of 1903 and No. 14,879 of 1904 ; and in one form the time mechanism section is arranged between a pair of circular frame plates situated in the rear of the usual rotary and fixed dials and separated by pillars to which the frame plates are secured so as to constitute "an independent and separable element of the apparatus."

The motor-mechanism section is similarly mounted between a second pair of circular frame plates, also separated by, and attached to, pillars. The frame plates are arranged co-axially in rear of the time-movement section ; and the pillars supporting the frame plates of the motor movement section are extended forwardly of the section and take into apertures formed in the rear plate of the pair of time-movement section frame plates—suitably spaced shoulders or collars upon the pillars serving to maintain an interval between the two sections when assembled.

In the interval between the two sections, the spring barrel containing the common driving spring is mounted by means of its arbor being carried in bearings formed in or upon the rear plate of the time movement frame plates and the front plate of the motor movement frame plates respectively ; and engagement with the spring barrel and mainspring arbor and the respective movements is effected by a pinion carried by a shaft projecting from each movement through an aperture in its respective frame plate and engaging with the toothed periphery of the spring barrel and a gear wheel operatively connected with the main spring arbor by means of the usual pawl and ratchet winding mechanism.

The illustration shows the above described form of the apparatus in (1) front elevation with the cover plate removed and showing the rotary and stationary dials and the operating pins whereby the valve mechanism controlling the supply of gas is actuated ; (2) a side elevation of the apparatus ; (3) a front elevation of the mechanism taken immediately behind the dial plates ; and (4) a side elevation, partly in section, showing the assemblage of the mechanism as contained within the casing.

Inverted Incandescent Gas-Burners and Lamps.

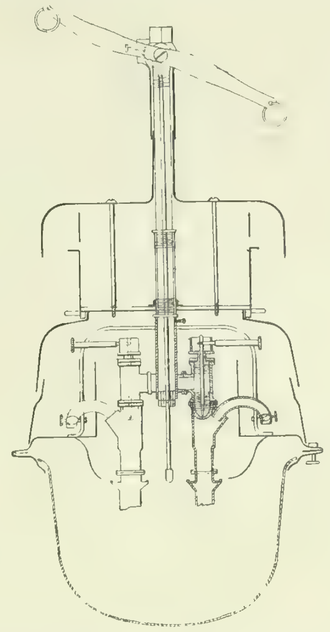
Grigsby, W. R., of Highgate Road, N.W.

No. 25,862 ; May 5, 1910.

With many inverted incandescent burners, the patentee says, the chief object aimed at is to prevent the (so-called pure) inlet air from coming into contact with, and being affected by, the products of combustion arising from the gas burning in the mantles ; and his invention "provides a clear and definite means by which this object is attained without an elaborate arrangement of chimneys, shields, &c."

Instead of a number of apertures for the air, there is (as shown) only one inlet into which a removable tube fits at an angle of 45°—claimed to be "an absolutely new principle in connection with inverted burners, for though air-tubes have been used before in connection with regenerative lamps, the use of this single removable tube leading at an angle of 45° to a closed chamber has never yet been adopted." In all former incandescent burners involving the use of two or more air-tubes, the several tubes counteract each other, with a total effect opposite to that produced by this proposed single tube.

By means of this arrangement, a lamp can be made in which the burners can be fitted in the centre of it with a direct outlet for the products of combustion, and fitted at the same time with an air-supply entirely free from the combustion products.



Grigsby's Inverted Gas-Burner and Lamp.

The lamp shown is fitted with two burners ; and the principles involved apply equally to any number of burners. The same arrangement is said to be equally satisfactory when fitted in a lamp which is not intended to be exposed to rain or outside air, and which only requires one centre chimney. The same principle, again, applies to burners (not necessarily fitted in lamps) arranged to take a globe-holder or any other contrivance of the kind.

Inverted Incandescent Gas-Burners.

Rose, A., and Bellamy, W., of Birmingham, and Dolphin, J., of Smethwick.

No. 22,659 ; Oct. 5, 1909.

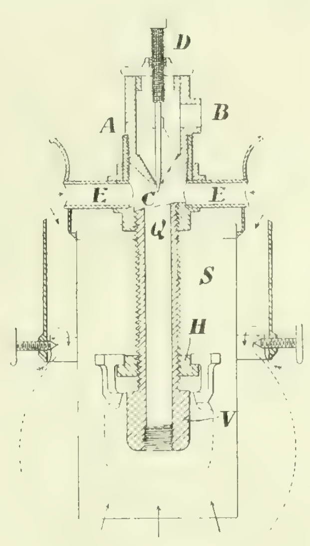
This invention has reference to a dust-trap to be applied to incandescent gas-burners immediately above the gas-inlet nozzle of the bunsen burner, so as to catch any dust in the gas and prevent it passing down and choking the small holes in the gas-nozzle. The dust-trap comprises a piece of gauze, preferably formed to a cup shape and adapted to fit or wedge within a central tapered cavity formed in a non-rotatable plug mounted in a body fixed above the burner. In addition, the plug has a pin attached to it which is adapted to enter a slot in the body for the purpose of ensuring the plug taking its correct position in the body.

Inverted Incandescent Gas-Burners.

Kost, K. F. M., of Ulm, Germany.

No. 29,452 ; Dec. 16, 1909.

This invention has for its object to automatically maintain a constant supply of gas to inverted incandescent light burners.



Kost's Self-Regulating Inverted Burner.

The regulating valve consists essentially of a hollow cylindrical part A screwed into the upper fittings of the globe-carrier ; gas being admitted to the chamber thus formed by a passage B. The gas thence flows through a nozzle C—being regulated by a cone-pointed spindle D, which protrudes into the nozzle. The spindle (brass) is adjustable by screwing into A, while the nozzle part C is made of iron or other

material having a smaller co-efficient of expansion when heated than the spindle E.

The gas, after flowing through the regulating valve, passes into the burner-tube U (leading to the burner-head V) forming a chamber in which the gas is mixed with air entering through the passages E, and consequently considerably preheated.

The form of the burner-head is immaterial; but it is found desirable, says the patentee, to furnish it with ribs on the outside and sometimes on the inside, so as to provide a large radiating surface which will prevent the head becoming excessively hot.

The mantle-holder (of the usual type) consists of a supporting ring H, adjustable as regards height by being screwed on the outside of the burner-tube. The spindle covers more or less the nozzle gap C; and as the co-efficient of expansion of brass is greater than that of iron (of which the nozzle consists), there is a tendency during the continuous heating of these parts for the passage at U to be gradually closed, whereby the supply of gas is reduced. In the case of high pressure, the brass spindle becomes warmer, and, notwithstanding the gas pressure, it again permits comparatively less gas to pass through.

Obtaining Mineral Fat or Grease from Coal Tar.

Sauvageot, S. J., of Chaumont, France.

No. 442; Jan. 7, 1910. Date claimed under International Convention, Jan. 20, 1909.

This invention relates to a process for obtaining mineral fat or grease, carbon, and combustible gases (the latter two being, however, merely bye-products) by the distillation of coal tar, coke-dust, quicklime, and water. For this purpose, an intimate mixture is made in the following proportions: 100 parts of coke dust, 50 of coal tar, 5 of quicklime, and 15 of water. The mixture is distilled in suitable apparatus at from 800° to 1000° C. With a distillation lasting four hours, the following products are obtained from the mixture: 22·5 kg. of mineral grease or fat, 130 kg. of carbon, and 16 cubic metres of combustible gases. The quantity of quicklime in the mixture may be increased up to about 70 per cent. of the coke dust used, if fats lighter in colour are to be obtained on distillation.

APPLICATIONS FOR LETTERS PATENT.

25,800.—Frame, W. J., "Exhausting or extracting air, gas, or vapour," Nov. 7.

25,813.—Southey, A. W., "Manufacture of gas." Nov. 7.

25,823.—Green, J., "Gas hardening and tempering stove." Nov. 7.

25,825.—Harrop, F. A., "Incandescent bodies or mantles." Nov. 7.

25,827.—Dor-Delattre, E., "Protecting the operatives of gas producers." Nov. 7.

25,829.—Frank Love, Limited, Love, F., Elliott, G. H., "Draw-off taps for water or other liquids." Nov. 7.

25,849.—Carpenter, C. C., "Gas-fires." Nov. 7.

25,854.—Joseph, W. O., "Air-gas producing apparatus." Nov. 7.

25,876.—Field, G. K., "Gas or liquid fuel burners." Nov. 7.

25,882-3.—Henri, V., Helbronner, A., and Recklinghausen, M., "Destroying bacteria in water supply systems." Nov. 7.

25,892.—Horlington, W. H., "Gas-ovens." Nov. 8.

25,943.—Bennet, J. H., "Gas-meters." Nov. 8.

25,983.—Thorn, W., and Mann, M. F., "Pipe couplings or joints." Nov. 8.

25,992.—North, R. B., and Thompson, C. H., "Indicating the rate of flow of liquids or fluids." Nov. 8.

25,996.—Russell, A. C., and J. H., "Lamps." Nov. 8.

25,999.—Bennis, E., and Bibby, J., "Conveyors." Nov. 9.

26,013.—Orme, T. A., Lees, J. S., and Meters Limited, "Wet gas-meters." Nov. 9.

26,021.—Robinson Bros., Limited, and Robinson, H. W., "Conveyance and heating of tar for the purpose of road construction." Nov. 9.

26,058.—Armstrong, J., "Coke-ovens, gas-producers, &c." Nov. 9.

26,072.—Bickerton, H. N., Bradley, H. W., and Clerk, D., "Gas-producers." Nov. 9.

26,109.—Weldon, H., Lound, J. A., and Atkinson, T. N., "Incandescence mantles." Nov. 9.

26,114.—Thompson, W. P., "Adjusting the valves of hydrocarbon pumps." A communication from Maschinenfabrik Augsburg-Nurnberg A. G. Nov. 9.

26,156.—Chipperfield, W. H., and Strangways, G. E. A., "Apparatus for compressing gas or air, or for the production and compression of hydrocarbon vapours for lighting and heating purposes." Nov. 10.

26,161.—Wright, W., "Lamps or lanterns." Nov. 10.

26,168.—Simmance, J. F., and Abady, J., "Gas analysis apparatus." Nov. 10.

26,186.—Yates, H. J., "Atmospheric or bunsen gas-burners." Nov. 10.

26,191.—Julius Pintsch Akt.-Ges., "Alternately lighting and extinguishing the main and bye-pass flames of railway-carriage lamps." Nov. 10.

26,242.—Simmance, J. F., and Abady, J., "Recording gas calorimeters." Nov. 11.

26,254.—Jones, A. O., "Conveyance of the coked charges from coke-ovens." Nov. 11.

26,258.—Bosch, R., "Ball-and-socket joint." Nov. 11.

26,274.—Wilkins, C. H., and Wilshir, J., "Pipe couplings." Nov. 11.

26,278.—Mackay, J., and Anderson, J., "Prepayment mechanism." Nov. 11.

26,316.—Downes, A. E., "Toasters for use in conjunction with gas-rings." Nov. 12.

The Heckmondwike Urban Council have given notice of their intention to sue the Dewsbury and Heckmondwike Water Board and certain members for damages unless the chalk treatment of the water supply is at once discontinued.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gas Companies (Standard Burner) Bills.

Sir,—You will be glad to hear that these Bills went through unopposed to-day. The promoters would esteem it a favour if you would insert a line in the "Journal" to this effect, and take advantage of the opportunity to thank any company, other than the promoting companies, who have interested themselves in the matter to obtain support.

R. W. Cooper and Sons.

5, Victoria Street, S.W., Nov. 15, 1910.

The Spiral Guiding of Gasholders.

Sir,—It is now twenty three years since I made and patented the invention of the spiral-guided gasholder, which I believe was first brought to the notice of the gas profession in the columns of the "Journal."

I am forcibly reminded of this flight of time, and also of the greatly altered attitude towards my invention, which has taken place in the interim, by perusing the description and illustrations of the completed new holder for the town of Oldham, published in your issue of the 8th inst. I suppose, Sir, the younger generation of gas engineers have very little conception of the criticism and opposition bestowed upon my views on gasholder construction in those days. My contemporaries will remember that some of the critics went so far as to express the belief that even a single-lift holder of this kind would be a dangerous edifice, which a very modest puff of wind would overturn. Indeed, I found it politic to advocate that the earlier structures should be restricted in height to about two-thirds of the base diameter. In time, however, three-lift holders were erected, then four lifts, without the dire results so confidently predicted by certain would-be authorities. Now we see, not only a four-lift holder projected; but one having a height greater than its complete diameter.

How many spiral holders are now in existence in various parts of the world, I have no means of knowing; but I am aware that the number is very great, and that licenses were granted in some foreign countries, and holders were erected under the patent, for which no royalties ever reached the patentees.

I think therefore, Sir, I may fairly congratulate myself that I have lived to see the complete triumph, in principle, of my invention. In detail, I yet hope to make further improvements by simplification, which have not yet been hit upon by others, although—like various details already adopted—these were produced on my drawing-board over twenty years ago. It would, indeed, appear that I have all through been a little before my time.

But if I have not received all the material benefits or sentimental recognitions I might fairly be entitled to expect, I trust I may be pardoned for expressing the satisfaction I feel, in my old age, that my early theories are now, by practical working on a world-wide scale, demonstrated to have been perfectly correct.

William Gadd.

Manchester, Nov. 16, 1910.

Burner Adjustment.

Sir,—The discussion at the Illuminating Engineering Society reported last week brings to the front once again the question of the necessity for, under present conditions, the adjustment and readjustment of burners. Personally, I am of opinion, after experience of both kinds of lighting, that the superior quality of the light obtainable from an incandescent mantle outweighs all advantages of either convenience or decorativeness that may be possessed by electricity; and I am convinced that, if it were possible to ensure that the supply of gas could be invariable in respect of composition and pressure—at any rate within such limits as to remove any necessity for adjustment of burners by the consumer—a very long step would have been made towards removing a disadvantage which, I feel sure, is responsible for some dissatisfaction and complaint on the part of consumers, and would further lessen the comparatively small measure of success that electricity has achieved.

Of course, it is difficult, where the gas supplied is a mixture of water gas and coal gas, to ensure that the mixture shall be uniform with respect to the quantity of air required for complete combustion; but it is surely possible to confine the variation within narrower limits than is at present sometimes the case. It is not uncommon in certain districts I have in mind for incandescent burners to require readjustment daily, and for non-adjustable burners in gas-cooking devices to light-back or burn badly. Variation in pressure can, and ought to be, confined within narrow limits. Nothing militates against the use of gas so much as the lack of sufficient pressure to allow gas-fires to be used without affecting the lighting efficiency of the burners in use at the same time; while many people find it a nuisance to have to readjust the gas supply to a burner several times in the course of an evening.

From the point of view of the commercial success of gas supply, these matters are of infinitely greater importance than minor variations in the efficiency of appliances, or even a reduction of price; and I am exceedingly glad to see that the South Metropolitan Gas Company, who so often led the way under Sir George Livesey's direction, are, under his able successor, attempting to deal adequately with these important matters. It will be interesting, when the experience is available, to learn how the burner devised by Mr. Carpenter behaves with a gas containing a percentage of water gas. With the means now at our command for increasing pressure in trunk mains, and with the other resources at our disposal, it should be possible to remove all grounds for dissatisfaction on account of the variability of the supply afforded.

Arthur Valon.

Caxton House, Westminster, S.W.,
Nov. 18, 1910.

Mr. Johns' Paper on Ammonia Recovery.

Sir,—Will you permit me to point out a slight error in Mr. Johns' interesting paper published in the last number of the "Journal"? The illustration on p. 490, showing (fig. 1) a tar-washer, which is applicable also to naphthalene extraction, and referred to in the same paper as "Kirkham's 'Standard' Washer," should not be so described. The apparatus shown is one of which I am part-patentee; Messrs. Kirkham, Hulett, and Chandler, Limited, having had sole licence to sell since the date of patent grant. The correct description, therefore, should have been "Chandlers' 'Standard' Washer," *vide* specification No. 11,825 of 1901 ("Journal," Vol. LXXIX., p. 1689).

Samuel B. Chandler.

Balham, Nov. 17, 1910.

PARLIAMENTARY INTELLIGENCE.

FURTHER PROGRESS OF PRIVATE BILLS.

Both Houses of Parliament re-assembled last Tuesday after the recess. The most important event to be recorded on the first day was the third reading in the House of Commons, without opposition, of the three Gas-Burner Bills. They were returned to the House of Lords on Friday, and the amendments made in them were considered and agreed to. They now only await the Royal Assent.

In the House of Lords on Wednesday, a Bill was introduced to confirm a Provisional Order applied for by the Dundee Gas Commissioners to obtain authority to raise further money to the extent of £65,000 for the purposes of the gas undertaking, and various other powers in regard thereto. The Bill was read the first time; deemed, pursuant to the Private Legislation Procedure (Scotland) Act, 1899, to have been read a second time and reported from the Committee; and ordered for third reading last night. The Warrington Corporation Bill, which has passed the House of Commons, was read a second time and committed on Thursday.

In the House of Commons, on Friday, Mr. Lees Smith, the Member for Northampton, gave notice of a Bill to further amend the Municipal Corporations Act, 1882.

FURTHER AMALGAMATION OF GAS COMPANIES IN THE METROPOLITAN DISTRICT.

Important Proposal by the Gaslight and Coke Company.

The Gaslight and Coke Company have given notice of their intention to apply to Parliament next session for authority to amalgamate with the Barking and the Chigwell, Loughton, and Woodford Gas Companies, or to acquire the undertakings of these Companies.

The Bill to be promoted will make provisions with respect to the capital of the amalgamated Companies in the event of amalgamation, define the rights of the holders of the capital of the several Companies, and, if thought fit, provide for and authorize and require the exchange of the stocks, shares, or securities of any of the said Companies for the stocks, shares, or securities of any other of them. It will also prescribe the consideration (whether in stocks, shares, or other securities of the Gaslight Company or in cash, or partly in such stocks, shares, or securities and partly in cash) to be paid by the Gaslight Company to the two Companies for any such sale and transfer; make provisions for and with respect to the allocation of such consideration among the holders of stocks or shares of the two Companies; and, if thought fit, provide for the vesting in the holders thereof of stocks, shares, or securities of the Gaslight Company; require the holders to accept these, together with any sum payable, under the provisions of the intended Act, in cash, in substitution, either wholly or in part, for the stocks, shares, or securities of the two Companies held by them, and make provision with respect to holders of debentures, debenture stock, mortgages, or other charges of the two Companies, and, if thought fit, to empower the Gaslight Company to redeem, discharge, or pay these off by the issue of debentures, debenture stock, or mortgages of the Gaslight Company, or by the payment of such pecuniary consideration as may be specified or provided for.

It is proposed to extend the existing limits of supply of the Gaslight Company by adding thereto the areas comprising the limits of the two other Companies, and to enable the Gaslight Company to supply gas therein and open streets and roads; also to extend and apply to the enlarged undertaking of all or any of the provisions of the existing enactments relating to all the Companies or any of them, and authorize the Gaslight Company to exercise and enjoy all or any of the other powers, rights, privileges, and exemptions of the other Companies. In particular, the Bill will or may make applicable to the extended undertaking the provisions of the Acts of or relating to the Gaslight Company with respect to the illuminating power of gas supplied, the burner to be used in testing such gas, the sliding-scale of price and dividend, the standard price for gas, and other matters incidental thereto, and will or may make all such provisions as may be thought fit with respect to the actual price to be charged for gas supplied within the enlarged area, and authorize the fixing, for such period as may be specified in the Bill or prescribed by Parliament, of such actual price, whether for public or private lighting or for any other purpose, at different rates in the several areas now forming the limits of supply of the three Companies respectively. Provision will be made that any differential price to be charged in the areas now forming the limits of the two Companies shall not be taken into account in ascertaining the rate of dividend payable by the Gaslight Company upon their ordinary stock under the provisions applicable to that Company with respect to the sliding-scale of price and dividend. The provisions of the Acts of the Barking and Chigwell Companies relating to the testing of the gas supplied in their respective areas are to be repealed, altered, or amended.

The Bill will provide for the transfer to the Gaslight Company of all or any of the officers and servants of the two other Companies, sanction the settlement of the terms of their employment and the compensation and gratuities to be granted to the officers and servants removed from office, make provision for the payment of compensation to the Directors and Auditors, and provide for the dissolution of the two Companies.

The other provisions of the Bill include authority to form renewal and special purposes funds; deal with the existing insurance fund of the Gaslight Company; and exempt engines, meters, stoves, &c., on hire from distress, notwithstanding that they are fixed to the premises in which they may be situated. It is proposed to convert into ordinary stock of the Gaslight Company all or any of the existing convertible "A" 5 per cent. preference stock, first, second, and third issues, of the Company, and to authorize and require the holders of such preference stock to accept in lieu thereof, or in substitution therefor, such amounts of ordinary stock as may be specified in the Bill. But, instead of such conversion, the Bill may, if thought fit, provide for and authorize the compulsory purchase by the Gaslight Company of the above-named preference stock, at such price and on such terms and conditions as may be specified in the Bill or prescribed by Parliament. The Bill will provide for fixing the remuneration of the Secretary of the Gaslight Company by the Directors of the Company, and for increasing that of the Auditors. The promoters will seek authority to supply gas in bulk outside the limits, and to lay mains and pipes in streets not dedicated to the public use; they will also ask for powers with respect to pipes and fittings between their mains and the consumers' meters, the prescription of the size and nature of such fittings, and the use of anti-fluctuators on gas-engines. Authority will likewise be sought to apply their existing funds to the purposes of the intended Act, and to raise additional capital. The intended Act will vary and extinguish all rights and privileges which would interfere with its objects, and confer those which may be necessary. Certain Acts are to be incorporated, amended, or repealed.

Extensions by the Cinderford Gas Company, Limited.

The Cinderford Gas Company are putting down the latest form of carbonizing plant; and the building, which will contain a bench of three settings of retorts, is well advanced; the contractors for the whole work being Messrs. R. & J. Dempster, Limited, of Manchester. The Company are also erecting a waggon-weighing machine. These improvements—including new scrubbing plant, &c., previously erected—will represent an outlay of some £2000. On the completion of the extensions, the Company will be able to meet the wishes of many of the inhabitants of Ruspidge by extending the gas supply to the bottom of that district. It is intended to lay down a 5-inch main to Ruspidge valley, and the work will be proceeded with next spring. The length of the main will be some 3500 yards, and the cost of the various connections, meters, &c., to the houses will probably represent an outlay of a further £2000.

Complaints as to Electric Lighting at Sandown.

At a recent meeting of the Sandown Urban District Council, Mr. Way called attention to the bad lighting of the High Street. He said one day the previous week six electric arc lights out of seven were not burning. On two nights the lamp was out at one of the most dangerous corners in the town. It did not appear to him that the Electric Light Company cared anything about the lighting of the streets. All they seemed to want to do was to get as much money as they could, and then ask that the penalty should not be inflicted because the lights had not been out for long. Three arc lamps were out one after the other; and had it not been for the brilliancy of the tradesmen's shops, the High Street would have been as dark as any country lane. He moved that a very strong letter should be sent to the Company, complaining of the manner in which they had lighted the streets lately; and he asked the Surveyor to tell them the number of lamps that were out during the previous fortnight. Mr. Board, in seconding the motion, said the Electric Light Company were simply "fooling" with the lighting—or rather the non-lighting—of the town. There was scarcely a night when all seven of the arc lights in the High Street would be found aglow; and on the previous Sunday night it was so dark that one could not see which was the causeway and which was the road. He thought it was high time that some stringent measures should be taken to make the Company act in accordance with their contract. The Chairman (Major W. T. Arnell) said the members of the Council who were favourable to electric lighting were of the same opinion. The Surveyor (Mr. L. G. Dashper) stated, in answer to the question put by Mr. Way, that during the past month he had had 24 notices of lamps being out—some of them being for ten lamps and others for six, five, two, and one. The motion was agreed to.

Newly-Tarred Roads.—A recent County Court decision is of interest in connection with the liability of highway authorities for accidents on newly-tarred roads. According to the "Contract Journal," a cyclist fell on such a road, and claimed damages for negligence; alleging that he was covered with tar. He admitted that his speed might be about ten miles an hour, and that he had passed over other portions of the roads which had been tar-sprayed but afterwards sanded. The work was not completed where the accident happened, and plaintiff's case was that there was no indication of the fact; the defence was contributory negligence. The Judge said he had to ask himself what a reasonable and prudent man would have done in the circumstances. The moment he came to the spot, plaintiff had every reason to suppose the tar was there, and there was even a strip of liquid tar alongside him. The public now expected highway authorities to tar the roads to lay the dust, and everyone knew that when first applied it was to a certain extent dangerous. By the exercise of prudence and reasonable caution, the accident might have been avoided. The action was therefore dismissed, with costs.

LEGAL INTELLIGENCE.

ACTION FOR TRADE LIBEL.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, Nov. 17.

(*Before Mr. Justice* WARRINGTON.)

B. Cars v. Bland Light Syndicate, Limited.

This was an action brought against the above-named Syndicate for trade libel.

Mr. BUCKMASTER, K.C., Mr. CAVE, K.C., and Mr. R. REEVE (instructed by Messrs. Harris, Chetham, and Cohen) appeared for the plaintiff; Mr. CLAUSON, K.C., and Mr. O. THOMPSON (instructed by Messrs. Spyer and Son) represented the defendants.

Mr. BUCKMASTER, in opening the case, said the action might be divided into two branches—one trade libel, the other the statutory right to prevent the allegation that certain articles were sold in infringement of patent rights, when the person making the allegation was not taking any steps to assert those rights. In the present case, there were, in fact, not any to assert. The defendant Company dealt in gas-lighting accessories; and the plaintiff carried on a similar class of business. There was a maker of gas-burners in Hamburg—Mr. Wilhelm Schmitz—whose goods seemed to be much sought after in England; and in August, 1908, the defendants entered into an agreement with him under which they obtained the exclusive right of selling his burners in England for one year—the minimum quantity to be taken being 15,000. Samples were to be submitted, and all burners were to be stamped "Bland." This agreement came to an end on July 15, 1909. Mr. Schmitz thereupon came to England to see if he could find someone else to take up the agency. He saw the plaintiff, and arranged to sell him 3000 burners. The plaintiff obtained certain of them, and proceeded to sell them, not under the name of the Bland burner, but as the "Venus" or "Shell" burner—never attempting to use the name of defendants, or appropriate it as a description of the burners. Probably the defendants got into communication with Mr. Schmitz. At any rate, they entered into another arrangement with him in December, 1909, for the exclusive right to sell his manufactures in England; undertaking to purchase 35,000 burners in the first year and 30,000 in the second, at certain prices. It was very curious that after the earlier agreement the defendants should have written to a customer of the plaintiffs: "We feel confident that a firm of your standing will not give encouragement to a foreign made and pirated burner, but would do your utmost to uphold fair play, and help us to substantiate our English patent rights." He should submit, when the evidence had been called, that the plaintiff was entitled to the protection of the Statute against threats, and also to an injunction and damages for trade libel. On this point he cited *Thomas v. Williams* (14 C.D.).

Friday, Nov. 18.

Mr. BUCKMASTER this morning further referred to the above-named case, and resumed his narrative of what had occurred. He said that soon after the plaintiff commenced selling the Schmitz burners he found there was an interference with his customers by defendants, who were going round and saying, as they said in the letter he had previously read, that this was a pirated, cheap, foreign-made burner, and not the Bland, but presumably a cheap imitation of it. The fact was it was the Bland burner, though not so named. These statements seriously prejudiced the plaintiff in his business. Having harassed the plaintiff in this way, the defendants resumed the agency for Schmitz, to which they attached so much importance that they backed his bills for a considerable sum as a consideration for getting the exclusive agency for fourteen years. He submitted that, under section 36 of the Patent and Designs Act, 1907, the plaintiff was entitled to an injunction restraining the threats. On Sept. 2, 1909, a letter was sent to the plaintiff by the defendants' Patent Agents in these terms:

Our clients, the Bland Light Syndicate, Limited, whose registered address is 29, Little Trinity Lane, London, E.C., have consulted us with reference to the infringement of their patents and designs relating to inverted gas-burners, which patents and designs our clients have reason to believe are now being copied by certain importers of gas-burners. It would appear that two of the British patents and three of their registered designs in particular are being copied; and as these patents and the designs have been granted under the Patent and Designs Act, 1907, the strongest possible proof (apart from actual legal action) of their validity has been established. The Directors of the Bland Light Syndicate, Limited, have decided to carefully watch for any infringement of their rights by importers, or by the wholesale or by the retail distributors; and it must not be forgotten that any firm or individual vending a patented or registered article procured from others than the patentee or his agents is liable to an action for damages. The Bland Light Syndicate, Limited, are anxious to maintain the very pleasant relations they now have with their numerous customers. But it is imperative that they protect their rights; and it is obviously necessary they must protect their customers from competition by others, who, alleging they are selling Bland burners, are in reality offering an inferior article, both as regards workmanship and quality of material, and a direct infringement of the Bland burner.

Correspondence then ensued between the plaintiff and some of his customers, among others, with Mr. Gratrix, of Manchester.

Extracts from this correspondence having been read, the following evidence was called.

Mr. *George Brooks* said he was a Director of Samuel Gratrix, Jun., and Bros., Limited, who dealt in gas-lighting accessories. In the autumn of 1909, they had from the plaintiff a few samples of gas-burners, of which the one produced was a specimen. [This was marked "G.B.1"] On the 3rd of September, he received the circular from Messrs. Bromhead and Co. [marked "G.B.2"] which had been read by Counsel in his opening. Shortly after this, one of the defendants' representatives called on him. One of the burners was on the bench, and he said he was sorry that a firm such as theirs should take up a burner like that, because it was an infringement of the defendants' burner. In consequence of this, he wrote to the plaintiff on the matter, and correspondence ensued. The result was that he could not go on doing business with the plaintiff as he should have done, being afraid of what might occur. Apart from this, they were willing to buy, and should have been glad to do so, as there was a demand for these burners, and they had to meet other competitors.

Cross-examined: They were now dealing in burners supplied by the plaintiff which were the same as that marked "G.B.1" From October, 1909, until about September last they did nothing at all, as they wanted to be quite sure they were in the right. The burners were sold as the "Venus." Another burner now shown to him was the new burner as sold by the defendants [marked "G.B.3"]. It was stamped "Bland." He had no idea who made it. In September, 1909, he was dealing in defendants' burners; and this one was practically the same make. There were slight differences in the top portion, and he thought he remembered that the defendants' representative mentioned certain advantages; but he left these matters entirely in the hands of his assistants. On the defendants' burner there was the word "Bland," which was not on the plaintiff's burner. He could not say that the defendants' burner was made of brass and plaintiff's of iron electro-brassed; he did not know what it was made of. He did not think it made any difference whether it was made of iron or brass; it was more a question of price, if it was a taking burner. The "Venus" was the same thing as the "Shell" burner; the plaintiff's burner being sold under both names. He thought that there was some difference in detail, but it would answer the same purpose. The "Shell" burner was sold by others as well as the plaintiff; but the "Venus" only by the plaintiff, he believed. On the 18th of September, he wrote to the plaintiff saying they still waited his reply *re* "as Bland" burners, and asking for some more sections. "As Bland" meant that the burner was similar to the Bland. He might, in speaking of the "Venus" burner, refer to it as the "as Bland." He believed it was Mr. Squires who called upon him on behalf of the defendants; but he could not say that he referred to the burner as the "as Bland" burner to Mr. Squires. He did not remember Mr. Squires pointing out that they must not sell the "as Bland" for a Bland burner. He gave him to understand that it would be wise not to sell the burner—not as a Bland burner, because they would not think of doing so. He had never had any litigation in connection with the plaintiff's firm, with whom he had done business for many years. He never heard of a Mr. Edgar, or that an action was brought by defendants to restrain him from selling his burners as Bland. He did not take in the "Gas World," and had not seen the advertisement in that paper on April 4, 1908. He took the "JOURNAL OF GAS LIGHTING;" but he did not remember reading the advertisement of Aug. 10, 1909.

The advertisement was read, as follows.

NOTICE.—The Bland Light Syndicate, Limited, have had to seek the assistance of the Courts for infringement in connection with their well-known burners. The action has been disposed of on satisfactory undertakings being given, and on payment of an agreed sum for damages and costs. The Bland burner is entirely of British manufacture. All Bland burners are manufactured on scientific lines under English patents. The Bland burner embodies points not known in any other burner. The Bland gas-regulating nipple is guaranteed gas-proof. All Bland burners are stamped "Bland Patent." The Bland inner bulbs are made of the celebrated Monopel glass, which will not crack or fuse.

Cross-examination continued: Shortly after September, 1909, the plaintiff wrote saying that he had now an indemnity from his friend abroad, saying he held himself responsible; and then he purchased some burners, but sold very few. Later on he did more; but they were very sensitive about it. He did not know that after November, the plaintiff was unable to get any more of these goods from abroad. They did not do much with them, because they wanted to keep out of any quarrel. He was sure what Mr. Squires said was that it would not be wise to sell the burner; but he had not a very clear recollection of the exact words.

Re-examined: His firm had never attempted to sell the plaintiff's burner as the Bland burner, nor had they thought of doing so; and nobody could ever suggest that they had. In April last, he wrote to the plaintiff saying that not being able to sell his burner was very prejudicial to both their interests. In the autumn of 1909, he had been selling Bland burners. At that time they had never had a brass burner like "G. B.3;" they were like the one now produced [marked "G. B.4"]. It bore the words "Bland Burner; Schmitz Patent." Comparing this with the one he got from the plaintiff, he should say, as a practical business man, that there was no difference in outward appearance between the two.

Mr. *J. G. Watkinson* said he carried on business as Messrs. J. & W. B. Smith, manufacturers of, and dealers in, incandescent mantles and gas-lighting accessories. In July, 1909, he had an interview with Mr. Joseph Schmitz, and shortly afterwards the Managing-Director of the Bland Syndicate called upon him. He said he had heard that witness had given Schmitz an order for 5000 burners; and he was desirous that they should not sell them, and wished to come to some arrangement. First he wanted witness to cancel the order; and that being impossible, he then suggested taking the burners off his hands, and so retaining the amicable relations which had existed. This was done; and they took the burners at the invoice price. Exhibit "G.B.4" was supplied by him to the plaintiff's solicitors. It was a burner he bought from the defendant Company. It was impossible to say definitely when, but from its appearance he should think it was supplied about eighteen months ago.

Cross-examined: If the defendants said they had not sold any such burner since February, 1909, he should think it was quite likely.

Mr. *R. S. Tobey*, Secretary to the Horley Gas Company, said that on Dec. 16, 1909, he wrote to the plaintiff with regard to certain gas-burners which had been purchased from him. He did so in consequence of an interview on the telephone with Mr. Gould, the Manager to the defendant Company, who told him that he must not sell the burner; that it was an infringement of their patent; and that an action was pending. He immediately wrote to plaintiff asking him how they stood in the matter. Later on he had a further telephonic communication from defendants, in which reference was made to this letter; and they asked him to say that he had misunderstood what they had

said or meant to say, which was that these burners should not be sold as Bland burners. This was not what they had said; otherwise he should not have written to the plaintiff about it. The burner produced [marked "R.S.T.1"] was one he bought from Mr. Bland—in 1908, as far as he could remember. It bore the words "Bland," and "Made in Germany."

Cross-examined: The second telephonic communication was to the effect that Mr. Gould wished witness to write and say he had misunderstood the message. This was some time in September of this year, as far as he could remember. No doubt Mr. Gould's view was that he (witness) had misunderstood the communication; but at the first communication the words "as a Bland burner" were not used. Otherwise he should not have written the letter to plaintiff the same morning.

Re-examined: He had never attempted to sell any burners as Blands except those obtained from the defendants.

Mr. *John Dargavell* said he was in the service of the Bland Light Syndicate as Chief Clerk from October, 1907, to April last. While with them, they purchased from Mr. Schmitz, in large quantities, burners which were sold as the Bland burner. To the best of his recollection, they stopped having burners from Schmitz about July, 1909. The one produced ["G.B.1"] was the class of burner they got; he thought it was identical. All the burners which came from Schmitz were stamped "Made in Germany," so far as he knew, and he looked at a good many. In August, 1909, he remembered the defendants buying about 5000 burners from Messrs. J. & W. B. Smith. He saw a good number of them arrive. They came in boxes; and he believed "Made in Germany" was on the boxes.

Cross-examined: His duties were not confined to copying and writing letters. Among other things, he had to superintend the despatch of goods; and he very often went into the warehouse and saw them packed. He was discharged by defendants, he thought because he was not well enough to attend to his duties. There was no other reason that he knew of. He was then asked if there was not another reason—viz., that he was short in his petty cash. This he objected to answer. He said he had been subpœnaed in the case and did not care who won or lost it; but he was not going into a discussion as to his own character.

His LORDSHIP ruled that the witness was not obliged to answer the question.

Cross-examination continued: About July, 1909, the defendants stopped having burners from Schmitz. He did not think it was correct to say that they stopped in February; he could only speak to the best of his recollection, which was that they had burners from nobody else until July, 1909. He knew the firm of Messrs. Thomas Glover and Co., Limited; but he could not say that from February to July, 1909, practically the whole of the burners came from them. The burners for the new season of 1909 were made by Messrs. Glover; but he did not think there were any brought into the place in the middle of the summer.

By his LORDSHIP: The Bland Syndicate never made any burners themselves while he was with them.

Mr. CLAUSON said the defendants never had been manufacturers; they always had the burners made for them.

Mr. *Baruch Cars*, the plaintiff, said he carried on business at 124 to 130, Tabernacle Street, Finsbury, as an importer of gas accessories and burners, and had been so engaged for twenty-five years. At the end of July, 1909, he had an interview with Mr. Schmitz, of Hamburg, in consequence of which he ordered a quantity of burners from him. At first samples were sent for, and subsequently orders went from week to week, fortnightly, or monthly, according to requirements; and the goods were delivered during the months of August, September, and October. Exhibit "G.B.1" was one of these burners; and the others were like it. They were of different colours; some were brass finish, some oxidized finish, and some steel finish. He proceeded to sell the burners in the English market immediately on receipt of the samples. Shortly afterwards he received the letter dated Sept. 2 from Messrs. Bromhead which had been read. He also received letters from Messrs. Gratrix and Co., and from the Horley Gas Company, and others. Some complaints came through travellers; and in certain instances they were made personally to himself. In the early part of December, Mr. Gould, the defendants' Manager, called at his office and said he might already have had a letter from Mr. Schmitz, informing him that the defendants had been appointed sole agents for the sale of the Schmitz burner. This agreed with a letter he had received from Mr. Schmitz. Mr. Gould then suggested that he should buy Schmitz burners through his firm. This he declined to do; saying he would not play second fiddle to them. If he bought Schmitz burners at all, he would buy them direct. Mr. Gould suggested that an interview should take place the following day between him, Mr. Bland, and Mr. Joseph Schmitz; but next morning a telephonic message came that Mr. Bland had been suddenly called away, and could not keep the appointment. The important trade in gas-burners was from September up to December. It settled down a little at Christmas, and then went on to March. Any interference with the trade in the autumn was most serious. He knew the burners the defendants had been selling, which they obtained from Mr. Schmitz; "G. B.4" was one of them. There were slight technical differences between this and the burners he was selling; but to all outward appearance they were the same goods.

Cross-examined: He had been getting the burners from Schmitz at the end of July, and went on giving weekly orders during August, September, October, and November. Roughly he had about 20 gross of various types of burners, differing in finish and also in shape and construction. There were about 500 like "G. B.1." Schmitz could not induce him to give a large stock order, because at the end of July he had already made arrangements for the coming season, and did not want to overbuy. The trade would develop, taking out a new pattern in August or September, as people saw it. After Dec. 1, Schmitz had made an arrangement the result of which was that he would not supply any more burners like "G. B.1;" in fact, he declined to supply witness with anything. He wrote saying that Mr. Bland had been in Hamburg, and he had entered into an arrangement with him. At that time there was part of an unexecuted order due, and he insisted on this being completed; and this was done. It was a quantity of various types of burners, perhaps, 1000; but he could not say how many like "G.B.1"—perhaps about 500 or 600. He could have sold many thousands of these burners but for the interference. At the interview with Mr. Gould, nothing was said about the defendants taking over any of the Schmitz burners he had on hand, and giving him a profit of 25 per cent. He should not have sold them to him. They could not push the sale of the burner during August until they had Mr. Schmitz's indemnity. At the interview with Mr. Gould, he said if he could not have Mr. Schmitz's burners he would get somebody else's made like them. He did not remember saying that much the best thing to do was to settle the matter amicably, and that Mr. Bland had better offer some amount to put an end to the whole thing; nor that he should require a considerable sum—it would not be a matter of hundreds. There was no question of any money payment at all. He recollected seeing the advertisement in the "JOURNAL OF GAS LIGHTING" in August, 1909; but he did not know what it referred to. He had heard Mr. Edgar's name, but not in connection with any action. With regard to the statement that "the Bland burner embodies points not known in any other burner," there was perhaps a point which was not in the burners he got. Since that time, he had examined the difference between the burner he was selling and the one they were now selling; but he had not compared the burners defendants were selling in August, 1909, with the Schmitz burner he was then trying to sell. After seeing the advertisement, he wrote to Mr. Schmitz on the 30th of August, drawing his attention to it, and making an inquiry as to patent rights. Mr. Schmitz replied on the 1st of September, saying that the firm of Bland could not do anything whatever; that any English patents on his behalf did not exist; that if they had any English patents of their own he (witness) could ascertain it for himself; and that he should be very glad to know the result of his inquiries. Mr. Schmitz concluded by saying he (witness) might go on quietly selling his burners, and need not be afraid of the defendants. The circular from Messrs. Bromhead, of the 2nd of September, was sent to him direct, and registered. When he got the letter, he understood that what the defendants desired to protect was a new burner made in England. He could not say it was something different from those he was getting from Schmitz; the only difference was that it was made in this country instead of abroad. He saw it in September, and found it was an English-made burner; but he did not notice any other differences. It was not correct to say the difference was that the Bland burner was of brass, while his was electro-brassed. His burner was brass. "G.B.1" was not iron oxidized, but brass oxidized. He could not tell what burner the defendants were selling in December, 1908. A burner made of iron electro-brassed was not necessarily inferior to one made of brass. Iron would stand wear and tear equally long, but might not have so good an appearance. The burners he got from Schmitz were sold to him as brass. He was able to sell them at a cheaper price than that at which the Bland Syndicate were selling theirs. Witness was then questioned as to certain details of the burners, and said he should think, from the appearance, the nipple in his burner was in two pieces. He did not consider there would be a tendency for it to work loose when heated; it might tighten. He could not say whether the nipple in the burner sold in September, 1909, was in one piece. It was important that the needle in the nipple should maintain a central position; and in the Bland burner, there was an adjustment to keep the needle central. Most burners of this type had needles; and invariably the needle came through in the centre. In his burner, the nozzle was not made of steatite, but of a mixture of clay and magnesia. He did not know that in the Bland burner it was made of electro hardened steatite. He was now selling the identical thing—burners with the same nozzle as the Bland. They were supplied by the same manufacturer. The nozzle in the Schmitz burner was not of the same material, and the shape was different; but the Bland burner he saw in September, 1909, was apparently identical with the one he was selling. He did not recollect examining the nipple or the details of construction; and he admitted there was a difference in the nozzle. When he received the letter from Gratrix, saying "we are still waiting your reply *re* 'as Bland,'" he took it to refer to his burner being a similar-looking article. He never heard the expression "as Bland" in conversation, and never used it himself. He supposed the phrase in the letter to Messrs. Gratrix "we understand from our representative in Manchester, after an interview with your Mr. Brooks, that a German firm is about to put, or has put, a burner on the market similar to our own," to refer to himself. He did not think it referred to Mr. Schmitz, because he was not putting it on the market. The burner was not stamped "Bland;" and it was not the Bland in that sense; but to all intents and purposes it was the same. The burner he was putting on the market was the same make, and to all outward appearance the same burner, but without the name; and it was made abroad. The regulators were made of solid metal with a centralized needle. He could not say whether there was a stuffing-box which was absolutely gas-tight. He tested the burners, but not up to 14 inches pressure. In October, he wrote to Mr. Schmitz, saying he could push the business a great deal more if he had the sole sale. But while his opponents could get all they required, he could not see his way to advertise in order to benefit them; and he therefore asked for the exclusive sale. Schmitz did not agree to this. He pushed the burner the same as any other article, but did not specialize it; and he continued to do so until Schmitz declined to send further supplies in December. The burners he had in hand were gradually sold.

Mr. CLAUSON said neither party wished to publish trade secrets, but he would ask witness to write down on paper the amount of 25 per cent. profit on 1000 of these burners, with a view to ascertaining the special damage he could claim.

Justice WARRINGTON said if the plaintiff made out his case he would be entitled to an inquiry.

Mr. BUCKMASTER suggested that such a figure would not be at all the measure of damages.

Witness said the figures could be arrived at more conveniently by turning to his catalogue, which could be put in evidence. Referring to this, he said the burners were sold to the ordinary trade at 22s. 6d. per dozen in polished brass finish, equal to 1s. 10½d. per burner.

Mr. CLAUSON suggested that calling 25 per cent. on that 6d., the profit on 1000 would be £25.

Re-examined: Before he had the interview with Schmitz in July, 1909, the defendants were, to his knowledge, selling extensively a gas-burner like "G.B.[4]." At this date he took Schmitz's burner to be the Bland burner—a Schmitz burner with the name "Bland" upon it. Schmitz supplied him with burners in three styles—brass, oxidized, and steel. There was no distinction apparent between the Schmitz brass and the defendants' brass burner. He had never attempted to sell them as Bland burners; but his customers all round seemed too timid to buy, fearing legal consequences. Witness concluded his evidence by putting in one of the brass-finished burners as supplied by Schmitz, which was marked "B.C.[1]."

Charles Brown, clerk to the Horley Gas Company, identified exhibit "R.S.T[1]," which he took to the plaintiff's Solicitors. He said it was put up, as far as he could remember, in November, 1908. He was present when Mr. Tobey received the telephonic communication. In September last, he (witness) had a similar communication with Mr. Gould, who said he wanted Mr. Tobey to write him to the effect that what he meant in his first communication was that Mr. Tobey was not to sell the Cars burner as a Bland burner. He also said that if Mr. Tobey would not do this he should simply get up in the witness-box and say he told him in the first place that it was not to be sold as the Bland burner.

Mr. Buckmaster said this was the plaintiff's case.

Mr. Clauson said he would call his evidence before addressing the Court.

[The first witness called was Mr. W. R. Francis, in the service of the Davis Gas-Stove Company, Limited, who in September last year were the agents in Manchester and the North of England for the Bland Light Syndicate. Following him came Mr. Charles W. Bland, the Managing-Director of the Syndicate, who was under cross-examination when the further hearing was adjourned till to-day. The defendants' case will be reported next week.]

A QUESTION OF DISCOUNT AT KIRKCALDY.

An action has been raised before Lord Dewar, in the Court of Session at Edinburgh, at the instance of the Kirkcaldy Gaslight Company, Limited, against the Provost, Magistrates, and Councillors of the Royal Burgh of Kirkcaldy, in which decree is asked for £233 18s. 5d., as balance due for gas supplied to the Corporation for the public lamps. The total charge for gas, at 3s. 2d. per 1000 cubic feet, amounted to £1336 14s. 5d.; but there is deducted 25 per cent. as discount upon £1133 8s. 1d., amounting to £283 7s., and there has been paid £819 9s.—leaving the sum sued for due as at May 31, 1909. The discount of 25 per cent. has been allowed in respect of street-lamps since 1867. Prior to the raising of the present action, an offer was made by pursuers to defenders to allow a discount of 10 per cent. on the consumption of gas in public buildings. The offer, however, was not accepted, and is now withdrawn.

In defence, it is stated that the pursuers possess no statutory powers authorizing them to lay or maintain mains in the streets; but that the defenders and their predecessors, as the local authority vested with the control of the streets, have permitted the pursuers to lay and maintain their gas-pipes in the streets. For many years past, and at least since 1867, the defenders have received from the pursuers an abatement of 25 per cent. on the price of gas supplied to them for lighting the streets of Kirkcaldy. Prior to this, the price was the same as that charged to other consumers. The abatement was granted in consideration of the facilities given to the pursuers in laying their pipes through the streets. In March, 1908, the pursuers introduced a sliding-scale of charges for the supply of gas, proportional to the consumers' consumption, to take effect after the May, 1908, survey. Under this sliding-scale, consumers of 5 million cubic feet and upwards annually are entitled to a discount of 17½ per cent. The defenders' total consumption in each of the years in question exceeded 5 million cubic feet; and they accordingly became entitled to a discount of 17½ per cent. over and above the abatement of 25 per cent. on the price of gas supplied for street lighting purposes. The sum sued for represents this discount of 17½ per cent. The defenders go on to say that on Feb. 19, 1910, a concluded agreement was entered into between the pursuers and the defenders in pursuance of the Burghs Gas Supply (Scotland) Act, 1876, whereby the defenders agreed to purchase from the pursuers their entire undertaking. The purchase included all outstanding accounts, and in particular the account now sued for. From the date of the purchase, the undertaking was carried on by the pursuers on behalf of the defenders, pending the ascertainment of the price by arbitration and the payment of it.

In reply, the pursuers say that, in terms of the Act of 1876, the defenders will not become vested in the undertaking until a conveyance has been delivered to them and until the consideration has been fixed and paid over to the pursuers. Until the date of vesting, the pursuers are entitled to continue manufacturing and selling gas. The purchase by the defenders does not include any outstanding accounts, and in particular does not include the account sued for, which was due at May 31, 1909. They admit that in March, 1908, the pursuers issued a circular intimating that they intended to give certain discounts to large private consumers. A copy of this circular was, *per incuriam*, addressed to the Town Clerk. The circular, *ex facie*, does not apply to the defenders, but only to private consumers. The defenders, who are not private consumers, had already a separate arrangement for a discount of 25 per cent. for street-lamps. The defenders are not entitled to the discounts offered to large consumers, either on the account for public lighting or on their general account.

The case is on the roll for discussion as to the relevancy, but has not yet been reached.

The Pateley Bridge Gas, Coal, and Coke Company, Limited, has been registered with a capital of £5000, in £1 shares.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

In the course of their report, to be submitted at the meeting of proprietors on the 6th prox., the Directors of the Continental Union Gas Company give the following information as to affairs at their various stations.

Owing to negotiations now in progress, the Directors are unable at the present moment to make any statement with reference to Messina. They hope, however, to be in a position to do so at the meeting.

During the year under review, the Union des Gaz secured the concession for the lighting of Pont Evêque, a suburb of Vienne; and, since June, that of Eckbolsheim, near Strasburg.

In spite of the strike last autumn at the Italian stations, which lasted nearly the whole of November, the increase in the gas sales for the year was 1⅗ per cent. The private consumers have increased by 14,522—making a total of 272,903; and the public lamps have increased by 259. The length of mains has been increased by 46 miles—making a total of 1227 miles. The amount charged to capital account was £90,292.

The Union des Gaz reduced its dividend from 9 to 7½ per cent., and carried forward £14,556, as against £13,358 last year. This reduction in the dividend is due to the serious decrease in the selling price of coke owing to the mildness of the winter, to the very heavy expenses of the strike in Italy, and to the losses caused by the floods in France, which affected more particularly that Company's works at Nanterre.

As regards the Continental Union Company's accounts, the effect of the fall in the Union des Gaz dividend has been to lessen the Continental Union Company's revenue from this source by about £12,000. Also the pensions, which the Company has to pay under the agreement with its former employees at Messina, are now charged directly against revenue; and a further sum of £10,000 has been written off the Messina outlay account.

The net profit available for distribution is £56,966, from which the Directors recommend a dividend for the year of 7 per cent. on the preference stock, less income-tax, and of 4 per cent. on the ordinary stock, free of income-tax, carrying forward £11,783 to the new account, as against £12,954 last year.

The Directors deplore the death, which occurred last April, of their esteemed colleague Mr. Frederick Tendron, who for twenty-two years was a member of the Board. Colonel H. Le Roy-Lewis, D.S.O., who is associated with other important gas undertakings, has been elected to succeed him.

ORIENTAL GAS COMPANY, LIMITED.

The New Lighting Contract—Works and Distribution Plant Modernization and Extension—Retirement of Mr. R. Hesketh Jones.

The Ordinary General Meeting of the Company was held last Wednesday, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. H. D. Ellis in the chair.

The Secretary (Mr. H. J. Luff) read the notice calling the meeting; and the Directors' report and the accounts were taken as read.

The Chairman, in moving their adoption, said he would first draw attention to a few of the salient items in the accounts. Taking the credit side of the revenue account, it would be seen that the gas-rental had produced about £1350 more than in the previous year. This was always a gratifying feature. In the matter of the residual products, tar had been very good; and they had nothing of which to complain in respect of it. But unfortunately the coke market had been very weak indeed. Coke, as the proprietors were doubtless aware, was one of the most difficult factors with which a gas manager had to deal. Sometimes it was a good friend; sometimes it was not. This time it had been very bad. Unfortunately, as the make of coke was incidental and corollary to the make of gas, it followed that so long as the demand for gas continued, so long must the manager make coke, whether or not the market wanted it; and he was quite powerless to control the market. But they were seeking for fresh outlets and new markets for coke; and he was not without hope that they might be successful. In the result, setting the increased gas-rental and the additional receipt for tar against the loss from coke, the aggregate revenue (£97,745) was within £8 of what it was last year. The first item on the expenditure side of the account was "coals, purification, and wages, £32,723." This item exhibited what they might call the normal increase that they expected from the increased make of gas. Salaries in India and London (£3470) also presented an increase for which they were prepared. As the proprietors were told last year, to meet the greater requirements of the future contract, the Directors had sent out an able distributing engineer, with an assistant, for the purpose of taking charge in that department; and their salaries appeared in this item. Passing over the items of Directors' and Auditors' fees and Indian income-tax, the next two items were the largest, next to the manufacturing expenses, in the account. They were "mains, meters, services, and fittings, £22,213;" and "wear and tear of works, £10,052." But into these he would not go now, as there would be something more to say when he treated of the operations of the year. He might say here, however, that the money had been thoughtfully and judiciously expended; and the Board were confident it would bear good fruit in due season. The result of the trading was that they had a balance of £23,396; and this was carried down to the profit and loss account, and added to the sum of £9916 brought forward from the previous year. The dividends on investments amounted to £2291, and interest and discounts came to £154. These various amounts produced an aggregate sum of £35,758. On the opposite side of the account, it would be seen that they took out of this sum £10,500 on account of the dividend distributed last May. Income-tax amounting to £2097 had been paid;

and there was the small amount of £29 for loss on sale of investments. The result was there was in hand £23,132. This enabled the Board to offer the proprietors the full balance of their usual 8 per cent. dividend, and left them in the pleasing position of having £9632 to carry forward to the current year. The Directors had felt much satisfaction in being able to present these accounts; and he hoped they would be received by the proprietors with equal satisfaction.

Turning now to the report, the Directors mentioned that, in order to meet the greater requirements of the Corporation under the new contract, and the prospective demands of consumers, they had had to expend a large sum of money. The French had a number of witty and epigrammatic sayings; and one of them was that "appetite comes with eating" What was true of food was also true of light to a great extent. The more light and the better light they gave the public, the more light and the better light would the public demand. The very best advertisement of gas was itself. They had been for some time past exhibiting to the Council and the public of Calcutta what could be done by Lucas and other high-power lamps in the way of improved illumination; and he had no doubt that many of the Councillors of Calcutta had seen in London and other capitals of Europe the amazing potentialities of gas as an illuminant. This no doubt had whetted their appetites for more and better gas lighting. They made these requirements; and the Company were ready to agree to them upon commercial terms. The Directors said: "We can do all this; but it will involve the outlay of a large sum of money, and it is only equitable we should have such a term of years as will enable us to recoup our outlay, and to enjoy the fruition of all the money we shall have planted in your soil." The Corporation were most business-like men, and were, moreover, advised by officers of high ability, and they readily consented to give the Company the term of 20 years. The only condition remaining to be satisfied was the consent of the Bengal Government. This having been obtained since the proprietors last met, the Directors and their officers went ahead at full speed with the necessary plant alterations. The most urgent matter was the overhauling, improvement, and increasing of the mains, because they were bound under this contract to give a much greater pressure of gas. Up to June 30—the date at which their financial year ended—they had laid more than 30 miles of trunk mains. Calcutta was a huge city. In point of population, it was the second in the whole of the British Empire—second only to London itself. Therefore the proprietors would readily grasp that the mileage of mains must be something very extensive indeed. Roughly speaking, Calcutta was a parallelogram. It was a long city which in length, running from North to South, was about four times the width, East to West. The largest works—the Sealdah works—were on the eastern boundary, and about midway between the northern and southern borders. From these works they proceeded to lay a trunk main to the north and one to the south. Then from the centre out westward, and traversing nearly the whole width of the city, they laid a 14-inch high-pressure steel main in two branches forking out from the works. This was for the purpose of feeding the subsidiary mains. It would be obvious that by these trunk and high-pressure mains, they had made an enormous addition to their distributing power—as a matter of fact, their power for supplying the city had been multiplied manyfold.

While this work was going on, they were also altering and relaying the existing mains, and in many places substituting mains of larger diameter. They were also overhauling their plant inside the works. They were practically converting old scrubbers into new, resheeting (where necessary) their second largest holder, in the course of the year between 400 and 500 extra lamps were erected, and they opened a depôt for the distribution department which had been doing excellent work. All this change was going on at the same time that the entirely new work was being executed. With regard to the Company's smaller station at Howrah, which was across the river, they had had it entirely overhauled; and Mr. Watson, their General Manager, had reported that, when the operations he had in hand were completed, these works would be fully on modern lines. Going back to the Sealdah works, large improvements had been made in the purifying plant. From this country a new rotary washer-scrubber was sent, and a "Cyclone" tar-separator, and they were now erecting a powerful new condenser. The result was that they were practically increasing the capacity of the works in these respects by 50 per cent. at least—probably more. He saw his friend, Mr. Stanley Jones, nodding his head. [Mr. JONES: It has doubled the capacity I should think.] In addition, in order to measure the large amount of gas they were preparing to distribute in response to the demands of Calcutta, they had sent out a new rotary station meter. They had further resolved—and this was a most important point—largely to increase the manufacturing power in the matter of retorts by installing regenerative settings in No. 1 house, with all the latest improvements, and charged and discharged by the most up-to-date stoking machinery. Then as from time to time the existing retorts required renewing, they would be replaced by similar regenerative settings. These were indeed large operations. The Board had considered them very carefully, and were confident that their policy was correct, and that they were placing the Company in a position of very great strength. It had involved expenditure, and was still involving expenditure. But the money had been thoroughly well laid out; and they would reap the advantage of it. The works were not completed yet; and busy and interesting as the financial year 1909-10 had been, he thought that the current year 1910-11 would be as full of life and action as its predecessor.

The Directors look to a bright prospect in the Company's future. He did not think it was too much to say the present was an epoch in the history of the undertaking. They were about to embark on a new career, with an undertaking rejuvenated with the strength of youth combined with the experience of age. They would be equipped for their campaign in a manner and upon a scale which, in his opinion, had never been equalled in any period of the Company's existence. Thanks to the wise and prudent policy that the Board had adopted for some years past, of husbanding their resources and of accumulating in reserve a portion of the annual profits, this strong position would be attained without calling upon the proprietors to provide a single penny of additional capital.

A further paragraph in the report mentioned the reduction of the price of gas by ½ rupee. They were not only reducing the price to the ordinary consumer, but they were going to do all in their power to encourage the use of gas for purposes other than illumination, and to give special rates to trading concerns who would use gas for industrial purposes and power during daylight hours.

The proprietors would have missed from the chair the patriarchal figure of Mr. R. Hesketh Jones, who, though an octogenarian, was so hale and hearty that they had thought they could confidently look forward to him being with them for, at all events, some time more. But last Easter, while crossing a street in Paris, he was struck down by a recklessly driven vehicle. The accident (if that was the right term to apply to it) might easily have been fatal to a younger man. Happily no bones were broken; but it caused a very severe wound. Thanks to his fine vitality, Mr. Jones was able to make an entire recovery. But he felt that he had in some measure sustained a shock, and that it was only prudent for him to relieve himself of a portion of his public work. The chairmanship of the Company being, as he (Mr. Ellis) believed, the most onerous of his duties, he tendered his resignation. The Board felt that Mr. Jones was the best judge of his own feelings in the matter; and they could not doubt it would be wise for him to retire then, and not to keep on with the possibility of breaking down entirely. Mr. Jones was a most active and zealous Director; he took the greatest interest in all that concerned the Company, and never grudged any amount of time or trouble in doing all in his power to promote its interests. He gave the Company of his best.

Under these circumstances, it devolved upon the Directors to seek a successor to fill the vacancy on the Board; and unanimously they came to the conclusion that they would invite Mr. Stanley Hunter Jones, M.Inst.C.E., to accept the vacant seat. Mr. Stanley Jones, who was known throughout the kingdom among members of the gas industry (and who was a namesake, but not a relative, of Mr. Hesketh Jones), held the appointment of Engineer of the Commercial Gas Company—a most important post, the duties of which he discharged with conspicuous ability. His father and his grandfather before him were also most distinguished Engineers; and he (the Chairman) thought he might fairly say that Mr. Jones possessed an inherited aptitude for gas affairs. The Directors felt it would be to the interests of the Company that they should have sitting with them on the Board a gentleman possessing a thorough practical acquaintance with all the inner details of gas manufacture; and he was happy to say Mr. Stanley Jones accepted their invitation. He (the Chairman) was sure his colleagues would wish him to say this, that during the few months Mr. Jones had been with them they had had an abundant opportunity of convincing themselves of the wisdom of their choice.

Mr. A. T. EASTMAN seconded the motion.

Mr. E CLARK remarked that the proprietors could not allow the retirement from the chair of a gentleman so respected as was their friend Mr. Hesketh Jones (knowing, too, his valuable services during the many years he had been connected with the Company) without comment. He hoped that Mr. Jones would have many years of rest and quietness in store for him. The Board, too, had been wise in selecting as their representative in the chair a man like Mr. Ellis who had aptitude, knowledge, and capacity for directing the affairs of such a Company as this. Regarding the reduction in the price of gas, it would be interesting to know the present price per 1000 cubic feet. He hoped the time was not far distant when the 8 per cent. dividend would be increased to 9, and even 10 per cent.

The CHAIRMAN, in reply, said the present price of gas was Rs. 5, so that the reduction was equal to 10 per cent. He was not going to forecast, but he sincerely hoped that the Rs. 4½ did not represent finality. An increase of the dividend was a matter upon which he could give no undertaking at all. He was himself, as a shareholder, in sympathy with Mr. Clark. If, however, they had distributed 10 per cent. instead of 8 per cent., the proprietors would now have had to dip their hands, and rather deeply, into their pockets, in order to provide the money to carry out the new contract, which gave them a new existence.

Moved by Mr. EASTMAN, and seconded by Mr. W. WILLIAMS, a dividend of 4½ per cent. (making with the interim dividend paid in May a total dividend for the year of 8 per cent.) was declared, free of income-tax.

The CHAIRMAN proposed the confirmation of the election of Mr. Stanley Jones as a Director.

Mr. EASTMAN, in seconding, endorsed the eulogistic terms in which Mr. Ellis had referred to the qualifications of Mr. Jones, and spoke of the advantage of having a technical expert on the Board.

The motion was heartily passed.

Mr. JONES having made acknowledgment,

Mr. WILLIAMS moved, and Mr. EASTMAN seconded, the re-election of Mr. Ellis to his seat at the Board; and thereafter Mr. Williams was also re-elected, on the proposition of the CHAIRMAN, seconded by Mr. STANLEY JONES.

Moved by Mr. B. W. ELLIS, and seconded by Mr. R. B. FITZMAURICE, the Auditors (Messrs. S. W. Savage and F. Seel) were re-appointed.

Mr. SEEL, in thanking the proprietors on behalf of himself and colleague, said he thought it was most satisfactory that, notwithstanding the immense sums spent in the improvement of the works, not a single penny had been added to the capital account or to the value of the works in the balance-sheet. The shareholders in a company that could stand such a strain as this, and not have to add sixpence to capital, might look forward to long years of prosperity.

The CHAIRMAN said he was sure they all had a sense of the obligation they were under to the excellent staff who worked for them in India under all the heat and stress of so distressful a climate. They had a large number of faithful officers who were working well for them. First and foremost he must put their General Manager (Mr. James C. Watson), who had been with them fourteen years, during the last seven of which he had been General Manager. The position of Manager out there was a highly responsible one. He was the sole representative of the Company. There was no power at hand for him to fall back upon. His duties were multifarious, and demanded a great many qualifications, technical knowledge, business aptitude, tact, and discretion. He (the Chairman) thought he might say for their Manager that he was not

wanting in these qualifications, and he did the work to their great satisfaction. Mr. Watson, for some time previous to the ratification of the contract by the Government, had a great deal of extra work put upon him; and he felt he required a little rest here in England. He came home last summer; and the Directors were very glad to see him. The opportunity of meeting and discussing with him points of policy and administration was of great value to them; and such opportunities should not be too infrequent. Mr. Watson arrived back in Calcutta last week; and he (the Chairman) hoped he had resumed his duties reinvigorated by his visit home. Mr. Barber took charge in his absence; and he had one of those opportunities which were so advantageous to a junior officer of acquiring insight in the high duties of management. Mr. Snelgrove, their Distributing Engineer, had done thorough good service during the year that had elapsed since he went out there. Mr. Watson, his chief officer, spoke of him in the highest terms of commendation; as also of Mr. Hurst, Mr. Park, and Mr. Bone. They had also a number of Indian gentlemen on their clerical staff, who were doing careful service; and he should like the thanks of the proprietors to go out to them. At home they had Mr. Luff—the same active, zealous, painstaking Secretary they had known for years past. He also desired to mention Mr. Rainer, their book-keeper, who kept the accounts in a manner that met with the entire approbation of the Auditors.

Mr. Stanley Jones, in seconding, said he had had the pleasure of meeting Mr. Watson since his (the speaker's) election as a Director, and had had an opportunity of forming an opinion of him. He felt he was a good man, who did his work well.

The motion was cordially carried.

Mr. Luff responded on behalf of himself and his fellow-officers.

On the motion of Mr. Clark, seconded by Mr. Louis Penny, a hearty vote of thanks was passed to the Chairman and Directors.

The Chairman's acknowledgment concluded the proceedings, which, under the unusual and interesting circumstances, had been protracted much beyond the usual length.

GAS CHARGES IN SALFORD.

The Position of Prepayment Meter Users.

A Special Meeting of the Salford Town Council will be held to-morrow, when two resolutions relating to gas charges will be considered. One is as follows: "That, in view of the strong feeling prevalent in the borough against the reduction of the quantity of gas allowed for 1d. by prepayment meter—viz., from 30 to 27 cubic feet—so much of the resolution passed by the Council on June 22, 1910, as relates to the supply of gas by prepayment meter be, and the same is, hereby rescinded, and that the Gas Committee be instructed to revert to the supply of 30 cubic feet of gas for 1d. by prepayment meter." The other resolution aims at the same object, but with the addition that the concession granted to large consumers of gas by the resolution of June be also rescinded. When the Council last met, a long and acrimonious discussion took place on these subjects, and finally they were referred to a special meeting. It is argued by supporters of the resolutions that the reduction in the quantity of gas supplied to slot-meter users is a great injustice to the poorer class of citizens, and casts a burden upon those who are least able to bear it.

Mr. Johnson, in whose name one of the resolutions stands, says that there are in all 28,912 prepayment meters in use by consumers under the Corporation; and he argues that, even supposing a large number of the people using these meters could afford to have a quarterly account, there must be, at a very low estimate, 15,000 who are so poor that they cannot afford this reduction in the quantity of gas given for 1d. A reduction of 3 cubic feet of gas was equal to a reduction of 10 per cent.; and the amount the Gas Department expected to get from the change was between £3000 and £4000. This means that the Corporation would take this amount of money out of the pockets of poor people, and put it into those of people better able to bear the burden.

On behalf of the Gas Committee, it is pointed out that, owing to the demands made upon the Gas Department in the way of contributions in aid of rates, and the increased cost of coal, some means had to be devised for augmenting the revenue. Rather than raise the price of gas, the Council at their June meeting agreed to a re-imposition of the meter-rents (since rescinded), a reduction by 3 cubic feet in the quantity of gas supplied for 1d. to prepayment meter users, and an alteration in the charges to large consumers, with a view to an increased consumption of gas in mills and works and for power purposes.

FATALITY AT THE FULHAM GAS-WORKS.

A Defective Joint in a Handrail.

At the Horseferry Road Mortuary, Westminster, last Friday, Mr. J. Troutbeck, the Coroner for Westminster, held an inquiry relative to the death of Richard Thomas Grant (38), a labourer employed at the Fulham station of the Gaslight and Coke Company.

Mr. W. C. Beasley Robinson (Messrs. Monier-Williams, Robinson, and Milroy) appeared for the Company; Mr. C. A. Tackley, Solicitor, attended on behalf of the widow; and Mr. L. Ward, one of His Majesty's Inspectors of Factories, represented the Home Office.

Percival Larkin, a coal porter at the Fulham works, said he was outside the retort-house on Monday, the 14th inst., just after seven o'clock. He was on the permanent staging where the stokers draw the retorts. The deceased was looking after a coal-conveyor. He (witness) was coming out with a waggon of coal, when one of the workmen called out that the deceased had fallen over the handrail. He went down the stairs, and found Grant lying unconscious on some bricks. He had fallen from the platform, which was about 37 feet above. The hand

rail was made of tubing; and he had never seen anything defective in it until the fall, when he saw the rail projecting.

Mr. *A. C. M'Minn*, the Assistant-Engineer at the Fulham station, said Grant's duties were to look after the coal-conveyor, lubricate the chain, and regulate the slide underneath, to allow the coal to fall into the hoppers. After the deceased had been taken to the hospital, he (witness) went on the stage and examined the rail, but could not find anything to account for the accident. [The witness produced a plan of the place.] The stage was about 2 ft. 6 in. wide, made of iron plates supported on girders. There were two iron tubular handrails, $1\frac{1}{4}$ inches diameter. The lower one was 2 feet and the upper one 3 ft. 6 in. from the stage. He found the end length of tubing had come away from one of the socket joints, and was hanging downwards. A coat was found on the projecting end of the rail. The sockets were 2 inches long, and the tube should be screwed up, which would give them $\frac{3}{8}$-inch bearing. He had no definite opinion as to the cause of the accident, though it might be explained in two or three different ways. The plant was quite new—having been up less than two years. There might be only a couple of threads on the socket, and the conveyor working within 10 feet of the rail would cause a good deal of vibration, and this might have caused the socket to give way. On the other hand, it might be that there was only a small amount of thread in when the job was finished. The deceased might have been sitting on the coat, or leaning on the rail, causing some strain which would have broken the thread away; but a steel handrail $1\frac{1}{4}$ inches diameter with $\frac{3}{8}$-inch bearing ought to stand the weight of a man sitting on it. It was put up by Messrs. Clayton, Son, and Co. two years ago. The Inspecting Engineer of the Gas Company (Mr. Spencer) had inspected it at the time. There was no fracture.

By Mr. Tackley: The Company had no particular man to inspect the plant from time to time. If the men found fault with anything, they reported it, and it was attended to immediately. Since the accident, no repairs had been carried out; but the foreman had been round to see that the joints were all right.

By Mr. Robinson: The sockets could not be tested after they were screwed on tight without undoing every piece of tubing, and doing it up again.

By the Inspector: If the joint had been properly made, it should have had a $\frac{3}{8}$-inch bearing in the socket; and he considered that then nothing but vibration could have caused the accident. He did not think there was a $\frac{3}{8}$-inch joint there. In his opinion, the accident could not have happened if the joint had been properly made. The next joint might have been loose. If there had been no loose joints, of course the pipes could not have moved longitudinally along the length of the run. If the vibration had been going on for two hours, it might have loosened the joint; but he thought it very unlikely that a socket would go back $\frac{3}{8}$ inch, even with vibration.

By Mr. Robinson: Assuming the joint was defective originally, there would be no means of seeing it from the outside; and unless it was taken to pieces, there would be nothing to show it was defective.

William Henry Grant, the uncle of the deceased, said he took him to the hospital, and asked him on the way how he fell—whether on his feet, back, or hands—and he replied, "To tell you the truth, I remember nothing, only the handrail giving way."

Dr. *W. P. Atkinson*, House Surgeon at St. George's Hospital, said that death was due to hæmorrhage and a broken back.

The Coroner, in addressing the Jury, said it seemed to be quite certain that one of the ends of the top rail came out as deceased was either sitting on or leaning against it. It was not suggested he was doing anything improper, or subjecting the rail to a strain it was not meant to bear. From the evidence of the Assistant-Engineer, it became apparent that there was no reasonable suggestion for the accident, except that originally the joint must have been improperly made, and that it would be practically impossible to discover this unless the whole of the railing was taken to pieces. The Gas Company seemed to have inspected the rail in the ordinary way before it was put up; and he did not see that they could do more. There was nothing to suggest anything of a criminal nature in the way it was made; the period was far too remote. At the same time, he thought it should be emphasized that scamped work might have serious consequences.

The Jury, having briefly conferred, returned a verdict of "Accidental death;" adding as a rider: "We think that the Gas Company ought to have had this work inspected at some time or other. It is rather negligent on their part in not having the work tested at all."

The Coroner: I suppose you heard the evidence that the work was inspected by the Company before it was put up.

The Foreman: That was a long time ago.

The Coroner: It has only been up a year-and-a-half.

The Foreman: That is quite long enough. We think it ought to have been inspected and tested before.

Mr. Robinson: There is no evidence that inspection would show this flaw.

The Coroner: No. I think that is clear. The rider is, of course, obviously open to these criticisms.

PROGRESS OF VIENNA MUNICIPAL GAS UNDERTAKING.

The "Zeitschrift des Vereines der Gas und Wasserfächmanner in Oesterreich Ungarn" of the 1st inst. continued its review of the progress of the Vienna Municipal Gas Undertaking from the point to which it was taken in former articles, of which an abstract was given in the "Journal" for Oct. 25, p. 270. The following particulars are taken from the last article.

When the new municipal gas-works commenced supply in the year 1900, the productive capacity of the retort-house was 15,185,880 cubic feet per twenty-four hours, corresponding to an output of about 3040 million cubic feet per annum. By the year 1903, the annual output

from the works was slightly in excess of this quantity; and the retort-house plant was extended in order to bring its total productive capacity up to 17,658,000 cubic feet a day, while a water-gas plant of 3,531,600 cubic feet per diem productive capacity was also installed. These extensions of the manufacturing plant were brought into use November, 1904. Further extensions, however, soon became necessary; and in 1908 an installation of inclined carbonizing chambers of 1,236,060 cubic feet per diem capacity was erected, and the water-gas plant was extended so as to raise its total productive capacity to 6,180,300 cubic feet per twenty-four hours. Extensions of the rest of the works' plant and apparatus to correspond with the increased output of the retort-house and water-gas plant were made at the same time. The following year, the installation of carbonizing chambers was enlarged by the addition of 19 chambers, making the total 34, with a daily productive capacity of 2,825,280 cubic feet. At the close of next year, the area supplied by the Municipality will be considerably extended by the addition of the remaining nine districts of the City which hitherto have been supplied by the Austrian Gaslight Company and the Imperial Continental Gas Association. In order to meet this increase, further extensions are being made at the municipal gas-works at Simmering; while a new works is being erected at Leopoldau.

The total make of gas at the municipal works in the year 1900 was about 2759 million cubic feet. In ten years, this had increased by 46 per cent.; the make last year being 4,026,785,000 cubic feet. The maximum quantity of gas delivered in any one day in the year 1900 was 14,161,716 cubic feet; while the corresponding maximum quantity last year was 20,745,678 cubic feet. The average consumption of gas per head of the population has risen by 18 per cent. in the ten years. A change which was made in the method of charging in the middle of the year 1907 has had a great effect in increasing the sale of gas. Up to that time, differential rates prevailed—viz., 4s. 6d. per 1000 cubic feet for gas sold for lighting purposes, and 3s. 4d. for that sold for heating or industrial use. From that time, however, a uniform price of 4s. per 1000 cubic feet has been charged for gas for whatever purpose it was used. A considerable portion of the increase in recent years has, however, been due to the introduction of prepayment meters, of which there were only 451 in use in the year 1905, through which only 791,467 cubic feet of gas were sold. Last year, the number of prepayment meters in use was 16,098; and the quantity of gas sold through them amounted to 121,162,000 cubic feet. The working of the gas undertaking is represented as having been extremely profitable to the Municipality of Vienna, since, during the ten years, a sum of about £961,265 has been applied to the relief of rates, while no charge has been made for gas supplied for public lighting.

Reduction in Price at Ipswich.—The Ipswich Gas Company announce that, as from the end of the present year, the price of gas will be reduced from 2s. 6d. to 2s. 4d. per 1000 cubic feet. This concession is considered to be equivalent to a present of between £3000 and £4000 a year to the consumers.

MUNICH GAS-WORKS.

Report for the Year 1909.

The report of the working of the Corporation Gas-Works of Munich for last year contains some interesting particulars, especially in regard to the new gas-works in the Dachauerstrasse, and the work done by the Munich type of large carbonizing chambers.

The consumption of gas in the year amounted to 33,299,690 cubic metres (about 1,183,055,000 cubic feet), which is an increase of 6·88 per cent. on that for the preceding year. The gas sold specifically for lighting, however, showed a falling off of 1·91 per cent.; the proportion of the total consumption being 31·95 per cent. This does not include gas used for lighting when sold through prepayment meters, which, if included, would raise the proportion of gas used for lighting to about 42 per cent. of the total output. The consumption for public lighting increased by 4·7 per cent. compared with the previous year, and amounted to 8·48 per cent. of the total output. There was a diminution in the amount of gas sold for power purposes; the proportion now being only 1·31 per cent. of the total quantity of gas sold. On the other hand, the gas sold specifically for cooking and heating purposes showed an increase of 16·53 per cent. over the preceding year. The consumption for this purpose now amounts to 47·1 per cent. of the total output. The gas sold through prepayment meters was 6·22 per cent. of the total amount supplied.

The coal carbonized was mostly obtained from the Saar district, but some was derived from the Ruhr, Austrian-Silesia, Bohemia, and Upper Silesia. Coke sold badly on account of the exceptionally warm weather; while the prices of tar and ammonia were lower, and the value of cyanogen fell so much that spent oxide became unsaleable. The make of gas for the year was distributed between the three works in the following percentages of the total make: Thalkirchnerstrasse, 8·27 per cent.; Dachauerstrasse, 23·62 per cent.; Kirchstein, 68·11 per cent. The old gas-works in the Thalkirchnerstrasse were given up after sixty years' use as a manufacturing station on June 1, 1909, and the new works at the Dachauerstrasse, where the carbonizing plant is entirely large chambers, were brought into use. The ratio of the maximum daily output of gas to the total annual output was as 1 : 231·3. The total consumption per head of population was 2073 cubic feet. When the plant at the Thalkirchnerstrasse works was thrown out of action preparatory to being dismantled, it was filled with flue gas, which was drawn in through holes made in the retorts in a few of the settings in which the furnace fires had been kept up. The blowing through of the old plant in this manner by flue gas avoided any danger of explosion from accumulations of coal gas when the plant was opened up.

The five chamber settings at the Kirchstein works which were brought into use on Oct. 6, 1906, continued in use throughout the year. At the time of maximum make, 350 retorts were also in action at this works. The new works in the Dachauerstrasse started work on

April 23, 1909. The carbonizing plant comprised at first six settings of inclined chambers, and a second bench of similar chambers was partially brought into action towards the close of the year. At this works, the number of charges of the chambers amounted to 4197, and the make of gas per ton of coal carbonized was 12,455 cubic feet. The coke consumed in the furnaces amounted to 12·63 per cent. by weight of the coal carbonized. On the other hand, the retorts at the old works in the Thalkirchnerstrasse gave a make of 11,830 cubic feet per ton of coal with a fuel consumption of 12·90 per cent. The mixed working of chambers and retorts at the Kirchstein works gave a make per ton of coal of 11,816 cubic feet; and the fuel consumption was 15·96 per cent., which is comparatively high, owing to the fuel used in keeping empty settings under fire as a stand-by being included. In addition to 100,395 metric tons of coal carbonized, 33·724 tons of benzol were used in the manufacture of gas. The production of ammoniacal liquor was greater than in previous years, and the yield of ammonia amounted to 0·1776 per cent. of the weight of coal carbonized, which is considerably higher than in any previous year. [It is not stated whether this increase is due to the increasing use of large chambers in place of retorts.] The average specific gravity of the gas was 0·4225, and its average illuminating power, when consumed in a batswing burner at the rate of 5·3 cubic feet per hour, was 11·71 hefners (10·65 candles). It is stated that the results at the new Dachauerstrasse works, both as to the quality of the gas and the bye-products, completely fulfil expectations.

After providing for interest and depreciation charges, a net profit of 1,409,544·63 marks (£69,095 6s.) has been realized on the year's working, as compared with 1,411,463·11 marks the previous year.

Charges for Prepayment Gas Supplies in Belfast.—At a recent meeting of the Gas Committee of the Belfast Corporation, the Gas Engineer and Manager (Mr. J. D. Smith) reported as follows: "With reference to the price charged for gas supplied through automatic as compared with ordinary meters, I have examined the rates charged by twenty of the largest towns in England, Ireland, and Scotland, and find that they vary greatly. In only six cases is the difference between the ordinary and slot price smaller than in Belfast, and then but to a small extent. If we leave out Sheffield and Widnes, which have the cheapest gas in the kingdom, owing to being situated in the heart of the coalfields, I think Belfast has a lower price both for ordinary and prepayment than any town in the country. Birmingham charges 1s. 9d. to 2s. 3d. for ordinary and 2s. 6d. to 3s. for automatic consumers—a difference of 10d. per 1000 cubic feet; whereas in Belfast it is only 7d. In the great proportion of cases, the same ratio is noticeable. For instance, the difference between ordinary and prepayment charges is 4d. in two towns, 5d. in two, 6d. in two, 7d. in one town, 8d. in three towns, 9d. in three, 10d. in four, 1s. in one town, 1s. 2d. in one, and 1s. 4d. in one. If we look at the number of feet supplied for 1d. (leaving Widnes out of consideration), Belfast heads the list. We give 35 cubic feet for 1d.; eight towns give 30 to 34 cubic feet, and eleven 20 to 29 cubic feet."

LIVERPOOL CORPORATION WATER SUPPLY.

Additional Works to be Undertaken.

The Water Committee of the Liverpool Corporation held their first meeting for the municipal year last Tuesday, when Colonel Porter was re-elected Chairman and Major Denton Deputy Chairman.

After thanking the Committee for their confidence, Colonel Porter said there were several new works and works of a special character which would have to be carried out or commenced during the ensuing year. On the Vyrnwy aqueduct, they had to construct the balancing reservoir at Malpas, which formed part of the second pipe-line, the cost of which was included in estimates already approved by the Council. More filtering-beds were required at Oswestry, as the existing beds only barely sufficed for the requirements of last year; and one or more beds must be added to satisfy the needs of the increasing population. They had also to meet an obligation lately imposed upon them by Parliament of erecting a high-level tank on Woolton Hill. Plans of a new tower would shortly be submitted to the Committee. Another high-level extension was required at Prescot, where the demands were increasing. An extension of mains was also wanted for the improved supply of the Garston district. In addition to this, a new line of pipes, several miles in length, would soon be required to carry a larger volume of water from Vyrnwy aqueduct to the southern part of the city. This new pipe-line would terminate at the service reservoir to be built on land acquired for the purpose at Woolton. A subject which had recently occupied the attention of the Committee, and was likely to call for still more consideration in the future, was that of the rateable value of the undertaking. Both at Vyrnwy and Rivington, attempts were being made to raise the assessments of the reservoirs and gathering-grounds; and these must be strenuously resisted. Already they were paying about £40,000 a year in rates and taxes; and there was a persistent upward tendency in this direction which seriously affected their expenditure. Before the end of the year, a question would probably arise as to matters that the Committee might wish to have included in any "omnibus" Bill the Council might decide to promote in the session of 1912. One of the most important of these would be the adjustment of the capital expenditure on the Vyrnwy scheme. The total amount the Corporation were authorized to spend under the Act of 1880 was £3,250,000. Owing to the cost of the Vyrnwy dam having exceeded the original estimates, the total expenditure up to the present had amounted to £2,950,000; leaving only £300,000 for the third pipe-line, which was likely to cost more than double this amount. They would therefore require further borrowing powers to enable them to proceed with the third pipe-line when necessary. In this connection, the sinking fund would also call for consideration. Under the Vyrnwy Act, the debt had to be paid off in sixty years. This was too short a period for works of so durable a character; and if an extension to a hundred years could be obtained, it would be a valuable relief to their finances.

SOUTHAMPTON WATER SUPPLY.

Southampton Corporation and the South Hants Water Company.

We learn from a local correspondent that the proposal of the Southampton Corporation to purchase compulsorily the undertaking of the South Hants Water Company, to which reference was made in the "JOURNAL" for the 25th ult. (p. 280), is a result of the annexation to the borough some years ago of the outlying districts of Shirley and Freemantle—the residents in these places having still to pay the Water Company's charges, while in the old town the water-rates levied by the Corporation are lower than the Company's demand—and also of the desire of the Corporation to redeem the promise made long ago to bring about, if possible, an equalization in the rating of the added areas with that of the town proper, as an Order is shortly to come into operation which will bring about the unification of the borough, making it into one parish. That there should be a differential charge for water within the county borough is felt, not without reason, to be a grievance; and as Parliament will not sanction the purchase of the part of the Company's works which is within the borough area, the Corporation concluded that the only way out of the difficulty was to seek powers to enable them to purchase the whole of the undertaking. It is now determined to proceed with the Bill next session. The Corporation suggested that the Company should become parties to its elaboration; but this suggestion the Directors declined to entertain, as they considered that the promotion of the Bill was unjustifiable. The scheme is undoubtedly a formidable one, from a financial point of view; and this water business promises to be costly to the ratepayers, as already there is a little item of £2000 to be provided for in the new rate estimate, on account of costs for recently opposing the Bill of the South Hants Water Company in Parliament. The Corporation have now suggested the convening of a meeting of the various local authorities concerned, for the purpose of discussing the matter, and have dispatched to them a circular letter pointing out the alleged advantages to be gained in the event of the Municipality acquiring the Company's undertaking. On the other hand, the Company have not been idle, but have also circularized the Councils; showing the incompetency apparent in the management of the Corporation water supply in comparison with their own, and stating that they will show, at the proper time, that the Corporation scheme will involve an expenditure so large as to postpone for an indefinite period any reduction in the price of water in the added areas. Meanwhile, the mains are shortly to be prolonged so as to serve several outside parishes.

Worksop Water-Works Arbitration.—The arbitration connected with the purchase of the Worksop Water-Works by the Worksop Urban District Council is fixed to take place in London on the 10th of January. The Arbitrators are Mr. Fowler, of Sheffield, for the Company, and Mr. Wilcock, of Birmingham, for the Worksop Urban District Council. Mr. J. Ram, K.C., will be the Umpire.

WATER SUPPLY OF JERUSALEM.

A new water supply, in which river water would be substituted for the present cistern supply, has recently been suggested for Jerusalem. The following data regarding the proposed and former supplies appeared in a recent United States consular report.

Jerusalem to-day, with its 80,000 inhabitants, depends almost entirely on rain for its water supply; the rainfall averaging about 27 inches a year. In the houses of the better classes, these cisterns are large enough to store an ample quantity of water. With the poorer people, however, the case is the reverse. Most of the cisterns in their houses are small, and the houses often so overcrowded that frequently long before the summer is over the water has given out, and a supply has to be purchased at high prices from neighbours. Among the poorer classes, few are able to own their own cisterns; and large ones are built, generally by charity funds, for a common water supply. In many cases they are filled with surface water; and the insanitary elements with which the water thus collected is impregnated are held responsible for a large percentage of the fevers and other diseases prevalent towards the end of the dry season. When there is a shortage of rain, a critical state of affairs in regard to the water question ensues, and at such periods most insanitary water is used.

At various times since the days of King Solomon efforts have been made to secure a water supply on which the city could depend. About 7½ miles to the south, a little by west, of Jerusalem, on the carriage road to Hebron, are three reservoirs known as Solomon's Pools. These were constructed in the bed of a valley, across which heavy walls were thrown and cemented. They were filled during the rainy season with water from the surrounding hills, and this was augmented by the inflow of a small spring a little higher in the valley, known as the "Sealed Fountain," and some other small springs. From these pools there was built a masonry aqueduct, said to have been the work of Solomon, which, winding around the hillsides, carried the water to the Temple in the city. At one point this conduit went through a mountain by a tunnel. In the Sixteenth Century of our era, the Mohammedans remodelled this aqueduct by replacing the open trough with pottery pipes, portions of which are still in use.

In the second century, the Romans began to carry into execution an ambitious scheme, which they seemingly were never able to finish. Their source of supply was Ain Arroub, a large fountain which is also on the road to Hebron, and about twice as far from Jerusalem as the Pools of Solomon, the water of which was led into the middle of the pools, and also Bir ed-Derej in Wadi el-Biyar, the waters of which were led through a large conduit, through channels cut in the rock, and through a tunnel to a point above the pools. These waters were led to the city by two aqueducts—the lower one carrying the water accumulated in all the pools, and the upper one conveying the waters of the Sealed Fountain and of the Bir ed-Derej. The latter descends into the valley, and then rises again, running through stone syphon-pipes.

These were made of solid blocks of stone about 3 feet square and 2 feet thick, pierced by a hole 15 inches diameter, and cemented together. Each one was made with a shoulder on one side and a flange on the other, by which they fitted into each other. Part of this work is still to be seen.

In 1901 there was a serious shortage in rainfall, and water had to be conveyed by train from a small spring a few miles down the line to meet the demand. This lack of water aroused the authorities, and resulted soon after in the connecting of the city with the Sealed Fountain by means of a 4-inch pipe. From its source to Bethlehem, the old aqueduct was utilized; and from Bethlehem to the city, iron pipes were employed—the tunnel above mentioned serving as a kind of reservoir. This water, which is but a trifle compared with the city's needs, supplies some fountains, where it is free to the poor. Most of it, however, is consumed at the military barracks. During the first session of the new Parliament in Constantinople, a concession was granted to the Municipality of Jerusalem to appropriate the hides of all animals slaughtered in Jerusalem as a tax to produce a fund with which a water supply for the city could be secured. The Municipality proposed to make a loan large enough to enable the city to lay a great pipe from Ain Arroub, and to repay the loan and interest thereon in instalments each year from the tax on hides and the money received from the sale of the water.

A Bremen firm, hearing of this project, sent their Director to look over the situation. He made a report, the main points of which are as follows: (1) The consumption of water at present in Jerusalem is, on an average, from $1\frac{1}{2}$ to 2 litres (0·4 to 0·5 gallon) per head per day. (2) If obtainable, 15 to 16 litres (4 to 4·2 gallons) per head would be used per day; and the amount would probably grow to 50 litres (13·2 gallons). (3) Ain Arroub, which is 23 kilometres ($13\frac{3}{4}$ miles) distant, will supply 528,000 gallons per day, 132,000 gallons of which will have to be left for the use of the surrounding villages. (4) This 396,000 gallons is insufficient; and since there is no further supply to be had near, and the water will have to be filtered, the cost will be great. (5) Ain Arroub is not elevated enough for the water to flow without being aided by pumps. (6) Ain Farrah, which is 12 or 13 kilometres ($7\frac{1}{4}$ to $7\frac{3}{4}$ miles) to the north-east of Jerusalem and 1640 feet lower, has a flow of 1,584,000 gallons per day, and is of the best quality—the water gushing out from beneath the solid rock cliffs—and therefore does not require filtering. Ain Fauwar, which is about 7 kilometres ($4\frac{1}{4}$ miles) down the same valley, has a flow equalling that of Ain Farrah; and this could be added to the supply if the demand in the future should grow to require it. (7) This project of erecting and maintaining pumps to lift the water of Ain Farrah to the level of Jerusalem would be less costly and more desirable than the building and maintaining of the filtering plant that would be required if the Ain Arroub water were used; also, at the same time, at Ain Farrah an abundant supply can be had, while the Ain Arroub flow would before long be insufficient for the demand.

The Bremen representative made a proposition that his firm would at their own expense put in a plant to pump the Ain Farrah water into Jerusalem; piping the water into each house, and charging for it 1·25 francs per cubic metre (about 4s. 8d. per 1000 gallons), or to any-one paying in advance £81 5s., an agreement would be made to give 264 gallons per day for thirty years. Also, 19,800 gallons of water would be allowed the Municipality free for drinking fountains and street sprinkling—any further quantity required to be supplied at half price. At the end of thirty years, the complete water-works were to be handed over to the Municipality.

While the price named seemed high, the general public feeling was in favour of accepting this proposition rather than letting the Municipality carry out the first project of building the water-works and levying a heavy tax to meet the indebtedness. The matter is in the hands of a Committee, and has become an open competition.

WATER SCHEME FOR HEACHAM.

As briefly stated in the "Journal" last week, Mr. W. O. E. Meade-King, M.Inst.C.E., recently held an inquiry in the Public Hall, Heacham, into an application made to the Local Government Board by the Docking Rural District Council for power to borrow £6250 for the purpose of providing a water supply for the parish of Heacham, in accordance with a scheme prepared by Mr. E. H. Stevenson. Mr. J. A. Stoughton, the Clerk to the Docking Council, appeared in support of the application.

Mr. Stevenson, in giving details of the scheme, said it would cost £6062; and he explained that the difference between this sum and the amount applied for was the estimated cost of the land. The cost of the mains was £3373; the hydrants and valves, £720; water-tower, £1900; and 10 per cent. would be necessary for contingencies and engineering and legal expenses. Half the cost of the 5-inch main that would be required between Hunstanton and Heacham would be repaid by the Hunstanton Urban District Council. The proposal was to buy water from the Council at a minimum price of £100 a year for three years, and afterwards at 7d. per 1000 gallons for whatever quantity they might require. It was thoroughly good water, and there was plenty of it. It was collected from a tunnel and pumped into a water-tower at Hunstanton with 50,000 gallons in the upper tank, from which Heacham would be supplied. The top water level of the tank was 187 feet above Ordnance datum; and the tower in Heacham parish would be 160 feet above it. The towers were 1450 yards apart; and the tanks would be connected by a 5-inch main. The Heacham tank would hold 45,000 gallons; and there would be a 6-inch main from it to the middle of the district to be supplied. Between the two towers mains were to be laid outside their district—that was to say, in the Hunstanton urban district. He was also Engineer for that Council's

water-works. The work was to be done, for the sake of economy, under the same contract as the scheme of the Rural District Council; and, under an agreement, Hunstanton would pay one-half the cost. Generally speaking, it was a house-to-house supply. There would be a number of stand-pipes, which were included in the estimates.

The Inspector asked if there was any opposition; but there was no reply. The Chairman of the Heacham Parochial Committee (Mr. G. B. M. Brown), however, remarked that if evidence were taken as to whether or not the parish was opposed to the water scheme, he should say that they would be. They felt that it was forced upon them by the Local Government Board. The Inspector said it was not much use saying that; but he would report it to the Board if they wished him to do so. After some further remarks, the inquiry closed.

Using Domestic Water for Trade Purposes.

In the "JOURNAL" for the 25th ult. (p. 268), a report was given of an appeal by the Cambridge Water Company from a decision of local Magistrates on a question raised under sections 18 and 19 of the Water-Works Clauses Act, 1863. The defendant in the original proceedings was summoned for using domestic water for the purpose of his business as a dairyman, and for affixing a pipe to a certain tap which he used in connection with his water supply. The Bench held that the use of the water was not otherwise than for domestic purposes, and that the temporary attachment of the hose to the pipe was not one within the meaning of the Act. The appeal was heard by the Lord Chief Justice and Justices Pickford and Coleridge, who unanimously allowed it with costs. The Lord Chief Justice thought the first point must go back to the Magistrates on its merits, and the second on the ground that the temporary affixing of a hose to the service-pipe might be as much an offence as if it were permanent. The case came on for re-hearing on Monday last week, with the result that the Magistrates inflicted a fine of 5s. in each case, but remitted costs.

The Hornsey Gas-Works Bowling Club held a very successful dinner and smoking concert on the 12th inst. at the Nightingale Hotel, Wood Green. The Engineer and General Manager of the Hornsey Gas Company (Mr. J. W. Buckley, Assoc.M.Inst.C.E.), the President of the Club, was in the chair; the Vice-Chairman being the Secretary of the Company (Mr. W. E. Roberts), who is the Vice-President. After the loyal toast and that of "The Hornsey Gas-Works Bowling Club" had been honoured, Mr. Buckley distributed the prizes, presented by himself and Mrs. Buckley, the Vice-President, the Committee, and Messrs. Mitchell, Owen, Procter, and Welham. In doing so, he expressed his pleasure at seeing that great interest had been taken in the game of bowls, which he thought was an ideal one for men who had to use their muscles in their daily work. He spoke of the great success of the Company in which they were engaged, and said it depended on every employee, from the lowest to the highest.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Notices have been published to-day by the Corporation of Dunfermline of their intention to apply to Parliament for a Provisional Order authorizing the extension of the burgh boundaries, to which I referred last week. Among other things which are sought is power to the Town Council, as Gas Commissioners, to acquire additional land adjoining the gas-works, and to extend the gas-works. It is also asked that the land to be acquired shall be exempted from the provisions of the Burghs Gas Supply (Scotland) Act, 1867.

In the Dunfermline Town Council on Monday, the Gas Committee stated that they had had a report before them with reference to the proposal to give a supply of gas to the village of Kingseat, and that it had been agreed that the Council should be asked not to come to a decision till the terms of the Fife Electric Power Company for the lighting of the streets should be obtained. It was stated that householders on the proposed line of pipe outside the existing district of supply had been canvassed, and it had been found that 200 were in favour of using gas, if pipes were fitted into their houses by the proprietors. The total consumption was estimated at 1,600,000 cubic feet a year. The cost of laying a pipe was estimated at £1929, upon which sinking fund and interest charges, at $5\frac{3}{4}$ per cent., would amount to £111, equal to 16·63d. per 1000 cubic feet. It was agreed, in accordance with suggestions of the Committee, to let the matter stand over.

The second of the course of lectures under the auspices of the Glasgow and West of Scotland Branch of the Smoke Abatement League of Great Britain was delivered in the Technical College, Glasgow, last night by Mr. F. W. Harris, the Corporation Chemist and City Analyst. The lecturer said that the foundation of an intelligent interest in the question of smoke abatement was a knowledge of the elementary principles of combustion. These he illustrated, verbally and by experiment, and then went on to explain why perfect combustion was easily obtained in the burning of coal gas in suitable appliances. He assured the audience that, provided the appliances were of sound construction, properly fixed, and intelligently used, the products of the combustion of coal gas were entirely harmless. He suggested that the Corporation should not only undertake the duty of instructing householders in the most efficient methods of gas consumption, but should be empowered to condemn inferior and untrustworthy appliances. He pointed out that the harmless-looking light-grey or brown vapour that was formed by the replenishment of a domestic fire with fresh coal was rich in the constituents of smoke which were deleterious to health, and which were the cause of the unsightly appearance of public buildings. The domestic coal-fire was neither more nor less than a crude and totally inefficient gas-retort; the gas and accompanying products, instead of being retained in gasholders and storage-tanks, were dissipated into the atmosphere, which became a receptacle for the polluting products that emanated from thousands of household fires.

Yesterday afternoon, an explosion of gas took place in a passage on the third floor of the Central Chambers, No. 11, Bothwell Street, Glasgow. A great deal of plaster was knocked down, and a fire broke out, which, however, was quickly subdued by the Fire Brigade. Damage to the extent of £500 was done by the explosion and the fire. The explosion, it is believed, was caused by a defective electric light fitting on the second floor melting a gas-pipe.

A letter was read at the Dumfries Town Council last week in which Mrs. Miskelly, of M'Lellan Street, complained of the inconvenience caused to her by the new machinery in the gas-works, in close proximity to her dwelling-house. Serious damage, it was stated, was being caused to the property; and the noise was such that it was quite impossible for the inmates of the house to sleep while the machinery was in motion. Unless the nuisance were removed, steps would be taken to obtain an interdict. The Council remitted the letter to the Gas Committee, to consider and report.

The announcement in last week's "Notes" that the price of gas to ordinary consumers in Helensburgh is at present 3s. 4d. per 1000 cubic feet was misleading, as in September last the price was reduced to 2s. 11d. The charge for gas consumed through prepayment meters is 3s. 4d. By the new arrangement, consumers of gas outside the burgh whose annual consumption is a million cubic feet and upwards will be charged at the 2s. 11d. rate. Below a million cubic feet, the charge will be 3s. 1½d.

We have now got into our hands the made-up record in the action by the Kirkcaldy Gaslight Company, Limited, against the Corporation of Kirkcaldy, to which reference was made in these "Notes" several weeks ago. The sum in dispute is £233 odd. But it is to be observed that the charge is for the year ending at May 31, 1909; and if the Company are successful in this action, there will be a like claim due for the year to May 31, 1910, and, indeed, till the transfer is determined. The merits of the case I cannot discuss; but I may go the length of reflecting upon the unusual spectacle of a Company and Corporation litigating after they have agreed to a transfer. The transfer, I understand, is to be a keenly contested business. For the post of Oversman, Lord Shaw of Dunfermline has been selected.

In the Inverurie Town Council on Monday, Treasurer Rae moved that the Council consider the advisability of entering into negotiations with the Gas Company with the view of acquiring the plant, &c., of the Company, and working the same as a municipal concern. His reason, he said, for bringing forward the motion was that they were paying far too high a price for street and private lighting. About two years ago, they applied for a reduction in the price of gas for street lighting, which the Company did not see their way to give. He thought it was their duty to the electors to get the lighting as cheaply as possible. Before anything practical could be done, they would require another election; but they could consider the question at their next meeting. By this time, the members could, if they desired, get information about other places. In his opinion, they could easily reduce the price of gas by 2s. per 1000 cubic feet. The motion was unanimously adopted.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a quiet tone in the northern coal trade (more especially in the steam coal branch), and prices are rather weak. Best Northumbrian steam coals are from 9s. 3d. to 9s. 4½d. per ton f.o.b.; second-class steams are about 8s. 6d.; and steam smalls from 5s. 3d. to 6s. 6d. The production is fairly full, but the demand is rather restricted by the limited exports usual at this time of the year, so that the prices are in many cases rather easier. In the gas coal trade, the demand is increasing; and the deliveries on the long contracts are now nearly at their maximum. Durham gas coal varies in price. The usual classes are from about 8s. 3d. to 9s. 6d. per ton f.o.b., according to quality; while for "Wear" specials, about 10s. 3d. is the current quotation. A few sales of large quantities of gas coals to one of the London Gas Companies have been made; and the price is said to be from 8s. 7½d. to 8s. 9d. per ton f.o.b. for good second-class Durham kinds. Other sales for export are reported to be in treaty. In these, lower prices than those that have been current are offered; but sellers do not readily accept these at a time when the demand is nearest its highest for the season. Coke is quiet. Gas coke retains its price, however, despite the increased output; and for good quality, 14s. 3d. per ton f.o.b. is quoted.

Scotch Coal Trade.

Except that there is a demand for household purposes, for which cold weather is responsible, the coal market is unsatisfactory, both in the home and the foreign sections; but probably the foreign trade is affected as much by storms at sea as by lack of demand. The home market continues to suffer from the trouble in the boilermaking industry. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 287,376 tons—a decrease of 17,629 tons upon the preceding week, and of 28,905 tons upon the corresponding week of last year. For the year to date, the total shipments have been 14,028,128 tons—an increase upon the corresponding period of 673,784 tons.

Gas Supply for Mersea.—We learn from the "Essex Telegraph" that the gas-works for Mersea, to which reference has already been made in the "Journal," are progressing. The Contractor for the buildings (Mr. Thorp) has finished the retort-house with the exception of the iron roof, which is coming from Drakes Limited, of Halifax, who are supplying the gasholder, retorts, and other gas plant. Their men are expected very shortly to erect the holder and put in the retorts. Permission to open the roads has been obtained from the Lexden District Council, and a staff of men will soon be engaged in laying the pipes; and the whole work is expected to be completed in February next.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices,' see p. 597.]

LIVERPOOL, *Nov.* 19.

Sulphate of Ammonia.

The outstanding feature of the market this week has been the lack of strength in the Leith position, at which port prices have now become lower than those either in Hull or Liverpool, whereas Leith values are usually the highest. Liverpool prices have, however, no doubt been sustained by the purchasing made in order to effect shipments against previous contracts, as consumers generally still show little disposition to commit themselves for anything beyond their immediate requirements. The values at the close have receded to £12 17s. 6d. per ton f.o.b. Hull, £12 18s. 9d. per ton f.o.b. Liverpool, and £12 16s. 3d. per ton f.o.b. Leith. There has again been little interest displayed for delivery next year, and no further transactions have transpired.

Nitrate of Soda.

There is still no change to report in this article, and the quotations remain 9s. 4½d. per cwt. for the 95 per cent. quality, and 9s. 6½d. for 96 per cent., on spot.

LONDON, *Nov.* 21.

Tar Products.

The markets for tar products have remained fairly firm during the past week. In pitch, business has not been very brisk; and in some quarters it is reported that slightly lower prices have been accepted. There is a fair demand for benzol, 90 per cent. and 50 per cent. qualities; but it is difficult to do business at the prices asked at present. Creosote remains in about the same position; and a little business has been done for delivery over the next few months at the present market prices. Further business is reported in crude carbolic at 1s. 1½d. for 60 per cent. Solvent naphthas are quiet. In heavy naphtha, business is fairly good.

The average values during the week were: Tar, 17s. to 20s. 9d. *ex* works. Pitch, London, 34s. to 34s. 6d.; east coast, 32s. 6d. to 33s. 6d; west coast, Clyde ports, 34s. 6d. to 35s. 6d., Manchester, 32s. to 33s., Liverpool, 32s. 6d. to 33s. 6d. Benzol, 90 per cent., casks included, London, 7½d. to 7¾d.; North, 7½d. to 7¾d.; 50-90 per cent., casks included, London, 7¾d. to 8d.; North, 7½d. to 7¾d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4¼d.; North, 3⅜d. to 3¼d.; solvent naphtha, casks included, London, 11½d. to 1s. 0½d.; North, 11d. to 1s.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 11d. to 1s. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2⅛d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d.; west coast, 1s. 1d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market has been considerably quieter during the past week, and prices on the whole have weakened slightly. Beckton make is quoted to-day at £12 10s. Outside makes are £12 7s. 6d. to £12 8s. 9d. In Hull, the price is £13; Liverpool, £12 18s. 9d.; and Leith, £13 2s. 6d.

Lord Robert Cecil on Co-Partnership.

Speaking at the Marylebone Town Hall on Monday night last week on the division of the profits of industry as between capital and labour, Lord Robert Cecil said this question would play a large part in the coming General Election. The intelligent workman was aware that management, enterprise, and judgment in the development of a great industrial concern must be paid for, and highly paid for; but what he asked was what security he had of getting a fair proportion of the profits. He (the speaker) saw a great difficulty in answering this question. He did not see how Tariff Reform was going to touch the question of the distribution of profits, even though it increased prosperity; and Socialism would either cause profits to disappear or seriously to diminish. The great thing was to get all who were concerned in any industry in this country—from the humblest worker to the richest director—to feel that they were working together to a common end and for a common object. He would like to see a state of things where working men would have, in addition to a minimum wage, a share of the profits of the industry in which they were concerned which would rise and fall according to its measure of success. This was a matter which it was not very easy for the State to deal with; but it was not impossible. Some small changes in the company law might be made with advantage; and a good deal of administrative encouragement might be afforded by the Board of Trade. There was no reason why the latter should not set about serious and scientific inquiry into the matter, and be prepared to recommend to each particular industry the form of co-partnership which was most suitable to it.

Burnley Water Supply.—A contract has recently been placed by the Burnley County Borough Council for a new reservoir to have a capacity of 300 million gallons. It will be constructed in the Hurstwood Valley, about four miles east of Burnley, between the Cant Clough and Swindon drainage areas. There is a drainage area of 594 acres which flows naturally into the reservoir, and another of 508 acres from which the water is brought to it by means of catchwaters and aqueducts 2900 yards in length. The reservoir will consist of an earthen embankment 470 yards long, the average depth of the trenches for which will be about 75 feet. They will be filled with concrete and puddle. The work embodies the usual waste weir, water-courses, meter chamber, and pipe-lines. The Consulting Engineers are Messrs. James Diggle and Sons; and the contractors are Messrs. Macdonald and Deakin. It is expected that the ultimate scheme will cost about £215,000.

Lecture to Brentford Gas Company's Employees.

By invitation of the Brentford Gas Company, Mr. J. W. Wilson (Messrs. Wilsons and Mathiesons, Limited) last Wednesday met the inspectors, salesmen, fitters, &c., at the Brentford works, and explained to them the new Wilson "Circulator" water-heater. He described the construction of the apparatus, and explained how the heat was obtained and absorbed by the water, and how the travel of the products of combustion ensured efficiency. He offered some observations on the action of the heated water, on the principles of hot-water circulation, and on the correct and incorrect methods of fixing and using it—particularly in regard to the adjustment of the proper amount of gas to the flue space. In order to illustrate the construction and action of the "Circulator," glass was inserted on opposite sides, and glass flow and return pipes attached it to a glass-fronted cistern. When working, the action of the water was very clearly seen; and it excited the greatest interest. Condensation was explained; and means for its collection were exhibited. A thermostatic valve was shown in action, and its principle, as well as that of the bunsen burner, was fully described. The different quantities of air drawn in by the same consumption of gas with the straight tube and the Venturi tube proved very interesting. A helpful discussion, including the exchange of experiences, brought to a close a very successful evening.

Improved Gas Lighting in Stoke Newington.—The Stoke Newington Borough Council last Tuesday decided on the recommendation of the Highways Committee, that 32 inverted incandescent gas-lamps should be altered from single to double burners, at an estimated cost of £53 12s. per annum for additional gas supply and maintenance. The cost of adapting the lanterns will be borne by the Gaslight and Coke Company.

Explosion at the Doncaster Gas-Works.—During the changing of the purifiers at the Doncaster Gas-Works last Friday morning, an explosion of gas occurred by which three casual labourers sustained injuries from burns and shock. They were removed to the Royal Infirmary, and two of them were admitted. The third was less seriously hurt; and after having had his burns attended to, he was able to go home.

Wigan Gas-Works Accounts.—The abstract of accounts of the Wigan Corporation Gas-Works for the year to March 31 last shows that the revenue amounted to £78,136, and the expenditure to £50,177; leaving a balance of £27,959 to go to the profit and loss account. Adding the amount brought forward (£6302), there was produced a sum of £34,261, which is accounted for as follows: Interest, sinking fund, bad debts, &c., £18,079; proportion of expenditure on water-gas plant, £1210; amount applied to reduce capital expenditure, £673; public lighting, £5470; transferred to the general district fund, £4000; balance carried forward, £4828—being the amount of profit for the year (£10,299), less the value of the gas given to the Streets Committee for public lighting within the borough.

Keighley Water Supply.—At the last meeting of the Keighley Town Council, the Water Committee reommended (1) that in view of the desirability of obtaining definite information as to the character and suitability of the site of the Lower Laithe reservoir before serving the necessary notices and incurring considerable preliminary expenses in the promotion of the proposed Parliamentary Bill, and of the impossibility of having such information in time, the question of the proposed application to Parliament be re-opened; and (2) that such application, so far as the same has reference to the water-works purposes, be deferred until the session of 1912. Alderman Brigg moved that, in view of the postponement of the Council's application to Parliament with respect to the water-works, the whole question of the proposed Bill be re-opened; and that the promotion of such Bill be deferred until the 1912 session of Parliament.

Monazite Sand from Brazil.—In the annual British consular report on the trade of Brazil, it is stated that the country still furnishes the greater part of the world's supply of monazite sand. It is shipped almost entirely to Hamburg from Bahia and Espirito Santo. The quantity shipped from Rio de Janeiro in 1908 was 1200 tons; and it rose to 3700 tons in 1909. This was twice the quantity shipped that year from Bahia, where exports of monazite have diminished. The contract made in December, 1903, by the Federal Government for the extraction and sale of monazite sands on the coast of the State of Espirito Santo lapsed last February; and in June tenders were called for a fresh contract. During the previous contract, 15,646,560 kilos of monazite were shipped to Hamburg; 7,848,670 kilos were sold; and 7,797,939 kilos stocked. Of £212,375 realized by the sale of sand, a sum of £108,915, or 51·3 per cent., was retained by the Brazilian Federal Treasury.

Ivybridge Water Supply.—Mr. H. Francis has submitted to the Ivybridge District Council a report on the improvement of the water supply. The present supply is derived from the River Erme, which runs through Ivybridge; and the works include a small reservoir situated at a point about 350 feet above Ordnance datum. The greater portion of the residential area is situated between the levels of 150 and 220 feet. But some portions rise to 400 feet; and these cannot be supplied from the existing works. Moreover, the pressure in many places is insufficient, and the supply generally is inadequate. Mr. Francis has investigated three sources of supply, any one of which he considers would meet the requirements of the district. The first of these contemplates the utilization of a spring on Hanger Down, and the provision of a reservoir of 500,000 gallons capacity; the approximate cost of the undertaking being £4350. The second proposal is to use a stream known as Redhaven Gulf, which would involve an outlay of about £5430. The third scheme is to impound the Butterbrook stream; the cost in this case being about £5150. It is pointed out that the third scheme would necessitate application to Parliament. On being questioned at a meeting of the District Council yesterday week, Mr. Francis said he would not like to bind himself to any of the schemes without further investigation; but he certainly liked the Butterbrook scheme. The Council appointed a Committee to see the owners of the land in regard to further investigations and the cost of the undertaking.

Winding-Up of the Beaufort Gas Company.—At a meeting of creditors and contributories of this Company recently held at the offices of the Official Receiver at Newport (Mon.), directions were given to him to apply to the Court for the appointment of a Liquidator, to act with a Committee of Inspection.

Sale of Shares.—At the Market Hotel, Bacup, last Thursday, six parcels of shares in the Rossendale Union Gas Company were offered for sale by public auction, and realized the following prices: 70 new £10 shares, £21 10s. each; four £10 preference shares, £21 10s. each; 45 new ordinary £10 shares, £21 6s. each; 77 Amendment Act shares (£10), £15 10s. apiece; 17 new Amendment Act shares of like nominal value (£5 called up, and £5 paid in anticipation of calls), £13 8s. each; and 36 shares of similar value issued under the Act of 1876 (£2 called up, and £4 paid in anticipation of calls), £7 12s. 6d. each.

Outburst of Natural Gas near Hamburg.—According to a Reuter telegram despatched from Berlin last Friday week, during the progress of some boring operations for water at Neuengamme, near Hamburg, there was an outburst of natural gas, which became ignited and burnt in three immense jets visible several miles off. It is stated that the roar of the flames is audible for six miles; and close to the escape the ground "trembles with the rush of gas." Thousands of people leave Hamburg daily to see the strange sight. It is not known whether the existence of the gas indicates the presence of petroleum or coal below the surface.

Electric Lighting in Bermondsey.—The Bermondsey Borough Council last Tuesday evening sanctioned an estimate for £100, the initial expenses of applying to the Board of Trade for a Provisional Order to supply electricity in the parishes of St. Olave, St. Thomas, and St. John, Horsleydown. The Town Clerk (Mr. F. Ryall) expressed the opinion that a further £350 would cover the total cost of obtaining the confirming Act of Parliament. The estimate of the Electrical Engineer for laying mains in the extended area was £8250. After discussion, the estimate was agreed to. The Council also sanctioned an application for a loan for £739 for extension of mains; making £6000 with a sum previously agreed to for this purpose.

Typist's Death from Gas Poisoning.—A mysterious death from gas poisoning is reported from Glasgow. A woman named Isabella Sinclair Buchanan, 24 years of age, had been employed as typist in the office of Mr. A. G. Robertson, slater, in Bothwell Street, for ten years. On Wednesday evening she left the premises shortly after five o'clock. Next morning, however, her body was found lying on the floor of the office, beside a gas-stove, the tap of which was turned full on. The mantle upon a gas-bracket in the office had been removed and the gas turned on. There was an overpowering smell of gas in the place. Death was certified as having been due to gas poisoning. Miss Buchanan had in her possession a set of keys of the office.

Bailiffe Bridge Gas Supply.—Negotiations are in progress between the Bradford, Halifax, and Brighouse Corporations and the Hipperholme District Council in reference to the gas supply of Bailiffe Bridge. The village is within the joint areas of supply of Bradford and Halifax; but these authorities do not exercise their powers. Gas is distributed to consumers by a private Company, who obtain a supply in bulk from Brighouse; the charge to consumers being 3s. 10d. per 1000 cubic feet. The price charged by Brighouse is 2s. 4d., in addition to which there is the cost of distribution. The Hipperholme Council have decided to approach the Local Government Board and ask for powers to take action with respect to the gas supply of the whole of their district, which includes Bailiffe Bridge. The Brighouse Corporation are making an offer to the Council and the Gas Company to supply consumers direct at 3s. 3d., which is the price charged to consumers outside the borough. The Halifax Corporation supply the major portion of the Hipperholme district, and, being much dissatisfied with the service, the District Council are making vigorous efforts to get free.

We have received from Messrs. James Milne and Son, Limited, a sheet of their illumination devices suitable for the forthcoming Coronation. They are varied in character, to suit all tastes; and their special features are that they are made of copper tube on iron framing, and the perforations are not punched but drilled.

With reference to the remarks on "High-Pressure Lights in London" in last week's "JOURNAL" (p. 460), we learn that the lamp-pillars in Parliament Square are Mannesmann weldless steel tubular columns; and that the high-pressure suspended lamps in Cannon Street are supplied from a main composed of Mannesmann weldless steel spigot and faucet tubes, with the rigid joint.

A correspondent sends us the following from a suburban paper: "A resident of Tottenham is introducing a 'Compound' gas-cooker, which scientifically falls into line with rigid household economy to a degree never before attained. The luxury of a hot dinner for a family of six persons, six days per week, is now made available at a cost for gas not exceeding the price hitherto paid for one. The apparatus is portable, needs no fixing, and may easily be transferred to any part of a house for warming rooms. We are inclined to hope that herein may be found a remedy for the fog nuisance. Whether for cooking or heating, coal is no longer necessary, as gas is for both purposes much cheaper and much better."

The holding of a chrysanthemum show in the Town Hall, Burton-upon-Trent, a few days ago, afforded the Corporation, in conjunction with Messrs. Bindleys Limited (a local firm), an opportunity of bringing under the notice of gardeners and floriculturists Messrs. John Wright and Co.'s "Garajo" gas-heated boiler, which is specially suitable for the warming of greenhouses and conservatories. It has always been acknowledged that there is no more convenient way of keeping these places at a suitable temperature than by water-pipes heated by gas; but this method has hitherto been too expensive for general adoption by gardeners of moderate means. The difficulty is now removed by the production of the appliance named, the utility and economy of which are not confined to the places already indicated, but are equally conspicuous in the cases of coach and motor houses.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ASSISTANT MANAGER. South Shields Gas Company.
GENERAL MANAGER (GAS ENGINEERS). No. 5313.
DRAUGHTSMAN. No. 5320.
WORKING SUPERINTENDENT. No. 5322.
WORKING MANAGER. Applications to Best and Turner, Skipton.
GAS COAL SALESMAN. W. H. Bowater, Limited, Birmingham.
WORKING FOREMAN GAS FITTER, &c. Shanklin (I. of W.) Gas Company.

Situation Wanted.

CLERK, ASSISTANT CASHIER, &c. No. 5320.

Plant, &c. (Second-Hand), for Sale.

MOUTHPIECES. Sutton (Surrey) Gas Company.

Patent Licences, &c.

DISTILLING AND COKING COAL. Marks and Clerk, Lincoln's Inn Fields.
GAS TURBINE. Cruikshank and Fairweather, Chancery Lane, W C.

Stocks and Shares.

BARNET GAS AND WATER COMPANY (BY AUCTION). Dec. 6.
SOUTHEND WATER COMPANY (BY AUCTION). Dec. 6.

TENDERS FOR

Coal.

NOTTINGHAM WORKS AND WAYS DEPARTMENT. Tenders by Dec. 8.

Fire-Clay Goods.

NOTTINGHAM GAS DEPARTMENT. Tenders by Nov. 28.

General Stores.

BRADFORD GAS DEPARTMENT. Tenders by Dec. 2.
NOTTINGHAM GAS DEPARTMENT. Tenders by Nov. 28.
NOTTINGHAM WORKS AND WAYS DEPARTMENT. Tenders by Dec. 8.

Meters, &c.

NOTTINGHAM GAS DEPARTMENT. Tenders by Nov. 28.

Pipes (Iron and Earthenware), &c.

NOTTINGHAM GAS DEPARTMENT. Tenders by Nov. 28.
NOTTINGHAM WORKS AND WAYS DEPARTMENT. Tenders by Dec. 8.

Purifiers.

DUNEDIN (N.Z.) CORPORATION. Particulars of T. Cole and Son, Westminster. Tenders by Jan. 25.

Steel and Ironwork, and Castings, &c.

NOTTINGHAM GAS DEPARTMENT. Tenders by Nov. 28.
SHEFFIELD GASLIGHT COMPANY. Tenders by Dec. 6.

Sulphate of Ammonia Plant, &c.

SUTTON-IN-ASHFIELD GAS DEPARTMENT. Particulars of Messrs. Corbet Woodall and Son, Westminster. Tenders by Dec. 6.

Sulphuric Acid.

SALFORD GAS DEPARTMENT. Tenders by Dec. 1.

Tar and Liquor.

GAINSBOROUGH GAS DEPARTMENT. Tenders by Nov. 25.
SHOTLEY BRIDGE GAS COMPANY. Tenders by Dec. 6.

Tar (refined), Pitch, Creosote Oil—Wanted.

NOTTINGHAM WORKS AND WAYS DEPARTMENT. Tenders by Dec. 8.

Tools, Implements, &c.

NOTTINGHAM GAS DEPARTMENT. Tenders by Nov. 28.
NOTTINGHAM WORKS AND WAYS DEPARTMENT. Tenders by Dec. 8.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Nov. 19. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	21s.	19s.—21s.	19s. 6d.—21s. 6d.	18s. 6d.—20s. 6d.	18s. 6d.—20s. 6d.	—
Pitch	,,	35s.—36s.	32s.—32s. 6d.	32s. 6d.—33s.	34s.—35s.	33s.—34s.	34s.
Benzol, 90 %	per gallon	8½d.	7d.—7½d.	8d.	7¼d.—7½d.	7¾d.	8d.
Benzol, 50-90%	,,	9d.	8d.—8½d.	9d.	8d.—8¼d.	8d.—8¼d.	—
Toluol, 90%	,,	10d.	9d.	10d.	10d.	10d.	10d.
Crude naphtha, 30%	,,	—	3½d.	3½d.	3¼d.	3¼d.	—
Light oil, 50%	,,	—	3¼d.	3½d.—3¾d.	3d.	3d.	—
Solvent naphtha, 90-160	,,	—	10½d.	10½d.	10d.—10½d.	1s.	11½d.
Heavy naphtha, 90-190	,,	—	11d.	11d.	11d.—1s.	11¾d.—1s.	11½d.
Creosote in bulk	,,	2½d.—2¾d.	2¼d.	2d.	2d.—2⅛d.	2 1/16	2d.
Heavy oils	,,	3¼d.	2½d.	2¼d.	2¾d.	2¾d.—3d.	3d.
Carbolic Acid, 60's	,,	1s. 0½d.—1s. 1d.	1s.—1s. 1d.	1s. 0½d.	1s. 0½d.—1s. 1d.	1s. 0¾d.	1s. 1d.
Naphthalene, crude drained salts	per ton	—	40s.—42s. 6d.	40s.—42s. 6d.	47s. 6d.	47s. 6d.—50s.	—
Naphthalene pressed	,,	—	50s.	63s.	60s.	60s.	—
,, whizzed	,,	80s.	—	—	70s.—72s. 6d.	72s. 6d.	65s.
Anthracene	per unit	2d.	1⅜d.	1½d.	1¼d.	1¼d.	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 554.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,863	Stk.	Oct 14	5	Alliance & Dublin Ord.	88-90	..	5 11 1
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95—98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6½—6¾	+⅛	5 3 8
40,000	5		7	Do. New, £4 paid	5—5¼	+⅛	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	247—250	+1	5 0 0
330,000	,,	,,	9½	Do. New	18,—187	..	5 1 7
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99 101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	158—161	..	4 19 5
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk.	105—108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	..	3 14 1
800 000	Stk.	June 10	4†	Continental Union, Ltd.	88—93	..	4 6 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Oct 14	5	East Hull 5 p.c. Ord.	103—105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¾—24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,415	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	105—106	..	4 8 0
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,052,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112—114	..	5 4 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	184—186*	..	4 16 9
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	163—165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅝—4⅞	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¼—12¾*	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138—140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd.	6¼—6¾	+⅜	5 18 6
31,800	53	Aug. 31	13	Portsea Island A.	131—133	..	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼—7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅛—5⅜	−1/16	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	[illegible] 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Co. Stk.	55—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	[illegible] 2	..	4 1 4
502,310	Stk.	Nov. 11	5	Southampton Ord.	109—111*	+2	4 10 1
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 0
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	113—115	+1	4 6 11
255,636	Stk.	Aug. 31	6¼	Wandsworth B 3½ p.c.	140—142	+1	4 15 1
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	74—76	+1	3 18 11

Prices marked * are "Ex div." † Next dividend will be at this rate.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

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O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
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AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers, Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2836 HOLBORN.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and TOWER BUILDING, 22, WATER STREET, LIVERPOOL.

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding
Oxide Lightly.
See Illustrated Advertisement, Oct. 25, p. 238.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 25, BRIDGE END, LEEDS.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
JOHN RADCLIFFE, Chemical Engineer, EAST BARNET.

SULPHURIC ACID — Specially pre-pared for Sulphate of AMMONIA and BENZOL Recovery Plants. JOHN NICHOLSON & SONS, LTD., Hunslet Chemical Works, LEEDS. Tele.: "NICHOLSON, LEEDS." Telephone: (Two lines), Nos. 2420 and 2421.

COAL TAR wanted,
BROTHERTON AND CO., LTD., Tar Distillers, Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
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OXIDE OF IRON (BOG ORE).

ANY QUANTITY. ANY PORT. ANY STATION.

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DUTCH OXIDE OF IRON.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

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NYMEGEN, HOLLAND.
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CHARLES E. FRY SUTTON, SURREY.
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BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

READ HOLLIDAY AND SONS, LTD.,
HUDDERSFIELD,
Are prepared to Supply
BENZOL, TOLUOLE, NAPHTHA, AND CREOSOTE
in large Quantities.

ENQUIRIES SOLICITED.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

ENQUIRIES SOLICITED.

FOR Gas-Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS.

C. & W. WALKER, LIMITED,
DONNINGTON, NEWPORT, SALOP.

TAR WANTED.

Telephone: Central Manchester, 7002.
Telegrams: "UPRIGHT."
Apply, THOMAS HORROCKS,
Albert Chemical Works, BRADFORD, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of
AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

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(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.

BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL LTD.
with which is amalgamated WM. PEARCE & SONS, LTD,
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 841 AVENUE.

LUX'S GAS PURIFYING MASS.
See Advertisement on First White Page.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

TAR WANTED.

THE BURNDEN TAR COMPANY (BOLTON), LIMITED.
Hulton Chemical Works, BOLTON.

CALCIDUM, a Limpid, Colourless, Neutral Liquid; does not affect Metals, freezes only at -67° F., and, therefore, when mixed with Water in Gas Meters, Engines, Generators, &c., prevents these Freezing in the most severe weather. It is also the best means of thawing everywhere, for Extinguishing Fires, and for working Mortar and Cement in Winter. Used regularly for Eight Years by one English Gas Company.
RICHARD SIMON AND SONS, LIMITED, NOTTINGHAM.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Thornhill, DEWSBURY.

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IT is Worth Your While to Buy Direct from the RELIANCE LUBRICATING OIL COMPANY GUARANTEED ANTI-CORROSIVE LUBRICANTS—viz., Motor Waggon Oil, 1s.; Motor Car Oil, 1s. 6d.; Engine, Cylinder, and Machinery Oils, 1s.; Axle Oil, 10½d.; Exhauster Oil, 10d.; Special Cylinder Oil, 1s. 4d.; 650 T Cylinder, 1s. 9d.; Special Engine Oil, 1s. 4d.; Gas Engine and Oil Engine Oil, 1s. 6d.; Refrigerator, 1s. 9d.; Renown Engine Oil, 11½d.; and Astral Disinfectant, 2s. 6d. per gallon. Barrels free, carriage paid. Solidified Oil, 25s. cwt.
THE RELIANCE LUBRICATING OIL COMPANY, 19 & 20, Water Lane, Tower St., LONDON, E.C. Agents wanted.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

BRITISH MADE.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

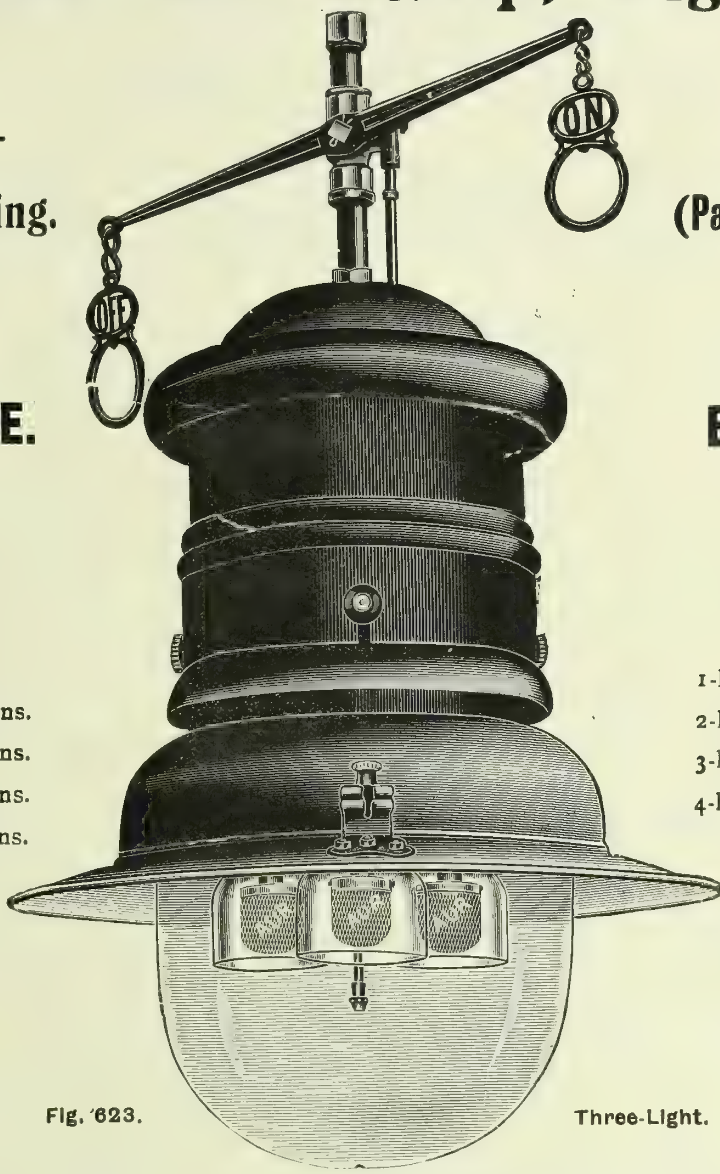

Fig. 623. Three-Light.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	C.P.	Steel.	Copper Case.
1-light	4 feet	125	**30/-**	**5/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.
3-light	12 feet	400	**52/6**	**6/-** extra.
4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	2-Light.	3-Light.	4-Light.
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	2-Light.	3-Light.	4-Light.
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, **4½d.** each, or **4s. 3d.** per dozen subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.

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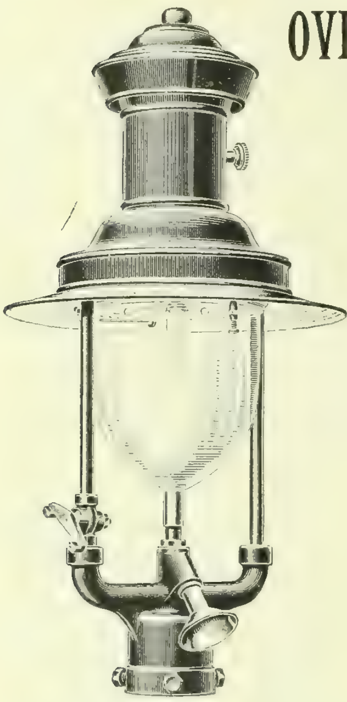

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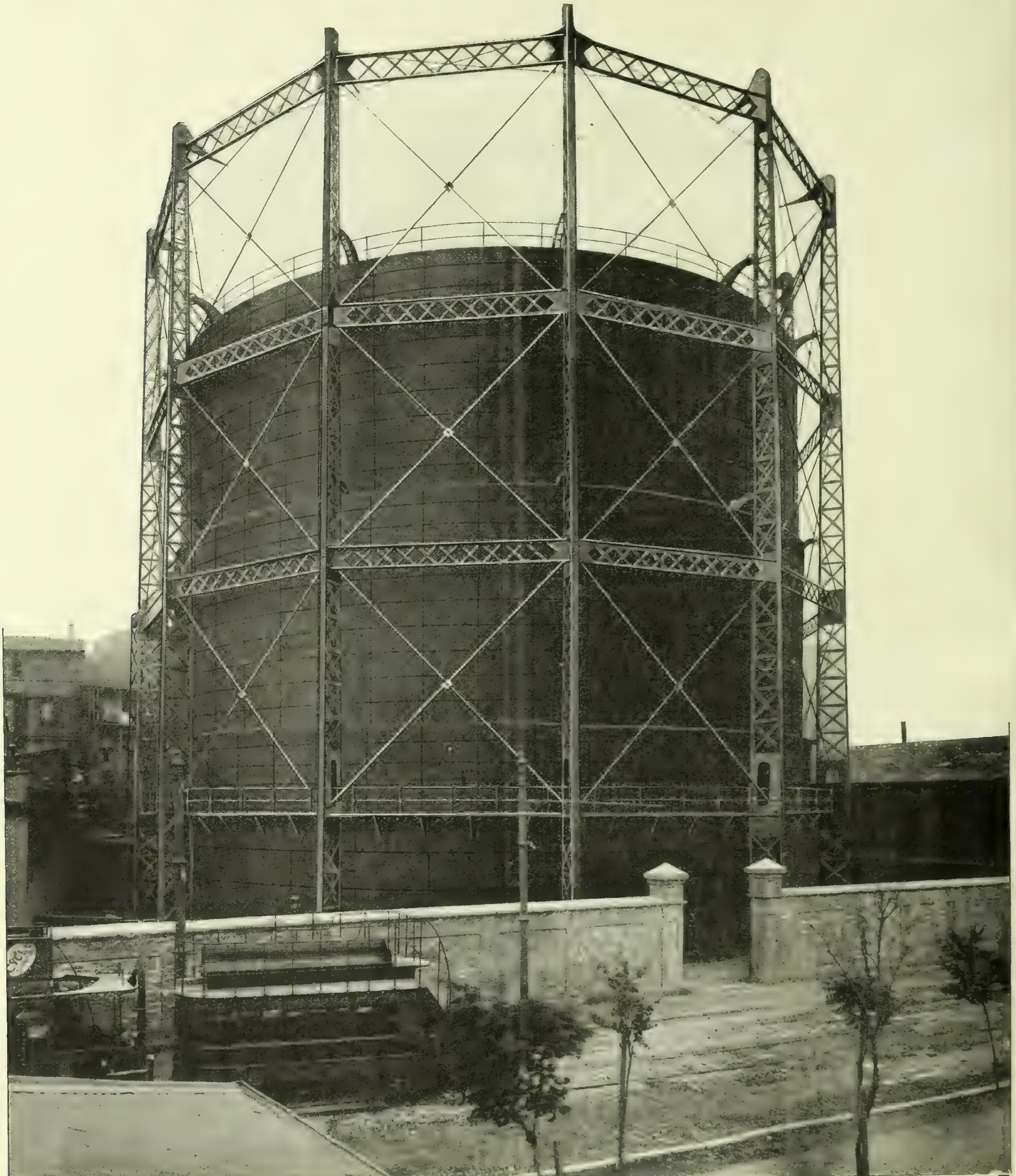
VOL. CXII. No. 2481.] LONDON, NOVEMBER 29, 1910. [62ND YEAR. PRICE 6d.



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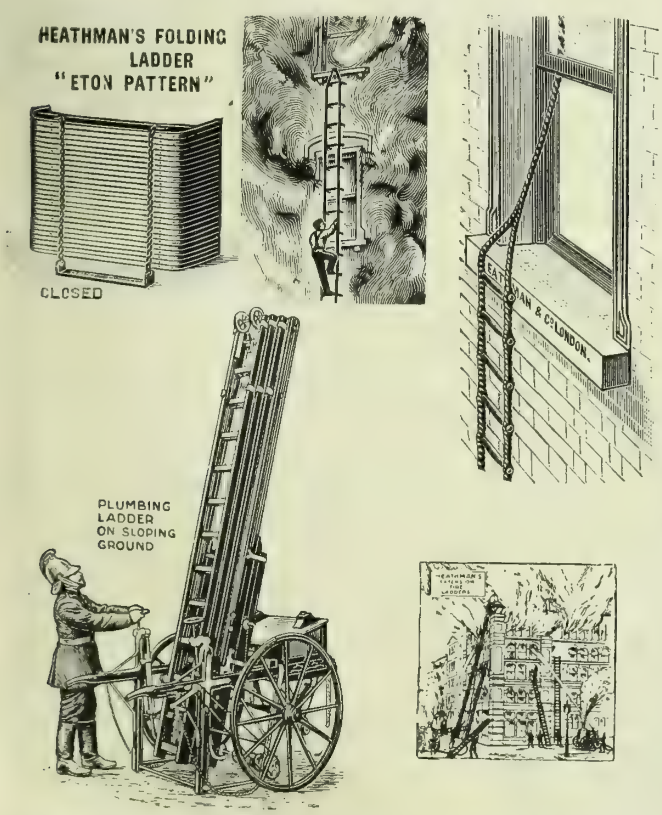

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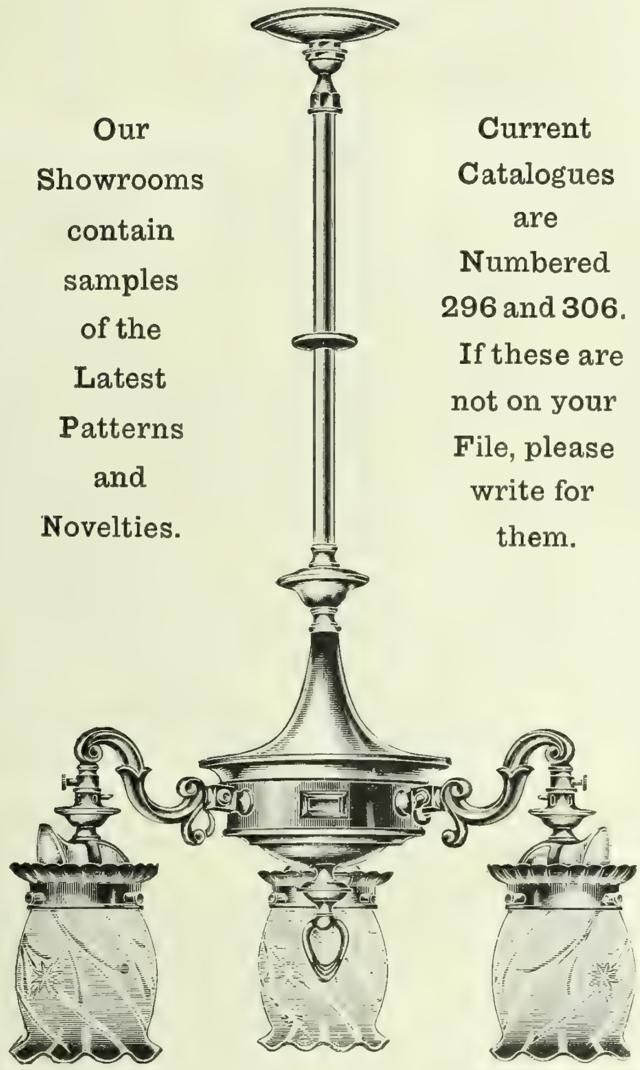

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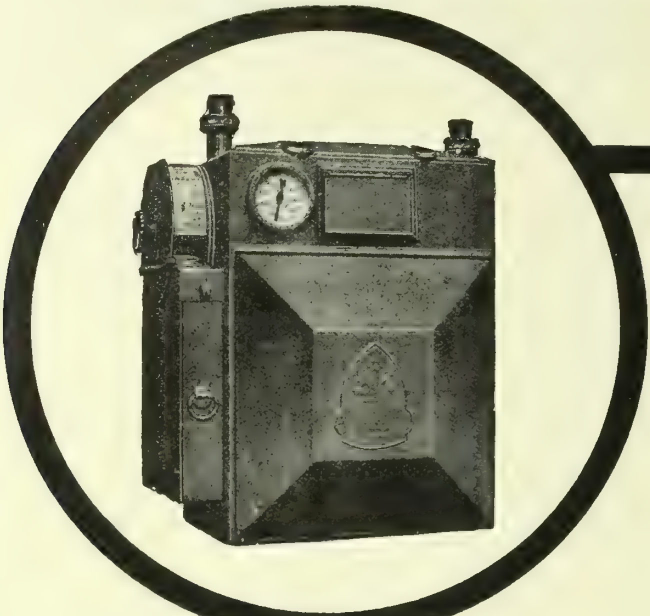
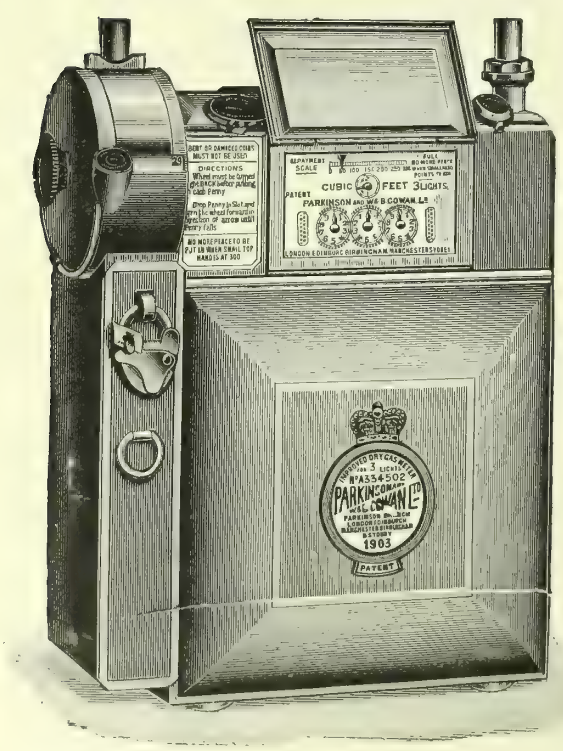




JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2481.——TUESDAY, NOVEMBER 29, 1910.

EDITORIAL NOTES—GAS, &c.

Publicity and Otherwise.

FROM time to time, intelligence as to what is being done in connection with the formation of a Gas Publicity Committee leaks out in a sort of informal way; and we would suggest, with the best desire at heart for the movement, that, in such a matter as this—in which above all things interest has to be aroused, and sympathy and support have to be obtained by cultivation processes—the fullest use should be made of publicity as to the progress of the movement. This is of greater moment than a tight compliance with archaic routine, or a temporary fear of letting the electrical people know what is being done. They will know all about it in time; and the more important thing is to get a compact adherence of the gas industry to the movement at the earliest possible moment. Otherwise we shall be going but slowly in this matter; and there will be a repetition of the well-precedented sluggish and driblet flow of the necessary funds. Publicity! The active spirit of publicity must be infused into the whole movement from beginning to end if the object is to be attained. But this active spirit has not displayed itself with any undue prominence so far. The resolution that the matter of systematic and national publicity and educational work should be taken in hand was passed last June. Six months have winged their way; and there have been a couple of leakages of information as to what is being done. This is surely not the way to arouse enthusiastic support for a cause that business competitors have forced the gas industry to take up. If Mr. James W. Helps had not spoken at last week's meeting of the Society of British Gas Industries, the knowledge might not have been public property even now that the Council of the Institution of Gas Engineers have lately formed themselves into a Publicity Committee, and have invited certain influential gentlemen to join them, and certain gentlemen whose counsel, it is believed, will be particularly welcome. When making the announcement, Mr. Helps prefaced it with the remark that he "did not think he was betraying any confidence." This is a matter for publicity—not one for secrecy, and subject to strict governmental routine. That is the procedure to kill in a case of this kind; and the less there is of it the better.

Mr. Helps is thanked for breaking through the bounds of the decorous observance of Institution tradition, and giving the information that, in this matter of publicity, a starting-point has at length been reached. If it had not been for him, knowledge as to what had actually been done might still have been confined to members of the Council, their personal confidants, and the offices of the Institution. We do not suggest that immediate publicity should be applied to all matters that come before the Institution; but this is certainly one in which publicity is the soul of the whole thing. Let there not be any idea there is any antagonism concealed in these remarks. We are only putting into words views that are now widespread in the gas industry—that, unless there is more activity, more mobility, more spirit put into this scheme than is sometimes conspicuously evident in matters taken up by the Institution, then the project will be worse than useless. We are at the starting-point of this fresh enterprise; and now is the time for all to realize that ordinary Institution procedure will not apply, and must not be applied, to it. It is a commercial matter, and not a technical one; it is a fighting matter, and not one that can be controlled with the quiet calm, subject to periodical supervision and instruction, of technical research. It is an altogether different matter. Six months have passed; and the Committee has just lately been appointed!

But what of the future? From the Committee is there going to be selected an effective and active working Committee, with plenary powers, so that they can act promptly as and when occasion requires? Or are their movements and spending powers to be subject to the regulation of a large body of gentlemen scattered so far apart that, however willing, active, and competent as individuals (and we know them to be all this), they are collectively as splendid a specimen of immobility as can be found? Perhaps it is thought that having such an extensive representation on the Committee, including the District Association representatives, will be an excellent thing from the three points of view of "bringing "home" to gas boards and committees the necessity of doing something in the way of a joint propaganda and protection scheme, of stimulating the flow of the necessary funds, and of sustaining interest in the matter. From these points of view, the appointment is incontestably good; but beyond that there must be a small active body, invested with plenary powers, to deal promptly with such matters as the recent misleading letter from the Electricity Publicity Committee regarding the lighting of London (which was sent broadcast to the newspapers through the country), and as the article on "The Ideal Day Nursery" by Lilian Whitling, appearing in "Every Woman's Encyclopædia," sample copies of which have been delivered free from door to door in some districts. Lilian Whitling writes:

> In conclusion, the ideal artificial light for the ideal nursery is electric light; but if this is unattainable, provide wall-lamps with metal reservoirs—not glass or china—and a safety apparatus for extinguishing the flame if the lamp overturns. Use the best oil, and have the lamp fixed in a strong holder on the wall out of the children's reach. Gas, though clean and most convenient, vitiates the atmosphere, and is therefore most harmful for the children's room.

There is a statement, based on lamentable ignorance, that will probably meet the eyes of thousands upon thousands of mothers in the country; and it is a matter against which protest should at once be made to the publishers of the Encyclopædia from an authorized Gas Publicity Committee, and the contradiction advertised in the advertisements in popular papers circulating among the mothers of the country. Matters of the nature of the two quoted for illustration are not of a kind that can leisurely wait for attention until the next Council meeting.

However, these are points that may have already been discussed and legislated for by the Council. But there is no information as to what is being done; no information of which use can be made in stirring up interest in what is being done, and in showing that the work is being entered upon with the requisite enthusiasm. This is a cause in which all in the gas industry are concerned; and let us make them feel that this is so. How is this best to be done? The answer is by Publicity, and that frequently.

Society of British Gas Industries.

THE paper read by Mr. Fred. J. West, the Chairman of the Council of the Society of British Gas Industries, at the meeting of the members last Tuesday, was a very appropriate contribution at a time when we are about to leave behind the first decade of the new century, and to enter upon the second one. The contribution was composed of retrospect and prospect in relation to the affairs and opportunities of the Society; and it should be the means of inspiring the members to attempt—good and useful as the work of the organization has been up to the present—to expand still further its serviceability. The power and the capacity are there; they only want developing. Among those who have taken very personal interest in the Society, though not qualified for membership, has been—and no one more so from the very first—Mr. James W. Helps; and he acknowledges that not only has the Society manifested its usefulness, but it has proved its indispensability. That is testimony, together with Mr. West's review, and points raised in the full discussion upon it, with which there is naturally no small amount of gratification on our part, in view of the fact that the original suggestion for the formation of the Society was made in an editorial article in the "JOURNAL" for Dec. 6, 1904 (p. 755); this being followed by

others that were, as acknowledged at the time, of assistance in establishing the Society.

The proposal was at the time looked at askance by many; and a short life was predicted. Why, we always failed to appreciate. But what was anticipated by those who were to the fore in the promotion of the Society—thus declaring their confidence—has come true. The organization has fashioned for itself, unaided, an honourable status, with a foundation firmer to-day than ever. It is accepted by the Institution and other organizations of the gas industry as being on equal level in its representative capacity of a section of the industry that before was unrepresented; and as such the members of the organizations meet upon common ground. For the members of the Society themselves, combination has provided a platform, a means for negotiation and for the exercising of a united influence, and it has enabled them to bring into stronger relief a side of their work that in previous recognition was relegated very much to the rear of the trading part of their business. Their very trade, their very existence, depends absolutely upon their technical progress, which must have for propelling power technical ability. The Society has enabled this side of the work of our manufacturers to be projected into better view; and the members have the right to claim that it shall receive further recognition at the hands of the gas-supply industry. The point was well made by Mr. West in the course of his paper when he said: "We can claim, without fear that "anyone will come forward with any well-founded denial, "that we have done an extremely good part, through our "work as manufacturers, in advancing the interests of the "whole industry. And we would that this side of our "operations, if I may venture to say so, as manufacturers, "and as contributors to the improvement of apparatus and "producers of economy, were given prominence equal to "that of the fact that we trade."

However, the record of usefulness, in paper and discussion, is highly satisfactory. It has shown how a society of the kind, with proper handling and direction, can be made to gradually develop in work of value not only to the members, but to the industry of which the operations of the members form part. In a portion of the work that the Society has accomplished, the members have recognized the interdependence in the matter of prosperity of the gas-supply industry and of the section devoted to the manufacture of the means of gas production, purification, storage, distribution, and use; and the more this feeling permeates and actuates, the greater will be the prospective broadening of initiatory, co-operative, and auxiliary work. Mr. West has pointed to the ways in which lie new usefulness of direct and indirect importance; but we will not—indeed, there is no necessity to—discuss them here. But there is in paper and discussion matter that can form the base of recommendation on the part of the Council; and it is to be hoped that the latter will not allow the suggestiveness reposing in paper and discussion to be left entirely to take care of itself. Professor Arthur Smithells succeeds Mr. Balfour Browne, K.C., in the presidency; and Mr. West, as Chairman of the Council, will find in the President one who will countenance any and every means of developing the proved serviceability of the Society to the members and to the gas industry at large.

Gas Legislation Next Session.

The first basis on which some estimate can be framed as to the character and quantity of the projected private gas legislation for next session is now before us; and in neither respect is there anything particularly thrilling in the information. All told, there are only thirteen Gas Companies applying through Bills for powers of varied description; and ten Local Authorities—the gas proposals of the latter being sandwiched for the most part among many other provisions referring to different matters. But in Gas Provisional Orders there is quite an enthusiastic outburst; the Board of Trade being invited to give their consideration to no less than twenty-one (of which four are introduced in relation to separate towns by the Holyhead and North Wales Gas and Water Corporation, and the Local Government Board to four. Under the Private Legislation Procedure (Scotland) Act, there are two measures alluding to gas.

To the extent that the notices of these measures enable us to judge of their several lineaments, there is nothing about them that raises any great expectations as to interest or striking contest. If at the present stage we were asked to name the two measures that will incite most general interest, there would be no hesitation in pointing to that of the Gaslight and Coke Company (providing for the amalgamation of the Barking Gas Company and the Chigwell, Loughton, and Woodford Gas Company) and to that of the Corporation of Salford. Editorial allusion was made to the former last week; and as to the latter, it is intended once more to try the parliamentary wheel of fortune, and ascertain whether good luck will now favour. The Bill will deal primarily with the new gas-works scheme; and, *inter alia*, with the application of revenue and the allocation of profits. This brings to mind the happenings of the session of 1909, when Parliament issued the first warning, through the Salford Bill, to municipal authorities in regard to the abuse of the power to apply gas surplus profits to the rates. The caution took the form of placing upon Salford a limitation to profit appropriation. Salford was amazed, Salford protested, and Salford eventually dropped the Bill in sheer disgust, in the hope that something might occur to enable them to continue to enjoy the right of lifting an unrestricted sum from the gas consumers' pockets, and of distributing it among the ratepayers generally. But Parliament last session refused to allow any profit appropriation whatever in at least a couple of cases; so that from the point of view of the attitude of Parliament, the position of Salford has not improved. However, in 1909, some of the outside areas were opponents of the Corporation on this question of profit-taking for the benefit of Salford ratepayers; and with these outer authorities there has since been an amount of parley by the Corporation, with the result that some sort of agreement has been arrived at. No doubt this accounts for the clause in the notice stating that one of the proposals will be "to make provision with respect to the application of the "revenue derived by the Corporation from their gas under-"taking, and with respect to the allocation of the profits of "that undertaking, and to vary the existing provisions re-"lating to the revenue of the gas undertaking, and the "application thereof." There will be interest in seeing what the plan actually amounts to that encourages the Corporation to come to Parliament again; and it will be a further matter of interest to see whether Parliament will be induced to confirm the provisions as presented, if they are in any way at variance with the decision of 1909. It is hardly likely they will conform.

Looking down the names of the Gas Companies who are applying to Parliament, it is a point of interest that such a large proportion are of minor rank in regard to dimensions who are seeking to bring themselves under the control, and to obtain the privileges, of parliamentary powers. Enlargement of capital, extension of areas, new works powers, and the hundred-and-one customary matters that are legislated for through Gas Bills and Provisional Orders in these times, are shadowed out in the notices. The march to uniformity of gas testing is to be continued. We have seen that Bills and Provisional Orders in which, wholly or partly, gas affairs are dealt with number nearly 50. It is difficult, however, with the meagre information imparted in the notices, to speak definitely, but anyway we can trace at least 26 companies and local authorities who are going, if their Bills do not suffer defeat on other grounds, to obtain sanction to the use of the "Metropolitan" No. 2 burner; and half-a-dozen are local authorities—including Halifax, Rotherham, St. Helens, and Salford. The successes of stand-by clauses in the last two sessions are bringing in a larger number of applications for the protection. In Bills and Orders, there will be—at any rate there are the indications in the notices—at least eight cases in which such clauses will appear—viz., Halifax, Rotherham, and St. Helens Corporations, and the Barnstaple, Enfield, Luton, Petersfield, and Swansea Gas Companies. The last-named Company are going to ask to be allowed to impose a minimum charge where gas is used merely as a stand-by to electricity.

The right to charge differential prices is being sought in certainly two cases—Belfast and Hythe; while the Preston Company are, in connection with public lighting, desiring an amendment of their 1865 Act, so that the charge for gas for public lighting shall be at a price equal to the lowest charge to private consumers for illuminating purposes. Certain Gas Companies will again seek electricity powers; and the Swansea Company are proposing to incorporate a scheme of profit-sharing. The Enfield Company are going to ask for a redemption fund. The Gaslight and Coke and Brighton cases are precedents for limited powers in this regard. In

the suggested extension of their areas of supply, at least a couple of companies will seek to absorb small concerns—the Uxbridge Company taking in the Amersham works, and the Chesham and District Company the Wendover Syndicate's undertaking. Purchase schemes by local authorities are not of very notable importance. The Bedwellty District Council will seek to absorb the Tredegar Gas and Water Company, Limited, the Blackwood Gas Company, and part of the undertaking of the Mynddyslwyn District Council; the Bicester District Council will seek to be allowed to acquire all the existing gas interests in their administrative area; the Chipping Norton Corporation are desirous, by acquiring the local gas-works, of removing the identity of the Mid-Oxfordshire Gaslight and Coke Company with the town, and to close that instance among many of questionable promotions; and the Margam District Council, being anxious to become the owners of the gas-supply rights in their area, are desiring to be empowered to purchase the part of the Aberavon plant lying in the district.

From all of which it will be observed that the indications for next session do not sanction any prophecy as to elevated interest in respect of gas affairs in the first session of the first Parliament of King George V.

A Politic Agreement at Liverpool.

It is distinctly in the interests of the gas industry at the present time that it should be made abundantly clear that the terms of the agreement between the Liverpool Gas Company and the Corporation, which has fortunately resulted in a *rapprochement* between these bodies, has no special significance in relation to the Standard Burner Bills, but covers outstanding matters of the past, and an understanding of prospective importance. It will be remembered that the Corporation and the Gas Company have been brought into collision not only over the Standard Burner Bills, but in regard to a claim by the Company concerning back-passage lighting. Proceedings in the High Courts in relation to this matter for the purpose of obtaining a judicial opinion were reported in the "Journal" for April 26 and May 10 last; and completion is given to this particular story by saying that the agreement that has been entered into provides for the reduction of the claim in respect of the back-passage lamps by one-half, the parties paying their own costs. According to our report of the legal proceedings, the claim amounted to £5063 for work done and material supplied. This matter is definitely determined by the agreement. The opposition to the Standard Burner Bills on the third reading was also to be withdrawn; and there are mutual understandings as to the future.

The main head of the agreement is the concession on the part of the Company of a reduction of 2d. in the price of gas as from March 31 next; and this reduction is to continue for two years. Of course, the interests of the shareholders have been fully protected, as is necessary in these days of a perennially agitated and uncertain coal market. The condition attached to the reduction is that the price of gas may be advanced or decreased by 1d. per 1000 cubic feet, for every shilling rise or fall as the case may be in the price of coal. There is precedent for this in the bargain effected in the session of 1909 between the Alliance and Dublin Consumers' Gas Company and the Dublin Corporation. The arrangement was explained in our "Notes from "Westminster" on July 13 of that year. During the two years that the terms as to price are to be maintained in Liverpool, the Company are under promise not to allow the illuminating power of the gas to fall below 18 candles, tested by the flat-flame burner. It will be seen from this that there will be a deferment of the Company's farewell to the antiquated testing condition; but this will not greatly matter for a period. The main point is that the Company are in possession of the new standard test-burner, and will be entitled to its use at the end of the term of the obligation here referred to. Moreover, they have straightened out their differences with the Corporation. There is value in this. The period, too, of relief from unnecessary and burdensome restriction is within measurable distance; whereas previously the Company appeared to be bound by unyielding chains to conditions that restricted the progress made otherwise possible by scientific achievement. We are satisfied that, under all the circumstances, it is a politic agreement that has been entered into; and it will be seen that the Company's participation in the Standard Burner Bills forms only one item in the arrangement.

Applications of Gaseous Combustion.

In his lectures to students and juniors, Dr. Harold G. Colman has the faculty of giving much information in narrow compass, and so impressing upon the mind the essentials of his subject. The lecture he delivered to the London and Southern Junior Association on Friday evening was no exception to the rule that he has established in this respect. The lecture was the sequel to the one delivered to the Association last session. Then he treated of the development of high temperature by combustion from the theoretical point of view. On this occasion, he dealt with the applications of gaseous combustion, taking the two appropriate illustrations of the heating of retort-settings and the development of the luminosity of the incandescent mantle. The greater portion of the lecture was devoted to the former subject; and, in the opening part, Dr. Colman gave a digest of the elementary actions that occur in the heating of a gaseous-fired retort-setting. But this was succeeded by a section that contained several golden rules which, being safely incorporated in the students' knowledge, and carefully observed in practice, will enable him hereafter to maintain an efficient control of the heating of the retort-settings that may be confided to his care. In the control of the heating of retort-settings, there are many pitfalls to be avoided; and unless there is careful attention to these, altogether wrong conclusions may be drawn, and the responsible manager or assistant may be inadvertently resting in the comfortable assurance that all is well, while the contrary may be the case, though gas production and fuel results may before long indicate this to be so. Loss is always to be regretted; and therefore it should be regarded as a matter of duty by every student to have the precautions set forth by Dr. Colman so well within memory that their neglect will be almost an impossible matter. The lecture concluded with a statement as to the necessity for high-flame temperature for lighting by means of incandescent mantles; and those among the members of the Association who did not understand the need to-day for higher pressures than formerly obtained cannot fail to do so now.

Practical Experience and Examinations.

There are not a few people who question any genuine value of set examinations as a test of real qualification and capacity, and in some degree the doubt attaches to the City and Guilds examinations in gas manufacture. At the same time, we should be sorry to see the fact have any detrimental effect, as examinations and certificates are in many cases excellent incentives to study. The City and Guilds pass lists are full of illustration of young fellows with both practical experience and technical education being placed, as a result of examination, on no higher plane than smart youths whose class attendance and whose book study (without ever having had soiled hands in doing the daily round in the various operations of a gas-works) have enabled them to get through. From a statement made by Mr. James W. Helps, at the meeting of the Society of British Gas Industries the other night, it seems the Council of the Institution of Gas Engineers have had under consideration, the question of whether or not it would be possible to alter the form of questions set in the City and Guilds gas examinations. But there is the difficulty of practical experience often counting for nothing more in the examination result than class and book study. It is a question, and a troublesome one, as to how this can be obviated under the present system. There are other matters for consideration. One is this, that, in certain recent examinations, it has been quite possible for a young fellow who has only had experience in the chemical department of a gas-works or in the drawing office to get the necessary marks entitling to a certificate for the questions he answers as another who has been through the whole processes of a gas undertaking side by side with the ordinary workers. There is no difference in the value of the certificates; and, from this point of view, there is a very real grievance. An all-round practical knowledge combined with an understanding of theory and principles ought to give a young man in an examination a position superior to the class and book student, or the man with practical knowledge of only one branch of a gas-works operations—derived (say) through the chemical department or the drawing-office. To bring about a revision that will secure justice is unquestionably a difficult matter; but it is one that is worth broad and full discussion by those (and there are many) who are qualified to speak.

The Eviction.

The high-pressure gas-lamps are now fairly in the home of West-end electric lighting, though the scheme is not yet quite completed. But as the street electric lamps are removed—flame arcs and their older pale-faced companions hereabouts—the high-pressure inverted-burner lamps take their place. Passing through Victoria Street, Parliament Square, Parliament Street, and Whitehall, the new lamps have already restored gas to the birthplace of public gas-lighting—Pall Mall, to part of Regent Street, Piccadilly Circus, and other places in the vicinity. The change will now soon be finished. The steady, constant, soft light, and the well-distributed illumination, attract much notice; and now that the electrical critics of the action of the Westminster City Council in adopting this large scheme of modern gas-lighting, who wrote the word "retrograde" large and often in their comments, have seen the new lights of various powers, perhaps they will explain how the expression fits the actual thing. The fact of the matter is that, in their wrath, expressions were allowed to slip that were a very fair measure of their knowledge of the subjects of their animadversion or of their malevolence. As we were saying, the new lamps shed a soft steady light about them, and, as one walks along, the eyes are not tortured by these lamps as they are, for instance, by the few plain globed flame arcs at the Charing Cross end of Whitehall. This means of trying to get more lighting effect out of flame arcs, causes much eye irritation; and we cannot imagine why these exposed flame arcs are allowed in the City of Westminster, and in a thoroughfare in which there is so much vehicular traffic—among it motor and other buses with crowds of passengers on top.

Coronation Illuminations and Electrical Fire Risks.

The introductory paragraph of "Electricity Supply Memoranda" this week refers to the question of illuminations during the Coronation celebrations next June. Since it was written, we learn that the Chief Officer of the London Fire Brigade has made certain suggestions to the Fire Brigade Committee of the London County Council, which the Committee in turn have recommended for adoption by the Council. The suggestions refer to fire risks from electrical illuminations; and it is desired by the Committee that the suggestions should be as widely known as possible. We have pleasure, in the public interests (of course, no other), in assisting in the laudable object in view. It is right that the Committee should take this early opportunity to make their monitory suggestions, in order to minimize the possible risk of disastrous fire during the Coronation. They did the same thing at the time of the Coronation of King Edward in 1902; and certain calamities since then associated with electrical installations have no doubt impressed the Chief Officer of the Fire Brigade with the necessity of emphatic warning and instructions on this occasion. It is proposed that all electrical illumination installations should be inspected and tested before being brought into use; and then there follows a list of precautions that should receive very careful attention, and which are based on experience obtained in connection with theatres, music halls, exhibitions, &c. The recommendations are for the protection of the public and property. There is no doubt that the Chief Officer and the Committee regard the matter very seriously. They recommend that their instructions should be sent to all the local authorities and companies supplying electricity in London, and also to the newspapers which deal specially with electrical matters. This is part of the duty of the "Journal;" and therefore the report is reproduced in our news columns.

Railway Companies and Private Waggons.

There has been a growing tendency among gas undertakings and traders generally to become possessed of their own railway waggons for the transit of coal and other material and goods; the objects, of course, being convenience and freedom, and reduction of rates that would have to be paid if the Railway Companies' waggons were used. But having purchased waggons, the final word (the Court of Appeal has said) as to whether or not they shall be used, does not rest with the owners, but with the Railway Companies. Mr. Balfour Browne, K.C., President of the Society of British Gas Industries, called attention, in a speech at the annual dinner of the Society last Tuesday, to the seriousness of this matter to traders owning railway waggons. He had been arguing the question, as leading Counsel for Messrs. Spillers and Bakers, Limited, before the Master of the Rolls and five Lords Justices as against the Great Western Railway Company. The claim of his clients was to an unlimited right to tender traffic for conveyance in their own waggons, and to the rebate provided by the statute for the use of owners' waggons. But the Railway Company disclaimed all obligation to accept loaded waggons for conveyance, or to make any allowance or rebate when they did so. What the Court found (supporting the Railway Commissioners) was that the Railway Company were bound, as a reasonable facility, to carry or convey Messrs. Spillers and Bakers' merchandise in their private waggons whenever a sufficient number of suitable vehicles were not from time to time provided by the Railway Company for the purpose; but otherwise they are not so bound. This means, in other words, that, to be on the safe side, a manufacturer receiving or sending away goods, and who possesses his own waggons for the purpose, must first ascertain whether the railway company will accept his waggons or prefer to provide their own. This power of the Railway Companies, now that such a large investment has been made in private railway waggons, is really, as Mr. Balfour Browne says a most serious matter. He places the investment in private waggons at no less than £15,000,000; so that he has not by any means exaggerated the importance of the question.

PERSONAL.

Mr. C. B. Tully has recently been appointed Engineer and Manager of the Hythe and Sandgate Gas Company.

The Directors of the Liverpool United Gas Company have appointed Mr. Edwin Upton, the Borough Accountant of Bootle, Treasurer of the Company, in succession to Mr. J. F. Robinson, who will relinquish the position at the end of the year. Mr. Upton has been in the service of the Corporation from boyhood, and succeeded the late Mr. George Milne in 1901.

After having been home since May last, Mr. Philip Holmes Hunt, the Chief Engineer of the Metropolitan Gas Company of Melbourne, commenced (with his wife) his return journey to Australia last Sunday, by travelling to Paris; and Thursday will see his departure from Marseilles by the Orient liner "Osterley." We wish him most sincerely *bon voyage*, health, and continued abundant success in his professional work in Melbourne. Since the home-coming, Mr. Hunt has had few idle or leisure hours. This is the first opportunity he has had since he left England in 1903 to return home, and so to come into immediate contact with gas affairs and practices here. The technical and commercial circumstances of the gas industry have undergone a remarkable change since the year named; and while the greater part of the months at home has been monopolized in studying and critically inquiring into the applicability of the vertical retort systems to Australian conditions and coals, Mr. Hunt has found the position of commercial gas matters of such a character as to absorb the balance of the time at his disposal. The value of a periodical visit of this kind to England of the chief adviser of a large Company so far removed as is Melbourne from the activities of technical gas development cannot fail to be of inestimable value to the interests he serves. During his visit, Mr. Hunt has been received, and has had information most liberally placed at his disposal, by his professional colleagues. As will be seen from our "Correspondence" columns, he felt he could not leave these shores without tendering to one and all of the professional friends referred to his sincerest thanks for their uniform kindness, which has been much appreciated, and has added greatly to the pleasure and value of the visit.

Mr. Alfred Bonham-Carter, C.B., formerly Referee for Private Bills in the House of Commons, who died on the 2nd ult., aged 85, as already noticed in the "Journal," left estate of the gross value of £49,367, with net personalty valued at £49,042.

In accordance with the announcement already made in the "Journal," the first of the series of Cantor Lectures on the subject of industrial pyrometry was given at the Royal Society of Arts, by Mr. Charles R. Darling, on Monday last week. He began by dealing with the early attempts made to measure high temperatures, and directed attention to the researches of Sir Isaac Newton, which were limited to temperatures recorded by the ordinary thermometer. Wedgwood's pyrometer was the first instrument for measuring furnace temperatures. Early forms of thermo-electric pyrometers were described, and the uses of pyrometers in the manufacture of pottery, glass, iron and steel, coal gas, &c., explained. Last night, the lecturer dealt with the laws of thermo-electricity and the thermo-electric pyrometers of Le Chatelier and Roberts-Austen; and next Monday he will discuss the laws of resistance to electricity, describe the Siemens and the Callendar pyrometers, and explain the special uses and limitations of resistance pyrometers.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 670.)

THINGS on the Stock Exchange last week, without being deeply agitated, were nevertheless swayed backwards and forwards a good bit. Happily the final swing of the pendulum was favourable. Apart from elections and labour troubles at home, unrest in Central and Southern America and a sharp tightening of money were the chief centres of disturbancs. Business was far from brisk. The opening on Monday was fairly good, with rather more activity and markets mostly firm. Government issues were strong, and Consols remained steady. Railways were in demand at advanced figures, and the Foreign Market was supported. But Americans began to lose strength. Tuesday was not quite so bright. Consols lost $\frac{1}{8}$, Rails were slightly lower, and the Foreign Market irregular. Business on Wednesday was on a very reduced scale, and markets were overcast. Gilt-edged issues gave way before the advance in money, and Consols receded $\frac{1}{4}$, while all the leading departments were weaker. There was hardly any increase in activity on Thursday, but the prevailing mood was not quite so heavy. Government issues were rather better; and Consols were firm. Railways looked up a bit; but Brazilian worries troubled the Foreign Market. Friday brought a nice change. Cheapening of money and more reassuring news from across the Atlantic were rays of light. Consols rose $\frac{1}{8}$, Rails were hopeful of a labour settlement, and things were better generally; but before the close realizations took the cream off the better prices. Saturday was very quiet, but the tone still good. Consols were unchanged. In the Money Market, a strong demand and harder rates ruled at first, but later on there was a marked relaxation of the stringency. Business in the Gas Market was rather humdrum, devoid of any particular characteristic, and with little change in values. The few movements noted were in the upward direction, except one—viz., Alliance and Dublin. Since this Company obtained new statutory powers, its stock has been subjected to strange shifts in price which are not easy to understand. In Gaslight and Coke issues, the ordinary was pretty busy at the unchanged limits of 105-6. Hardly anything was done in the secured issues. The maximum marked 87 and $87\frac{1}{2}$; and the debenture from $80\frac{7}{8}$ to $81\frac{1}{4}$. South Metropolitan was quiet and unchanged at from $121\frac{1}{2}$ to $122\frac{1}{2}$; and the debenture marked 81. In Commercials, there was one bargain in the 4 per cent. at 107 (a rise of 1), and one in the $3\frac{1}{2}$ per cent. at 103. Among the Suburban and Provincial group, Alliance and Dublin was put down $4\frac{1}{2}$, ditto debenture marked 97, Bournemouth preference $15\frac{1}{4}$, British $44\frac{1}{4}$ and $44\frac{5}{8}$, and South Suburban debenture 123—a rise of 1. In the Continental companies, Imperial was very sparsely dealt in at from 185 to $185\frac{3}{4}$, Union changed hands at $88\frac{1}{2}$, ditto preference at 139, and European fully-paid at from $23\frac{3}{4}$ to $24\frac{1}{16}$. Among the undertakings of the remoter world, Buenos Ayres debenture realized $97\frac{1}{2}$, Primitiva from $7\frac{5}{16}$ to $7\frac{7}{16}$, ditto preference from $5\frac{3}{16}$ to $5\frac{5}{16}$, and ditto debenture 98.

ELECTRICITY SUPPLY MEMORANDA.

Coronation Illuminations—Benevolent Landlords—Scheme for Fulham Flats and Other Small Property—Photometry and Public Lighting—Heating and Cooking and Wiring and Meters—Capital Costs, Heating and Cooking—Hastings Guardians in a Tight Corner.

BRITISHERS and people of most other nations like to signalize their pleasure, at periods of special public rejoicing, by, among other things, a plentiful display of light. Light and rejoicing harmonize. Suppliers of the means of providing light will be looking forward now to the Coronation festivities next June; and gas-supply authorities will be already hoping to get a fair share of the business in decorative work that will then be going. Some of the suppliers of electricity have already announced their intention of providing current for the illumination of premises at low rates per unit, and are already booking-up orders for connections. They want to be betimes in ensuring that they shall have a respectable showing in the displays. Gas suppliers will also see to it that the terms they offer for gas will also ensure gas taking a fair part in the national rejoicing. For the outlining of extensive buildings, electricity has an enviable convenience; but both in outlining and in illumination devices, gas tubing and jets require a lot of beating for cheapness and effect. The time has come for gas suppliers to make their arrangements, so that the rival illuminant does not score unduly through being early in the field. A little cautionary advice, in view of the fire risks attaching to electrical installations, has been made by the Chief Officer of the London Fire Brigade, in anticipation of the decoration of buildings by electrical means during the Coronation. The matter is referred to elsewhere in this issue.

Under all the new systems of mushroom growth and decay for supplying with electricity the tenements or houses of the comparatively poor, the landlords are expected to rise above the common level of human nature, and to take an actual and not an assumed benevolent interest in the tangible blessings that the electricity suppliers proclaim that they are conferring. But landlords are landlords, and are very human indeed—at least, so experience has taught us. Among landlords with whom we have been brought into contact, not one is known who would say that he was willing to raise the rent of his cottages or tenements (say) by 6d. a week in order to give his tenants a light by electricity of so mean an amount that they would be inclined to spend most of their time in the streets where the units of light are of considerably larger value, or in the nearest public house, to escape the misery of a bad light at home. Nor do we know of a single landlord who would become responsible for the collection of any fixed price per week for electricity. Nor, again, do we know any landlord who would take upon himself any guardianship of the wiring, lamps, and apparatus in empty houses. Why should he? It is more likely than not that a landlord would say, "I am not going to jeopardize the letting of my houses by making the use of electricity compulsory; nor am I going to act without remuneration as collector for the electricity suppliers; nor am I going to take upon myself any responsibility for the wiring and fittings." If the business in these small houses is worth having by the electricity suppliers, then why should the landlord save them the cost of collecting the revenue, or why should he remove from them the responsibility of looking after their own property, by and through which they do the business? It passes our comprehension what electricity suppliers are thinking about to suppose that landlords are so benevolently inclined that they will relieve the electricity undertakings of the trouble and expense of collection, save them capital costs, and act as surety for the fittings left in his houses. Next we shall be having the butcher, the baker, the greengrocer, the publican, and others all seeing whether they cannot run a little business in the same way through the landlord of such property. The idea is all right from the point of view of the vendors of any commodity, if landlords can be found who are fools enough to fall in with it.

Under the fixed price per light scheme, the landlord is expected to be generous with the sole view of extending the custom for electricity; under the Eccles scheme recently noticed, he is expected to be the same; in a similar piece of one-sided enterprise at Fulham, he is expected to give his consent to the wiring being done, sign the application form, and accept responsibility for damage to the fittings whenever the house is empty. Again we ask, why? Judging from the amount of damage to prepayment gas-meters, and the extent of robbery of gas-fittings from empty houses, the landlords (who took upon themselves the responsibility) would have to seriously consider which would be the cheaper—to run the risk of damage and loss, or mount a guard over the empty premises. The proposal of the Fulham Electricity Department is to provide—the landlord giving consent, and taking responsibility for the property during the time the house is empty—a complete installation free of cost to the tenant, and charge through prepayment meters at $5\frac{1}{2}$d. per unit; the ordinary rate being $3\frac{1}{2}$d. per unit, less 5 per cent. discount for cash. The difference is great; but possibly it is felt that the tenant will be sparing in his use of the current. The allowance for renewals is six lamps per annum in a ten-light installation. The wiring work is carried out through local contractors; and the manner in which one technical paper speaks of what is being done regarding fittings being bought in large quantities by the Council, leads us to imagine that the railway companies, carriers, and others are having a busy time in connection with the transport and delivery of electrical fittings in Fulham.

The question as to how the Holborn Borough Council will test the trial street lamps in Gower Street is, as we were showing recently, sadly vexing to the soul (assuming that it has one) of the "Electrical Times." After the last say of our contemporary on the subject, Mr. Kenelm Edgcumbe wrote blessing the paper for the attitude it is taking, and supporting it in the objection to a photometrical test; the grounds of which objection do not seem altogether clear. There is a good deal that is inconclusive and vague in the attitude of our friends. Just before the original objection was published, the "Electrical Times" was anticipating that every street authority would call the photometer to its aid in settling questions pertaining to the efficient illumination of the streets. Now it hopes that every street authority will do nothing of the kind. It seems to Mr. Edgcumbe that to deal with candle power at all is to beg the question, which is, after all, one of illumination, and not of candle power—the latter being merely a means to an end. But "Meteor" was only lately saying: "The illuminometer method has its drawbacks. In principle, the photometer may be preferable; but in a street-lighting contest, the conditions are very different from those of the laboratory." Then what are the Holborn authorities to do with the photometer all right in the laboratory but not in the street, and the illuminometer method possessing serious drawbacks? Are they to depend upon the results of tests by the capricious eyes of the borough councillors when reading their evening papers at certain distances from the lamps? What between the assertions of Mr. Edgcumbe and the photometrical nescience of "Meteor," the borough councillors, if they look in these directions for counsel, will be in a quandary. Mr. Edgcumbe's main objection to the photometrical test appears to be the two angles for making candle-power measurements adopted in the Westminster penal tests—viz., 20° and 50°. He holds that the curve of light distribution given by almost any of the modern street lanterns will show the futility of the test. "It is no uncommon thing," he writes, "to find a curve in which an error of as little as 4° or 5° in the determination of the angle at which the light is measured, makes a difference of some 50 per cent. in the candle power." That is not saying much for the distribution efficiency of the lamps concerned. An answer to Mr. Edgcumbe is found in Mr. Jacques Abady's

paper before the Institution of Gas Engineers. "It so happens," says the author, "that if the lighting curves of all types of lamp are examined—electric and gas, arcs, filament, upright and inverted mantles (high and low pressure)—it will be found that, in the majority of cases, the mean of the light given at 20° and 50° practically coincides with the mean hemispherical intensity, and therefore represents the value as candle power." Mr. Edgcumbe not, we think, question the competence of Mr. Abady in matters photometrical. Then what has he to say to the quoted statement? Electricians have hitherto been fond of the mean hemispherical candle power. But to arrive at the mean hemispherical reading of a street-lamp *in situ* is a very cumbersome, tedious, and time-absorbing method, and would be impracticable for the lamps in a large district. The angles adopted in the Westminster test, on the proof of a comprehensive set of lighting curves, offers something that may be taken as practically being coincident with the mean hemispherical candle power.

Cold weather; and gas authorities are fixing gas-fires at a rate that cheers, but does not inebriate. Electricity suppliers are fixing electric radiators at a sluggish rate; and when the subject is touched upon in the electrical press (which is a conspicuously infrequent occurrence in these times), the writers talk as though they were not quite *compos mentis*. In one of our electrical contemporaries the other day, there was a paragraph in which the writer bemoaned the cost of wiring and placing meters specially for electric radiators; and he finished up by saying: "Once the heater or cooker is installed and at work, the consumer will be the first to admit that it is well worth the cost and the trouble." This statement does not accord with experience. What the consumer really finds is that the radiator using a unit or more of current per hour is next to useless for heating a room; and consequently gas authorities are compelled to relieve the miseries of the users by displacing radiators and putting in gas-fires. This does not look as though electric radiator users consider them as being worth the cost of the wiring and meter-rent. But they do consider it well worth something to get rid of radiator, wiring, and meter, and have gas pipes and a fire that will render good heating service, put in their place. As to the use of electric cookers, inquiries through an extensive neighbourhood fail to discover in use a single specimen of these curiosities. Even the poor dwellers in certain habitations provided by the benevolent Marylebone Borough Council (which dwellers are apparently compelled to use small power metallic filament lamps as one consideration for being permitted to tenant these places, and so forfeit the right of ordinary British householders to choose their own illuminant), cried aloud against being deprived of their gas-cookers, and did not look upon the electrical makeshift as having any countervailing virtue. Actual conditions do not confirm the statement that householders admit that the installation of the electrical cooker is well worth the cost and trouble. Electricity purveyors, however, admit the inefficiency of electricity for cooking and heating by offering it at 1d. per unit, and ½d. per unit is spoken of as having made its appearance here and there for these purposes. But why need electricity people worry about wiring and meters for radiators and cookers just at present; for is not the good time coming when, according to the prophet Ferranti, electricity will be delivered from the pithead into every street of the country at an average price of ⅛d. per unit (*ante*, p. 551)? When the electrical industry gets into the happy position of being able to supply at a flat-rate represented by a fraction of a penny, then there will be no occasion to think about the drawback of duplicate wiring and meters.

It must be admitted—although Mr. Ferranti is held in high esteem in the electrical industry, and though certain of his former predictions have come true—that scepticism over his latest performance rules in electrical ranks. No one harbours the thought that his low selling figure per unit can ever apply to domestic supply. As he himself showed, the capital costs of the generation plant that would be required for the pithead and all-electric scheme would not be much more than half that of the distribution system. The "Electrician" makes a point, in commenting on Mr. Ferranti's address, of what might happen in connection with distribution capital costs (capital costs of any kind are not considered nowadays in making the prices for electrical heating and cooking) if all domestic cooking and heating were done electrically. This is what is said by our contemporary: "The cost of generating plant may be reduced still further; but there is not any indication of the much desired decrease in the cost of mains and services. These still remain a large proportion of the whole cost of an electricity supply system; and it is difficult to see how they can be reduced. *If* electric energy were used for *all* domestic purposes, the mains would have to be made considerably larger; and the revenue would have to be sufficient to meet the capital charges on these mains and services, and yet to prove remunerative to the station, while not prohibitive to the householder. Presumably under such conditions the energy for lighting would form so small a part of the whole, that no distinction would be drawn between this and the energy for heating and cooking." But these are all matters that have not part in the actual workaday affairs of the present; and, looking round, electrical engineers have certainly quite enough to monopolize their mental and working capacity in the effort to protect and develop their existing interests.

The character for care and disinterestedness which the Guardians of the Poor (including the Electricity Department of the Corporation) of Hastings have attributed to themselves, is not obtaining that ratification which they could desire the more the position of the question of the lighting of the establishments under their charge is examined—a matter to which reference was made last week. They are in a tight corner, from which they cannot wriggle no matter how much explanation is made, unless they admit that they have rushed through the resolution for conversion to electric lighting on insufficient information and consideration, by accepting the limited particulars vouchsafed by the ingenious Borough Electrical Engineer, and by neglecting their obvious duty, in the interests of the particular trust in their hands, of obtaining an alternative scheme. What they are doing is to obtain a lessened amount of illumination for the workhouse at a considerable (and it is questionable whether the estimate for the scattered buildings is sufficient) expenditure of capital, and at an annual outlay exceeding that for which the same illumination —by incandescent gas-burners or electricity—can be obtained elsewhere. That is what they have been shown, and that is the position in which they stand to-day, convicted of betraying the trust confided to them entirely in the interests of the Electricity Department, and with their protestations of purity of motive in regard to care and the interests of the ratepayers exposed as mere hollow words. We are glad to see the Gas Company are (through Mr. C. E. Botley and Mr. C. F. Botley) following the matter up in a manner that must end in the public exposure of this regrettable piece of cut-and-dried partizan business. A public authority such as a Board of Guardians ought to be above this sort of thing and influence. The Gas Company have not been given a chance; and their offers and communications are slighted and treated almost contemptuously. In regard to their latest letters, there was evidence that those chiefly concerned in engineering the matter through in the interests of the Corporation Electricity Department did not want to consider the question from any other point of view than that of the Borough Electrical Engineer, whose Chairman by the way (Mr. C. Hill) is a member of the Board of Guardians. It is seen from the report of the proceedings at the last meeting of the latter, that the further communications from the Gas Company were simply referred to the Buildings and Repairs Committee; and the treatment that was meted out to them was foreshadowed in a remark made by the Chairman that "the vote having been taken, the matter is settled." Details as to the existing gas and proposed electric lighting were given last week. The present lighting is by 610 gas-burners, largely of the Welsbach "C" type, consuming 3¾ cubic feet per hour each; and it will be remembered that the Borough Electrical Engineer considers that 486 electric lamps, mostly of very low candle power, will suffice for officials and inmates and for the conduct of the work during the hours of artificial lighting. Excluding capital expenditure, the annual charge for electricity is put at £225. Now the Gas Company have shown the rash haste of the Guardians in the matter by offering, if they are still enamoured of electric lighting and really wish to oust gas lighting, that they are prepared, for £600 per annum (subject to necessary agreement), to convert sufficient gas for the supply of the current necessary for the 486 lamps as per the Borough Electrical Engineer's list (see p. 555), though there is no wish, on the part of the Gas Company's technical advisers, to endorse the economical views of this gentleman as to the quantity of light required. The correspondence by the Gas Company has indicated other points at which there will possibly be a swelling of expense on the Electrical Engineer's estimate. However, the last has not been heard of this instance of contract-running (by a public authority) into the possession of a Corporation Electricity Department, through, it is palpable, inner influences.

Masonic.

The last meeting of the Evening Star Lodge (No. 1719) for the present year was held on Wednesday, at the Freemasons' Hall, London. The election, by ballot, of the W.M. and the Treasurer of the Lodge for 1911 took place, when Bro. Cyril G. Davis (S.W.) was chosen for the former office, and W. Bro. T. E. Priestman, P.M. (London Rank), was reappointed Treasurer. Another item of masonic interest to be noted is the fact that application has been made to the Grand Lodge of England for a warrant for a new lodge to be located in Birmingham; and the necessary papers have now all been sent in. The name proposed by the Founders is the "Murdoch Lodge." The W.M. Designate is W. Bro. Charles Meiklejohn, of Rugby; W. Bro. Adam Cooke, of Oldbury, will be Secretary; and W. Bro. Thomas Berridge, of Leamington, the Treasurer. It is intended that the meetings of the lodge shall be held at the Imperial Hotel, Birmingham.

Sir William Stephenson on the Working of the Mines (Eight-Hours) Act.—At the annual meeting of the Tyne Commission last Thursday week, Sir William H. Stephenson, the Lord Mayor, was unanimously re-elected Chairman. In returning thanks for the honour conferred upon him, which he said he valued highly, he referred to the cloud resting upon the district at the commencement of the year through the operations of the Eight-Hours Act for miners. This was not, he said, the time or the place for him to express any opinion upon the rights or wrongs of this new legislation, but it had operated most adversely on the finances of the Commission; and he was afraid that when the year came to a close, and the Finance Committee made their report, they would not have the satisfactory condition of things which it had been their good fortune to enjoy for many years.

OBITUARY.

We regret to record the death last Wednesday, at Loughborough, of Mr. C. E. Ball, who for some years held the position of Manager and Secretary of the Ilfracombe Gas Company. Owing to ill-health, he resigned the managership five years ago—only a few months after the opening of the new works which had been constructed under his supervision by Messrs. R. & J. Dempster, Limited—and devoted himself entirely to the secretarial duties. These, however, he gave up, and was placed upon the Board. He had resided a year or two at Loughborough, where the funeral took place on Saturday.

We regret to report the death, on the 29th ult., of Major Franz Walter, the Works' Superintendent of the Vienna Municipal Gas-Works. Deceased was born in 1854, and, after pursuing his course at the Technical Military Academy, entered a Field Artillery regiment as Lieutenant, and in 1889 was appointed an Instructor in the Technical Military Academy at Vienna, which position he held until 1904, when he retired from military service to take up the appointment of Works' Superintendent of the Vienna Gas-Works. On his retirement from the Military Academy, he was granted the rank of Major in recognition of his services to the academy. Deceased occupied the position of President of the Austrian Association of Gas and Water Engineers from 1903 to 1907; and since 1905 to the date of his death he acted as Editor of the Association's official organ, the "Zeitschrift des Vereines der Gas- und Wasserfachmänner in Oesterreich-Ungarn;" and doubtless the considerable improvement in the paper in recent years is to be traced to his control of it. He had received several distinctions, including Knighthood of the Order of Francis Joseph.

DESSAU VERTICALS FOR MELBOURNE.

The first vertical retorts, working on the intermittent system, that will be introduced into Australia for the purpose of gas making will shortly be erected at the works of the Metropolitan Gas Company of Melbourne. This is the result of the visit home, since June last, of Mr. Philip C. Holmes Hunt, the Chief Engineer of the Company—the journey having been taken expressly for the purpose of inquiring into the newer carbonizing systems. That Mr. Hunt came to England with a perfectly open mind on the subject is evinced by the address that he delivered as President of the Victorian Gas Managers' Association at their last annual meeting, as published in the "Journal" for Feb. 15, and commented upon in our issue for Feb. 22. Whether or not vertical retorts—continuous or intermittent—would be available for Australia depended, in his opinion, largely upon their suitability for dealing with Australian coal. To emphasize the point, perhaps we cannot do better than quote a portion of the comment on the address that appeared in the "Journal" at the time:

> There are Australian coals that require packing tight into the retorts for the making of decent coke; and there are other varieties which are of a contrary character, and will not submit to tight packing. These facts show that the character of the most available coal for gas making must influence future policy in Australia in the matter of the adoption of the newest systems of carbonization and practices. This dominating influence of coal is present in the mind of Mr. Hunt when dealing with heavier and longer duration charges, and with the vertical retort system. His latest installation of carbonizing plant at Melbourne, with the De Brouwer projector, has enabled him to commence experimenting with heavier charges, and twelve-hour working. And the results are, with the class of coal used, nearly 450 cubic feet per ton increased gas production, with a slightly higher calorific power, and a negligible reduction of illuminating power. But the weight carbonizing capacity of the retorts is somewhat reduced. Against this, in addition to the higher make per ton, has to be set the improved coke, and the lessened cost of production. This is highly satisfactory; and it is believed that there will be further increase in gas yield as the result of continued experience. Different considerations obtain in contemplating the vertical retort. There appears to be some doubt in the mind of Mr. Hunt as to whether vertical retorts will be capable of making gas of the illuminating quality required in Australia. The more recent comparative tests at home with the same coal carbonized in vertical and horizontal retorts permit the deduction that what Australian coal will do in the matter of gas quality in a tightly packed horizontal retort will have some approximation with the result that is realizable from vertical retorts. Mr. Hunt recognizes that vertical retorts—whether continuous or intermittent—hold out the prospect of completely revolutionizing retort-house practice, and also, if not to solve, at any rate to lead the way to a solution of, the problem of cheap heating gas. But the doubt as to whether Australia is ripe for the vertical retort finds expression in the statement: "Either it must be demonstrated that the vertical retort is capable of making gas equal to our standard, or our standard must be reduced before we can adopt it, provided always that the coals at our command will not give better results than those at home."

It was to personally settle that doubt, and to inquire generally into the newer carbonizing practices in this country and on the Continent, that Mr. Hunt has been to England this year; and, during his stay, he has had a busy time over his investigations of different plants working under all the varying circumstances applying to locality or to the personal preferences of the engineers. For the purpose of his investigation, a quantity of Australian coal was brought over, which we understand, has been tested in several different installations, with a view to ascertaining the sperm value produced, and also the character of the coke. The result is that Mr. Hunt has recommended his Board to adopt the Dessau system; and the contract will be carried out by the British Syndicate—the Vertical Gas-Retort Syndicate, Limited. The plant embraced by the contract will be capable of carbonizing 250 tons of coal a day, and will comprise fifteen beds of eighteen retorts each, which, as will be remembered, is the latest type of setting adopted at the Mariendorf (Berlin) works of the Imperial Continental Gas Association.

A matter that has given particular satisfaction to Mr. Hunt, as the technical adviser of his Board, is that it was arranged by the latter, before he left Melbourne, that he should have the assistance in his investigations of two well-known and independent British engineers—engineers who have not been, up to the present time, in any way identified with any vertical retort installations in this country or elsewhere. We understand that these gentlemen have endorsed Mr. Hunt's recommendation.

MUNICIPALIZATION OF THE GENOA GAS-WORKS.

From a recent number of our contemporary, "Il Gaz," we learn that the proposal of the Genoa Municipality to take over the gas-works belonging to the Union des Gaz Company (with which the Continental Union Gas Company are so closely connected) has, for the time being at least, been negatived by a decision of the Tribunale. An interview with Professor Grasso, the Syndic of Genoa, would seem to show that the reasons which led to this judicial decision included the fact that there is as yet no agreement between the Municipality of Genoa and that of Sampierdarena, which adjoins it, and in which one gas-works supplying Genoa is situated. A similar point arose when the question of municipalizing the electrical tramways was discussed, when it was decided that there must be an agreement between the various local authorities through whose territory the tramways passed. It is suggested that this difficulty should not apply in regard to the gas undertaking, and that a way out of it would be either to increase the output of the gas-works that are in Genoa proper, or else make a special contract with the Union des Gaz Company or with the Municipality of Sampierdarena in so far as their gas is concerned.

Says Professor Grasso: "Some time ago the manager in Genoa of the Union des Gaz proposed to supply gas at 14 centimes per cubic metre (3s. 2½d. per 1000 cubic feet) one centime (2¼d.) of which should go in favour of the Commune. The proposal was a good one, and would have been accepted . . . but the General Directorate of the Union des Gaz in England repudiated the proposal of their Genoa manager, alleging that it was impossible to supply gas at such a low figure in our city, where the cost of manufacture was higher than at Milan, notwithstanding the expense that has to be incurred in sending the coal from our port to the Metropolis of Lombardy and even beyond."

It was intimated that there would be recourse to the Court of Appeal.

COAL STATISTICS FOR 1909.

An Increase in Output.

The two points that first claim attention on the issue annually of Part III. of the Home Office Report on Mines and Quarries, are the output and price of coal during the twelve months to which they specifically refer, though the Blue-Book contains also many other particulars—dealing, as it does, with the output and value of all the minerals raised in the United Kingdom, the amount and value of the metals produced, and the exports and imports of minerals. The statistics for 1909 were issued a few days ago; they show that the total output of the coal mines and quarries during the year was substantially in excess of that of the preceding year, while the amount of money received for it was much less. So far as the first item is concerned, it may be pointed out that, though the output was larger than in 1908, it is still behind the record year of 1907—which, however, was the only year in which it has been exceeded. In fact, 1907 was the climax to a series of years of increased output; and the output even in 1909 was some 40 million tons more than ten years previously.

The total quantity of coal raised in 1909 was 263,774,312 tons, of a value at the mines and quarries of £106,274,900—the figures for 1908 being 261,528,795 tons, of a value of £116,598,848; for 1907, 267,830,962 tons, of a value of £120,527,378; for 1906, 251,067,628 tons, of a value of £91,529,266; and for 1905, 236,128,936 tons, of a value of £82,038,553. There was thus an increase last year as compared with 1908 of 2,245,517 tons in the output; but a decrease of £10,323,948 in the value. The fact that the larger output was accompanied by a smaller monetary return was owing to the price of coal averaging 8s. 0·7d. per ton in 1909, as compared with 8s. 11d. in 1908. The value of the coal at the mines for each of the past five years has been: In 1905, 6s. 11·38d.; in 1906, 7s. 3·49d.; in 1907, 9s.; in 1908, 8s. 11d.; and in 1909, 8s. 0·7d. Thus, in the period named there were two years—1907 and 1908—in which the price realized averaged more than in the twelve months now under review.

As regards the increase of 2,245,517 tons in the output last year, this was accomplished in spite of small decreases in Wales

(of 117,970 tons) and in Ireland (of 13,766 tons). The increase in the output in England was 1,767,113 tons, and in Scotland 610,140 tons. The output in England in 1909 was 183,476,396 tons, of a value of £70,856,198; in Wales, 40,440,159 tons, of a value of £22,118,882; in Scotland, 39,768,365 tons, of a value of £13,252,542; and in Ireland, 89,392 tons, of a value of £47,278. As usual, the term "coal" in these statistics includes anthracite, the total output of which in the year 1909 was 4,258,980 tons, valued at £2,616,353. This item shows an increase both in amountand in value as compared with the previous year, when the output was 4,080,460 tons, and the value £2,286,630. Of the total supply of anthracite, 3,226,725 tons, or over 75 per cent. of the total, came from Carmarthen and Glamorgan; but the output in Brecon was also substantial—637,737 tons. Pembroke supplied 49,938 tons; while of the remainder, 272,564 tons are credited to Scotland, and 72,016 tons to Ireland.

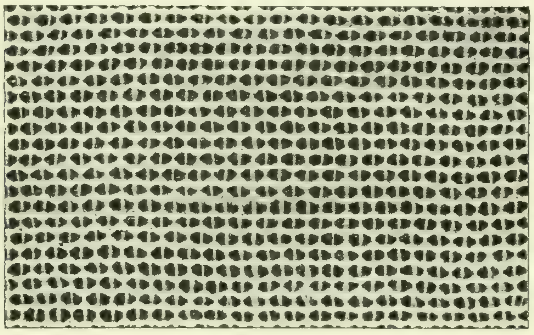
With reference to the prices of coal at the pit's mouth in the different fields, it may be here stated that in 1909 these were as follows: In the Scotch coalfields, 6s. 7·98d. per ton; in the Northern coalfield, 7s. 5·61d.; in the Yorkshire, &c., coalfield, 7s. 3·34d.; in the Lancashire and Cheshire coalfield, 8s. 4·81d.; in the Midland coalfields, 7s. 7·33d.; in small detached coalfields, 8s. 9·93d.; in the North Wales coalfield, 8s.; in the South Wales coalfield, 10s. 9·04d.; and in the Irish coalfields, 10s. 6·93d. The average price per ton at the pit's mouth was for England 7s. 8·69d., and for Wales 10s. 11·27d.; while, as already mentioned, it was for Scotland 6s. 7·98d., and for Ireland 10s. 6·93d.—bringing the average over the whole of the fields to the figure of 8s. 3·7d. The average price in the London market was 16s. 11d. per ton in 1909, compared with 17s. 6d. per ton in 1908, 19s. 9d. in 1907, 15s. 9d. in 1906, 15s. 6d. in 1905, and no less than 22s. 9d. in 1900.

(*To be continued.*)

VOELKER LOOM-WOVEN MANTLES.

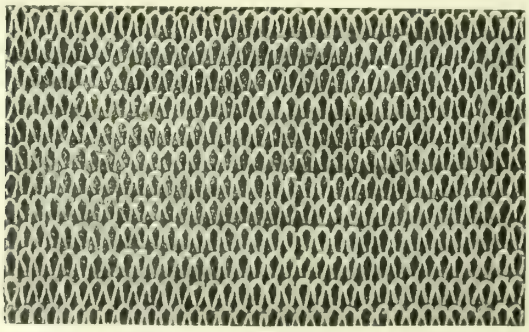
We have had an opportunity of examining the speciality in the way of mantles with which the Voelker Lighting Corporation are having much success; and they certainly seem to mark a great advance in mantle manufacture. The secret of their strength and durability, we understand, arises from the fact that the ramie thread is woven on a loom, and not knitted on a machine, as is usually the case. There are thus no series of acute angles in the fabric, against which another thread is cutting, which is so often responsible for the breakages to which mantles are subject.

The following illustration shows clearly that the threads run in straight lines, and that no part displays an angular structure.



Loom-Woven Mantle.

In order to emphasize the increased strength of a loom-woven mantle over a knitted mantle, the following illustration gives a representation of the mesh of an ordinary knitted mantle, as usually supplied to the trade. The marked difference in the increased strength of the mesh of the loom-woven mantle must be apparent to the most casual observer.



Knitted Mantle.

We understand that a number of engineers connected with leading gas companies, after giving these mantles a prolonged test, have pronounced emphatically in their favour; and the mantles should certainly prove of great interest to all engaged in street lighting and maintenance work.

BELFAST GAS-WORKS EXTENSIONS.

The Gas Engineer's Scheme in Place of the Twin Island Site.

We have received from Mr. James D. Smith, the Engineer and Manager of the Belfast Corporation Gas Department, a copy of the report he has made to his Committee on the existing works and his scheme for their extension. In view of the interest evinced in the proposal to give up entirely (in years to come) the present Ormeau Park site, and transfer all manufacturing operations to what is known as the Twin Island site—(see "Journal" for Feb. 15 last, p. 454), it will be well to reproduce Mr. Smith's report, together with the plan by which it is accompanied.

Gas-Works, Belfast, Nov. 11, 1910.

To the Chairman and Members of the Gas Committee.

Gentlemen,—In accordance with your instructions, I have examined the possible capabilities of the existing site, and beg to submit the following report.

The plant on the works at the present time has a maximum producing capacity of:

Carburetted water gas	6,500,000	cubic feet per 24 hours
Coal gas	5,640,000	" " "
Total	12,140,000	" " "

This, however, does not include the plant in the new retort-house known as "Klondyke," which, as you are aware, is under an injunction by the Courts. A steel chimney and smoke collecting flues have been erected to abate the trouble complained of. But, in spite of these, we might not be able to work this house without creating a nuisance; and it is better, therefore, not to count on this plant. Supposing, however, it could be worked as it is, the producing capacity would be increased by 2,160,000 cubic feet—bringing the total up to 14,300,000 cubic feet.

In this calculation, we are counting on every retort at work—without any stand-by for breakdowns or emergencies. So from the above figures a deduction of (say) 10 per cent. must be made for adequate reserve. This would reduce our total possible make to 12,870,000 cubic feet, or, leaving out "Klondyke," 10,926,000 cubic feet.

The present maximum make per twenty-four hours is 11,772,000 cubic feet; and with a gasholder storage of 6,183,000 cubic feet, the maximum day's output has been 12,608,000 cubic feet.

Very careful study of the present site shows that it is practically impossible to increase the producing capacity with a profitable result. For instance, supposing the retort-house under injunction is provided with a modern carbonizing plant, to increase its calculated output by (say) 1,750,000 cubic feet per day, this would make the total producing capacity of the works about 14½ millions per day. But as this includes 6,500,000 cubic feet of water gas, the percentage of the latter would be about 45 per cent. Therefore, if the proportion of water gas is brought down to 25 per cent. (as desired by the Committee), our total producing capacity would be only 10,700,000 cubic feet; and it will thus be seen that it is impossible with our present plant to make sufficient coal gas to compensate for the reduced amount of water gas.

Now, although it is possible to fit the condemned retort-house with modern plant capable of producing the above-mentioned increased quantity, it would be difficult to augment the coal-gas purifiers in this section so as to make them able to deal with the greater volume of gas. The only method of purifying the additional make would be by means of the existing overhead purifiers which would then be overtaxed. It would also be impossible to increase the gasholder storage, which at the present time is quite inadequate.

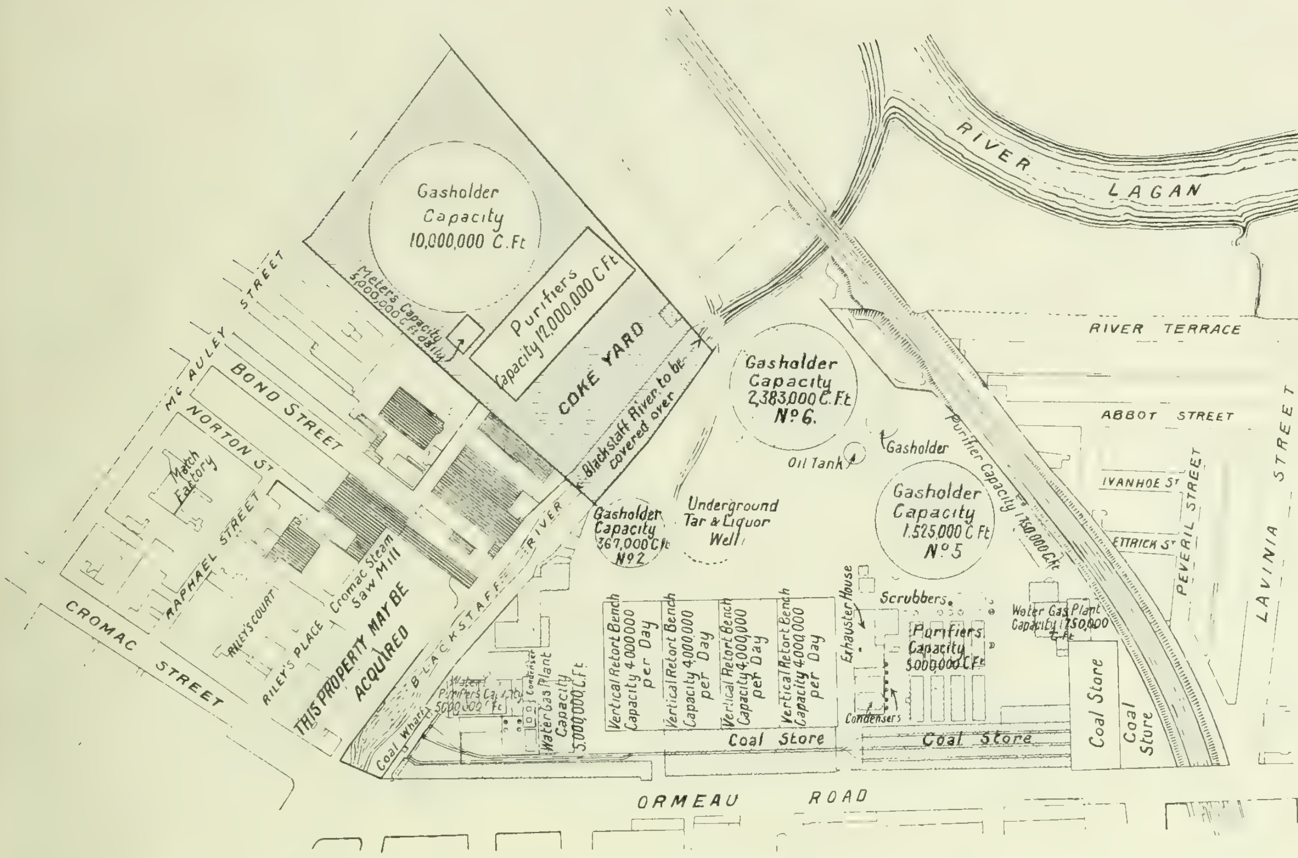
Apart from these considerations, owing to the restricted area and inaccessibility of the south coke yard, the coke-handling for any new carbonizing plant put into "Klondyke" would be a very costly item in labour, and would considerably reduce our income from this residual.

This practically means that the present site—if remodelled, and the percentage of water gas reduced—cannot make quite as much as is possible at the present time, and then only under very great difficulties with regard to purification, gasholder storage, and coke-handling. In fact, the latter will be much worse to deal with, as, on account of the reduced proportionate make of water gas, and consequently greater amount of coal gas, an increased quantity of coke will be available, for which extra storage would be required.

Taking all circumstances into account, therefore, I do not propose to deal with costs in connection with the remodelling of the present site, but to lay an alternative proposal before you.

I have pleasure in submitting a plan, from which it will be seen that this scheme would involve the acquisition of 4 acres of ground adjacent to the present works, and known as the "Abattoir Ground;" and to this I would add the space to be gained on the present site by abolishing gasholders Nos. 1, 2, and 4. These are all old gasholders of small capacity; and the ground so cleared could be filled-in or covered over, and this space would be available for coke storage or other purposes, as shown. At present, we have only 6363 square yards ground area available for coke, whereas by above means it would be 14,866 square yards.

I would propose to gradually do away with the present carbonizing plant, but retain the condensers, exhausters, scrubbers,



Plan of the Proposed Alterations of the Ormeau Park (Belfast Gas-Works.

and purifiers to deal with 6,000,000 cubic feet of gas per twenty-four hours. We would also keep the water-gas plant; but this would require new condensers and purifiers before its maximum capacity is again reached.

A new gasholder and tank to hold 10,000,000 cubic feet would be erected on the abattoir site. This is about the largest size that can safely be put into the width of ground available, and not only enables us to replace at a low cost per 1000 cubic feet the gasholders that are abolished on the present site, but it will bring the total storage up to 14 millions; and, if desired, another 3 millions could be added to this at some future time by doubling the capacity of Nos. 5 and 6 holders.

Under the new scheme, vertical retorts would be used, and the retort-houses centralized and arranged in four units of 4 millions each, or a total of 16 million cubic feet of coal gas. To this must be added $6\frac{1}{2}$ millions of water gas at present on the site. The total producing power would therefore be $22\frac{1}{2}$ millions. We would then be able to send out $21\frac{1}{2}$ million cubic feet of gas, of proper proportions as desired by the Committee—viz., 25 per cent. of water gas—and at the same time have a million of water gas to spare.

The plan shows a portion of the Blackstaff River covered over, so as to unite the ground space on each side, and thus gain additional coke storage.

The purifiers are arranged between the gasholder and coke yard, as shown; and I propose that they should be put on a superstructure, with an oxide floor underneath and another floor overhead.

There is also space here for additional station-meters, and, if it is thought desirable, a weighhouse and weighing machine could be fitted, so as to allow of the sale of coke by way of M'Auley Street.

The total coal storage that can be put on to the site, in accordance with this arrangement, would be 25,000 tons; but, if thought desirable, this could be supplemented by acquiring the ground occupied by the Cromac Steam-Saw Mills and others. By this means, we could easily increase our storage accommodation by an additional 16,000 tons.

It would be necessary to put down modern coal-handling plant to enable not only the coal-stores to be automatically filled, but also to convey the coal at a minimum cost into the retort-houses.

The coke yard would also require to be provided with the most approved coke-handling plant to economically stack and load this material.

Should the Committee desire at some future time to work up the ammonia products (instead of selling the ammoniacal liquor to a contractor as at present), we could easily find room for the necessary plant on the site of the Cromac Saw-Mills, or other ground close to the existing chemical works.

The total cost of the completed scheme, as shown on the plan, would be about £600,000, exclusive of the outlay on the ground to be acquired. The Committee can understand that it will not be necessary to spend all this money at one time, but to undertake the work in four sections. The first section would cost (exclusive of ground) about £250,000, which would be spread over four or five years; and the balance would only be expended when found necessary.

In conclusion, I have no hesitation in saying that if these works are reconstructed on the lines indicated, they will be quite capable of supplying all the gas required by the City of Belfast during the next sixteen years.

I am, &c.,

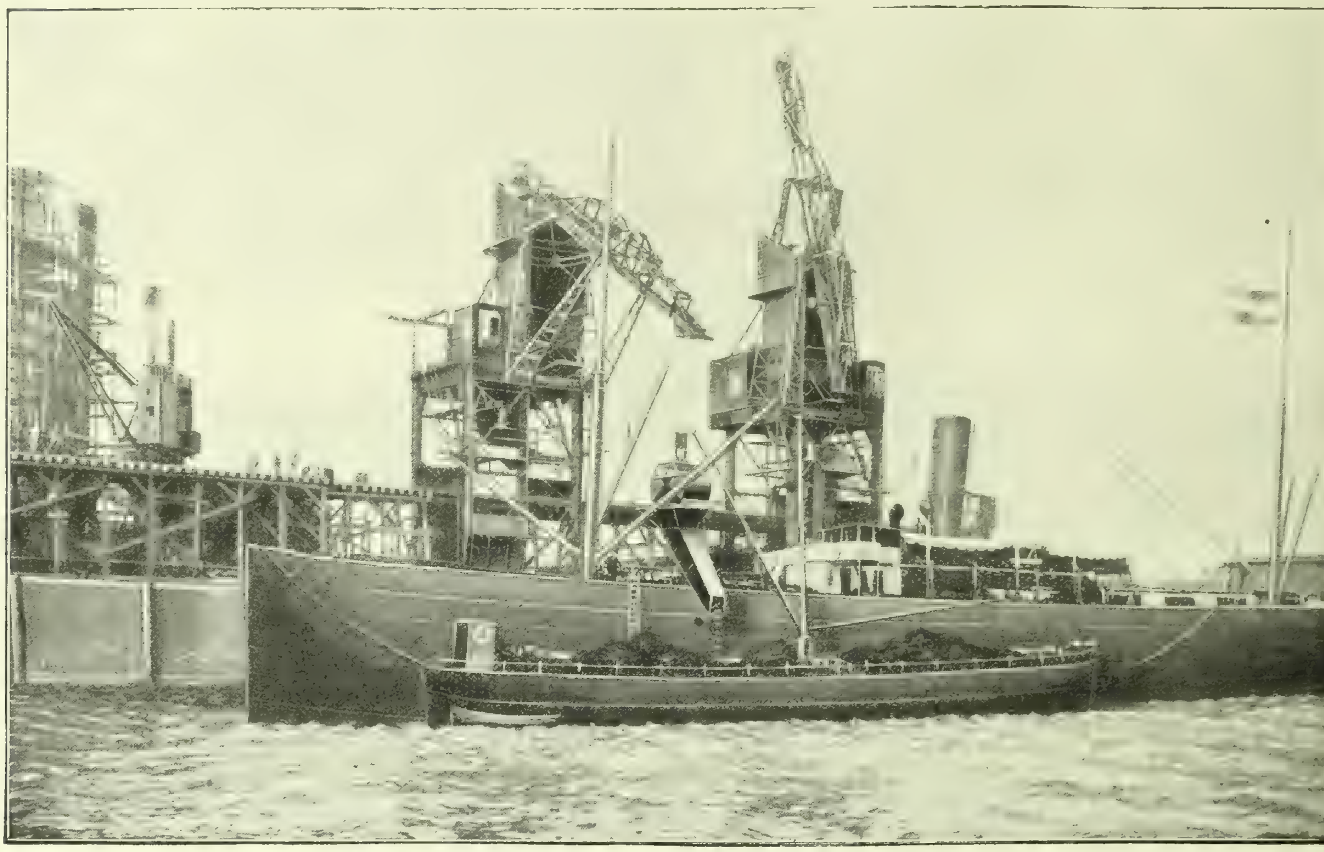
(Signed) JAS. D. SMITH, Engineer and Manager.

USE OF TAR ON ROADS.

The recently constituted Road Board, on Monday last week, held a meeting at which they discussed and settled some general questions of policy. The Board are precluded from making advances of money for any work which can be classed as "ordinary repairs essential for placing a road in a proper state of repair;" but they are prepared to treat the cost of applying tar (which expression includes pitch and suitable bituminous compounds), whether by mixing, spraying, grouting, or painting methods, to suitable road crusts or surfaces as expenditure on road improvement towards which they may make advances. The amount of the grant for tar treatment in each case will be limited to a single grant of 3d. for each superficial yard treated in any proper manner and which secures deep penetration; or, as an alternative, three annual grants of 1d. per superficial yard for surface tarring, either on new or on existing surfaces which are in good enough condition to justify such surface tarring. Inasmuch as it is believed that the use of tar will prolong the life of roads and tend to reduce the cost of future maintenance, the Board will not in the future favourably entertain applications for a second advance for tar treatment; but the continuance and renewal of such treatment will be regarded as a duty of maintenance.

In the course of a paper read by Mr. L. A. Legros, at the last meeting of the Institution of Mechanical Engineers, on "The Development of Road Locomotion in Recent Years," he referred to the question of dust prevention, and made the following remarks: "Many suggestions have been made for road surface treatment with a view to so binding the dust that its raising becomes difficult. Among those abandoned may be mentioned the use of calcium chloride and other deliquescent salts. A better method consists in the treatment of the road surface by tar-spraying carried out in dry weather. It is now generally recognized that the most efficient method of applying tar is by mixing it with the road metal and then rolling the tar-covered metal into place. By this means the interspaces, and any fine road metal used for binding, as well as any loose particles which may be formed slightly below the road surface, are effectively protected against the action of the weather, and also against the suction produced by rubber tyres. As the use of the tar treatment proceeds, the trouble caused by dust is likely to become greatly reduced."

NEW LOADING PLANT FOR COAL-TRUCKS AT THE GRASBROOK (HAMBURG) GAS-WORKS.



The Riverside Coal Plant at the Grasbrook (Hamburg) Gas-Works.

THE savings which can be made with modern loading appliances are shown by some figures published as to a new type of crane erected for the first time at the Grasbrook Gas-Works at Hamburg, the characteristics of which can be seen in the accompanying illustration.

The figures will be found of special interest, for comparison with earlier forms of mechanical appliances, instead of with manual labour. Formerly, the coal vessels were unloaded by a hydraulic and a steam crane, by lowering small trucks of one ton content into the ship and loading them by hand. During this operation two men were required to control the cranes, with an additional labourer on the steam crane; two men to direct the trucks; and twenty men to shovel in the coal—a total of twenty-five hands. The discharge of the coal, including transport to the coal-stores (an average distance of 590 feet), cost about 6¼d. per ton, and about ½d. extra for steam and lubricating material. Thus the total cost of discharging came to about 6¾d. per ton. Compared with these figures, the attendance on the two unloaders already erected—two further cranes are at the present time in course of construction—is very insignificant, as only two crane operators and four men in the ship (together six men) are required, representing a saving of no less than nineteen hands.

The cost of discharging and transporting to the sheds now amounts to about 3d. per ton, with an extra 1¼d. for electric current, which will, however, later fall to about ¾d. So that about 3¾d. will be paid, instead of the 6¾d. under the former arrangement. This represents a saving of about 50 per cent. on the working expenses, or a profit per annum of about £1350—assuming the present requirements of 100,000 tons. In addition to this amount, the allowance for reduced time required for unloading, which is calculated at fixed standards, must be taken into account. The time allowed varies according to the size of the steamer. It averages 36 hours per 1000 tons; and an allowance of 6s. is made to the gas-works for every hour saved. Now, assuming an average capacity of 100 tons per hour for each unloader, 1000 tons can be discharged in five hours with the two cranes already erected. This is an average of thirty-one hours for 1000 tons, or over 2¼d. per ton. Even in practical work on a large bulk of coal, there was an actual saving of 1¾d. per ton.

To keep on the safe side, the latter figure may be taken as a basis; and even this shows a saving for reduced time in discharging of about £700 per annum, which is increased to some £2000 by the reduction in the sum paid for wages. When the gas-works are fully equipped so as to require 360,000 tons per annum, the actual saving will be no less than £7200.

As soon as the two new cranes are completed, the plant is also intended to transfer coal from sea-going vessels into barges (as shown in the engraving) for the use of the Barmbeck and Billiwärder Gas-Works. For this service an allowance will be made to the Grasbrook works of 8¾d.—this rate including 2¾d. for the cost of current. The profit here will, therefore, be about 6d., or, including the saving for the reduced time required for unloading, 7¾d., which represents a further profit of about £5800 on a yearly consumption of 180,000 tons. The total profit accruing per annum is, therefore, no less than £13,000, which would cover the entire cost of the plant in about a year's time.

It may be mentioned, in conclusion, that the plant has been constructed by the firm of Adolf Bleichert and Co., of London and Leipzig.

Transport of Compressed Gas.

Referring to the notice in the "JOURNAL" last week, of Mr. André Grebel's article on the above subject in the "Journal de l'Eclairage au Gaz," we are reminded that similar proposals to those contained in it were made twenty-five years ago by Mr. Charles E. Botley, now the Engineer and General Manager of the Hastings and St. Leonards Gas Company, who was then in the service of the Great Western Railway Company, at their Wormwood Scrubs Gas-Works, and President of the Southern District Association of Gas Engineers and Managers. In the course of an article "On the Use of Compressed Coal Gas," which appeared in the "JOURNAL" for Sept. 22, 1885, Mr. Botley said: "Another use to which compressed gas could be put would be for lighting isolated railway stations or buildings, or supplying gas for motive power. All that would be necessary would be to send a store recipient to the place, and attach this to a governor in connection with the distributing-pipes, and change it for another when the gauge showed the pressure of gas to be exhausted. Suppose in another case a temporary building, marquee, or ball-room, had to be lighted with gas for an evening or so, where it would not pay to lay down a separate main for the purpose, a recipient charged with gas could be sent from the works and connected to the fittings as described; and the quantity of gas required would be easily estimated beforehand." We have given this extract from the pages of the "JOURNAL" a quarter of a century ago, as it furnishes still another interesting example of history repeating itself, and of the truth of the dictum of the Preacher, that "there is no new thing under the sun."

In consequence of the recent promotion of the Mayor of Bolton and one of the members of the Municipal Council to the aldermanic bench, vacancies occurred in two of the wards. For the representation of one of these wards (Deane-cum-Lostock), Mr. Joseph Taylor, of Messrs. Joseph Taylor and Co., chemical plumbers, &c., was a candidate, and we are pleased to learn that he was returned unopposed.

SOME APPLICATIONS OF GASEOUS COMBUSTION.

By Dr. Harold G. Colman.

[Lecture to the London and Southern Junior Gas Association.]

At a Meeting of the Association named on Friday, at the Westminster Technical Institute, Vincent Square, S.W., Dr. Harold G. Colman delivered a lecture on "Some Applications of Gaseous Combustion." Mr. L. F. Tooth, the President, was in the chair; and briefly introduced the lecturer to the members.

In the lecture given last session, we considered the development of high temperature by combustion, mainly from a theoretical point of view; and to-night we discuss the application of gaseous combustion to the heating of retort-settings on the one hand, and, if time permits, of the incandescent mantle on the other. In the former, the object aimed at is to heat the whole of the retorts in a setting to as nearly as possible a uniform temperature throughout their whole length; the actual temperature required, though high, being considerably lower than that which could be obtained if necessary by the combustion of the gas. In the latter, it is desired to burn the gas in such a manner as to give the highest temperature possible, and to so suit the shape of the flame to that of the mantle that the latter occupies the hottest position in the flame.

The Process of Heating Retort-Settings.

As an example of a retort-setting, we may take the usual type of a gas-fired setting of horizontal retorts, provided with regenerators, each setting having its own furnace. The latter, placed below the retorts, and fired with coke drawn from them, gives a deep bed of fuel; and a limited quantity of air is admitted below the fire-bars. In passing up through the incandescent coke, which is in large excess, the oxygen of the air is chiefly converted into carbonic oxide, with smaller quantities of carbonic acid. In addition, steam is always added to the primary air, and passes with it over the incandescent coke, and is converted to a large extent into hydrogen and carbonic oxide, with, again, smaller amounts of carbonic acid; so that the gas collecting above the fuel-bed consists chiefly of carbonic oxide and hydrogen, with smaller amounts of carbonic acid, together with all the nitrogen of the added air. A little methane is also usually present, probably derived from the hydrogen remaining in the coke.

The following analysis gives a general idea of the composition of gas thus obtained:—

Carbonic acid	5·2 per cent.
Carbonic oxide	24·4 ,,
Hydrogen	8·6 ,,
Methane	0·8 ,,
Nitrogen	61·0 ,,

In addition, a certain amount of undecomposed steam is also present which, like the nitrogen and carbon dioxide, acts as an inert diluent.

The composition of the gas, and especially the amount of hydrogen present, varies according to the amount of steam admitted with the primary air. The steam is derived from the water which is allowed to drip on to the fire-bars to keep them cool and prevent their burning through; the excess dripping into the ash-pan, where it is also constantly evaporating, and, in addition, in some cases, live steam is also blown in with the air. In the latter case, the percentage of hydrogen would be greater than that shown in the above analysis. The addition of this steam, however, does not actually increase the amount of heat units obtainable from the coke, for the formation of the water gas from the steam and coke absorbs a quantity of heat which exactly equals that given out by this amount of water gas on its combustion around the setting. Nevertheless it indirectly effects considerable economy, for the following reasons: The action of the primary air on the coke, even when the latter only burns to carbonic oxide, causes the evolution of very great heat, and with air alone the coke becomes raised to so high a temperature that the furnace lining undergoes rapid destruction, and the ash in the coke yields such hard clinker that this can only be removed with difficulty. The addition of steam, by reason of its absorbing heat in its interaction with the coke, lowers the temperature in the generator itself, and thus reduces the wear of the fire-brick lining, and renders the clinker more easily removable. The action of the steam, in fact, effects a transference of heat from the generator, where it is not required and is disadvantageous, to the space around the retorts, where it can be usefully applied.

The producer gas thus obtained consists to the extent of about two-thirds of incombustible gases, and is not an ideal one for obtaining very high temperatures. But it is nevertheless fully capable of developing the highest temperature required for carbonization—this being made more easy by reason of the fact that it enters the setting already heated to a very high temperature. Further, as will be seen directly, the air required for its combustion also enters the setting at a moderately high temperature.

Method of Working.

In very brief outline, the method of working the setting is as follows: The hot furnace gas collects above the coke, and then passes through nostril-holes cut in the furnace arch; one or more nostril-holes being placed at the bottom of each of the vertical spaces formed by the cross walls supporting the retorts. As it enters the setting, the furnace gas is met by the stream of secondary air necessary for its complete combustion; this being introduced by suitable flues so arranged that a supply of air meets each stream of furnace gas issuing from the nostrils in the furnace arch. Complete combustion of the gas takes place as the streams of furnace gas and air intermix in their circulation around the retorts; the heat thus evolved causing the temperature of the latter to be raised to the required point.

The waste gases leaving the setting have inevitably a high temperature, as they must be sufficiently hot to raise the temperature of the last portions of the retort with which they come in contact to the carbonizing temperature required. If allowed to pass direct to the chimney, much loss of heat would ensue. To effect a partial recovery of this heat, the waste gases, on their way to the chimney, pass through the regenerator, which consists essentially of a series of flues adjacent to, and separated by, a thin fire-brick partition from a parallel set of flues through which the secondary air is allowed to flow on its way to the setting, travelling in the reverse direction to the waste-gas stream. Much of the heat of the latter is thereby transferred to the secondary air, and carried back into the setting, resulting both in economy of fuel and enabling a higher temperature to be obtained with a low fuel consumption than would otherwise be the case.

The amount of primary air admitted to the furnace and of secondary air to the furnace is controlled by suitable slides on the ports of admission and by dampers placed at the outlet of the regenerators. In a setting of through retorts, these are usually four in number, each taking the waste gas from a quarter of the setting, so that by their adjustment not only is the total amount of gases drawn through the setting controlled, but also the proportionate amounts drawn into the different parts.

Control and Pitfalls.

From what was said in the last lecture, it is manifest that, to obtain the best results with regard to temperatures obtained and simultaneous economy of fuel, the amount of secondary air admitted must be, as nearly as practicable, the exact quantity necessary to effect complete combustion of the furnace gas—a smaller quantity resulting in combustible gas passing away unburnt to the chimney, and a larger quantity lowering the temperature attainable, and also increasing the amount of heat carried to the chimney, as the excess of air has also to be heated up to a high temperature. The practised observer, by inspection of the retorts and of the interior of the setting and adjustment of the air-slides and dampers, is frequently able to get a good approximation to this result. But in attaining this end, the analysis of the furnace gas to see that it is of good composition, and especially of the waste gases for oxygen and carbonic oxide, affords valuable assistance; and control by this means is essential if the best results are to be obtained.

While, however, the analysis of the gases is most valuable, it must be borne in mind that care and common sense require to be employed both in taking the samples for analysis and in interpreting the results; and these should always be considered in conjunction with the observations made by inspection of the setting. In fact, analysis of the furnace and waste gases, while giving valuable information, is far from giving complete knowledge of what is taking place within the setting; and the blind regulation of the latter on the results of such analyses alone will probably result in more harm than good, and in far inferior working to that attainable only by careful inspection of the interior of the setting. Thus, for example, the analysis only shows the percentage composition of the gas, and gives no information as to its quantity, and so, for example, a furnace may be producing gas of good quality, the waste gas may contain no undue excess of either oxygen or carbonic oxide, and the mere analytical results may indicate nothing wrong, whereas the amount of furnace gas being made may be insufficient to effect the proper heating of the setting; and although the secondary air may be adjusted in such a case to give a good waste-gas analysis, the retorts will not be properly heated. Again, excess of oxygen in the waste gas may be due either to a shortage in the production of furnace gas or to the excessive addition of secondary air; and the analyses themselves do not afford any indication as to which of these two causes is the true one, to ascertain which other observations must be made.

Further, it must be remembered that in every-day working it is not practicable to maintain the conditions of combustion exactly the same hour after hour, and that a certain amount of variation must occur, especially owing to accumulation of clinker in the furnace from the ash left by the combustion of the coke. When the furnace has just been clinkered, and the fire is clean, it offers less back-pressure to the passage of gas, and a larger production of furnace gas takes place. As time goes on, the resistance of the fuel-bed tends to increase, owing to accumulation of clinker, even when the latter is prevented from blocking the spaces between the fire-bars by periodic pricking with a suitable bar; and when the time for further clinkering approaches, the gas production is at its minimum. At the same time, as the back-pressure of the fire increases, while the draught from the chimney remains constant, the latter tends to draw more air in through the secondary air slides, as it cannot get as much through the furnace; and from both causes therefore the proportion of secondary air tends to become too high. Hence, in taking waste-gas samples, care should be exercised to avoid collecting them either too soon after or too soon before clinkering, as adjustment of air

slides on the results of such analyses would result in the first case of too little, and in the second case of too much, secondary air during the greater part of the time. One should also always make sure that the clinker has been properly removed from the furnace-bars before collecting samples.

A further matter requiring caution is the point at which the waste-gas samples are taken. This should always be as the gases leave the setting proper and before they enter the regenerator; otherwise most misleading results may be obtained. The regenerator brickwork, especially when it is getting old, frequently allows air to bye-pass from the secondary-air flue into the waste-gas flue; and in such a case, if the secondary supply is adjusted to give no material excess of oxygen or carbonic oxide at the outlet of the regenerator, sufficient of the latter will not reach the setting to effect the complete combustion of the furnace gas, which will then not evolve all its heat in the setting, but will pass partly unburnt into the regenerator. Here, it is true, it will be burnt by the air leaking in from the secondary-air flues; but the heat produced will be given off, not merely where it is not wanted, but where it is deleterious, and rapidly bring about the destruction of the regenerator. Analyses of the waste gas made simultaneously at the top and bottom of the regenerator are, however, of great use in determining the extent to which such bye-passing is taking place in the regenerator.

Proper Heating of the Setting.

Let us, now, assume that we have a setting in which all is so adjusted that the proper amount of furnace gas is being produced, and the secondary air is regulated just to effect complete combustion in the setting, and see whether this alone will ensure the proper heating of the setting. In considering this point, let us first examine more closely the object aimed at. Through the nostril-holes in the furnace arch is being admitted an amount of furnace gas which, by its combustion, is capable of evolving sufficient heat to raise the whole of the retorts to the required temperature. As the total amount of surface to be heated is very considerable, it is obvious that this heat should be evolved evenly and uniformly as the mixed furnace gas and secondary air travel around the retorts. If the combination of the furnace gas and the oxygen of the secondary air takes place very rapidly as soon as they meet, the whole of the heat of chemical combination is given off before the mixed gases have travelled far, and results in the production of an extremely high temperature at this point; and as the completely burnt gases travel on through the setting no further heat is evolved, and they become continuously cooler. The result of such a state of things is that some of the retorts, or portions of retorts, are heated to much too high a temperature, while other parts are much too low—a state of things which not only brings about bad carbonizing results, but also greatly increases the wear and tear of the brickwork at the points of high temperature, and may even bring about its complete destruction in a very short time.

In the last lecture, we saw that for the production of a high local temperature and a short flame the necessary conditions are to get as complete a mixture as possible of the combustible gas and the oxygen before or while the combustion takes place. In the case of a retort-setting such as we are now considering, a relatively moderate temperature (compared with the maximum which the gas is capable of producing) is required over a large area, and therefore just the reverse state of things is required; and here the object is to allow the streams of gas and air to mix slowly as they travel round the retorts, so that the heat is evolved gradually, with the proviso that combustion must be complete before the gases leave the setting; in other words, the gas must burn with a long flame.

Causes of Development of High Local Temperatures.

The extent to which this aim is attained depends upon the design and the method of working of the setting. To bring about a gradual combination of the furnace gas and air, it is necessary, in the first place, that the ports and passages in the setting through which the gases pass should be of ample size, so as to permit of the speed of travel being low, as the rapidity with which two streams of gas mix increases very greatly with the velocity at which they are moving. In the second place, they should be baffled as little as possible, as the direct interposition of any solid surface right across their path increases the rate of mixing, and results in the development of a high local temperature. This is frequently seen in a setting of eight retorts in three rows, where the centre retort tends to baffle the stream of furnace gas and secondary air entering just below it, and results in the centre, or "bull's eye," retort being much hotter than any of the others. In the third place, the streams of furnace gas and air, as they make their way into the setting, should enter as nearly parallel as can be arranged, as the impingement of two streams of gas at any considerable angle also tends to increase the rapidity of mixing and development of high local temperature.

Where the ports and passages are too small, or the angle of impingement of the gases too great, the attempt to improve the heating by further opening the dampers has usually a disastrous effect, as, although more gas and air are drawn in by this means, the speed of the gases, and therefore the rate of mixing, is further increased, producing still more excessive local temperatures, which may in a short time effect the almost complete destruction of the setting. Even where the passages are large enough in general and only constricted in certain parts, the increased speed of the gases at the constricted points (unless the gas has already undergone complete combustion) effects more rapid mixing at such points and the development of a cutting heat.

Such disadvantageous conditions as these, and others which might be mentioned, can be taking place when, so far as the analysis of the gases shows, all is as it should be, and emphasize the fact that, although such analyses are of great value in certain respects, no setting can be worked properly, or its defects ascertained and remedied or avoided in future installations, without careful inspection and study of what is taking place around the retorts themselves.

High Temperatures for Mantles.

In the second application of gaseous combustion mentioned at the commencement of the lecture—namely, the heating of an incandescent mantle for the production of light—different conditions are necessary. Limits of time, however, prevent more than a very brief and incomplete consideration of this subject. Here the object aimed at is to obtain from the gas a flame in which combustion takes place as rapidly as possible in order to obtain a high local temperature, and so to suit the shape of the flame to that of the mantle that the latter is situated in the hottest portion of the flame; the amount of light given off being largely dependent on the temperature to which the mantle is heated, and increasing very rapidly as the temperature rises.

Whereas, therefore, in a retort-setting the combustible gas should enter the setting with a low velocity, and should only gradually mix with the air and undergo combustion, in an incandescent burner the gas should mix with the air as rapidly as possible; and, as we saw in the last lecture, the highest flame temperature is obtained when the gas and the requisite amount of oxygen are mixed thoroughly before combustion takes place. Now, in the ordinary bunsen burner, the gas mixes with a certain proportion of air, but insufficient to effect complete combination, before it undergoes combustion; the stream of gas which issues from the small hole or holes in the gas-nipple with considerable velocity acting as an injector and sucking in this air through the air-holes. The higher the pressure of gas behind the gas-nipple, the smaller is the hole required to allow a given volume of gas to pass and the higher is the speed of the gas stream entering the burner-tube, and, in consequence of this increased velocity, the higher the amount of primary air which is thus sucked in. Further, owing to the higher speed of the gases travelling through the burner-tube, the mixture of gas and air is much more intimate before reaching the end of the burner where combustion takes place; and both of these factors tend to produce a higher flame temperature.

On this account, therefore, it is generally true to say that for the same gas the higher the gas pressure the more easy is it to obtain a high flame temperature, and that to get an effective flame a minimum gas pressure of 2 inches is required, and the proper mixture is more readily obtained if a higher pressure is available. The highest temperature is obtained if the quantity of primary air which is sucked in is sufficient to effect the complete combustion of the gas, and complete combustion can take place in the flame without the help of oxygen from the air in which the flame is burning. With the ordinary gas pressures of (say) 2 to 5 inches, there is a practical difficulty in the way of adding so much primary air; for when the primary air drawn in reaches about three-fifths of that necessary for complete combustion, the rate at which combination takes place in the flame is greater than the speed of the mixture of gases in the burner-tube, and the flame passes down to the tube and the gas fires at the nipple. By the employment of higher pressures than the above, in the manner now so familiar to you, owing to the greatly increased velocity of the gas through the nipple, this exerts so much force that the mixture of air and gas, even with the former in nearly theoretical proportion, can be forced through a narrower tube; the speed of the mixture through this tube being now so high as to make it more difficult for the flame to strike-back. Further, the intimacy of the mixture of gas and air, owing to this high speed, becomes so complete that the flame produced is of exceedingly high temperature, and results, as you are aware, in duties of up to 70 candles per cubic foot of coal gas used. In the Welsbach "C" burner, when this came into general use fifteen or more years ago, a duty of 15 candles per cubic foot was looked on as remarkable—being five times as great as that of an argand. But now, the latest results with high-pressure inverted burners have improved on this result again nearly fivefold; and this last improvement has been to a large extent brought about by improving the burner and the method of working it so as to obtain a higher flame temperature.

Discussion.

Mr. A. F. Browne opened the discussion by expressing his appreciation of the lecture. Dr. Colman, he said, represented the combination known as the chemical engineer, combining the qualities of the gas-works chemist with those of the practical engineer. Therefore the members of the Association could safely take him as a guide, philosopher, and friend on every one of those questions which were of such fundamental importance to the proper development of the gas industry. In listening to the lecture, the retort-house problems had a greater fascination for him than those relating to the combustion of gas for illumination purposes. He quite agreed with Dr. Colman that the best conditions for retort-firing were fundamentally opposed to those which brought about the best results in high-pressure lighting. He also

agreed with the view that the long flame was necessary in the retort-setting, and that space must be provided to allow it an adequate chance of full development, by giving sufficient area in all the passages, so that there might be no throttling or acceleration of the speed of the gases through the settings, and in order that the utmost amount of heat might be abstracted from the flame and products of combustion—while avoiding punishment of the refractory material, which was such a difficulty. Dr. Colman had said that the setting he had illustrated—viz., eight retorts, but not in vertical rows of two—was not quite the setting which adequately fulfilled the best conditions. The one that was used almost exclusively by the South Metropolitan Gas Company had ten retorts placed vertically in pairs; and it would be seen that, whereas in Dr. Colman's illustration combustion took place at just about the middle of the three retorts, in the South Metropolitan setting there was nothing in the way of the free development of the flame. Having got to the top, the products of combustion—whether there was any flame left, he did not know—came down each side, and to the front, and away to the top. Dr. Colman's illustration was very little better than the old direct-fired setting, so far as the furnace-arch being so close down was concerned. He certainly thought Dr. Colman had made a point as to the desirability of having a less wide angle at which the gases met at the top of the furnace-arch; it was of great importance as affecting the life of the retorts. This was a question which had much agitated gas companies and manufacturers of refractory materials during the past few years. Even in the setting at the South Metropolitan works, the second row of retorts showed more signs of wear and tear than all the others. It was the fact that—whether, as he was much disposed to think, it was due to some deterioration of the materials—retorts did not last as long as formerly. The settings at Vauxhall used to give a life of 2000 days of actual work. Of course, there were some repairs; but the retorts did good work for 2000 days, and they had to be in for about seven years in order to enable them to do this. Moreover, the combustion-chamber itself, in which they employed a special brick, used to stand practically intact for seven years. It might be said that the working conditions had been altered, though the design had remained the same. But if this were the case, he was inclined to think that the conditions, if anything, had changed in favour of the material. Horizontal retorts used to be charged with a large free space above the coal; and he did not think that this was the best way of doing the work. At all events, horizontal retorts were now charged almost full. Consequently, with a larger amount of coal, more work had to be done, but not necessarily with a higher heat. In the first place, with such a large charge, it was the usual practice to allow a longer period of carbonization. This filling-up of the retorts was a very interesting point in the firing of retorts, and one which, at first, was not apparent. As the retort was filled up, it would be evident that there was brought into operation a far larger area of the surface of the retort than was formerly the case. In distilling coal in the retort, the flow of heat from the outside to the inside was greater or less according to the difference in temperature between the two. If there was much free space, as there used to be in the old days, the heat had not such an opportunity of flowing freely to the coal as when the retort was full. In other words, the retort was filled up, and there was a larger amount of surface to convey the heat to the greater charge. Therefore, it did not follow that greater intensity of heat was required to do the work, if a larger quantity was being permitted to pass through it to the heavier charge. In the old days, there were reasons for the larger space; it had good and bad consequences. But at any rate, the fact that they were putting a larger quantity of coal in did not necessarily imply that the heat had to be applied at a higher intensity. As a matter of fact, experiments made, both in the combustion-chamber and in the retort itself, proved that the temperatures were very little (if any) more than they were in the old days.

Mr. C. E. ROSEVEAR asked, as the flame temperature played such an important part, would not the standardization of the quality and pressure of gas be an advantage, especially if accompanied by standardization of the burner?

Mr. J. G. CLARK, after referring to the greater utility of heat in the form of gas as compared with heat in a solid form, raised the question of the effect of surface combustion. It had often occurred to him that considerable combustion must take place in the settings in a form which was not gaseous—*i.e.*, as a flameless combustion. Did this take place to any great extent? With regard to flame temperature, he thought there was a distinction between this and mantle temperature, which was what they should really aim at.

Mr. S. A. BEVINGTON asked three questions: (1) In the retort-setting, was pressure favourable to more perfect combustion than high temperature? (2) Taking two retort-settings, one with more transverse walls than the other, would this setting require more fuel to maintain constant working temperature than the other? If so, what became of the greater heat? (3) With a water-circulator heated by a luminous gas-flame, or series of flames, what was the total amount of heat lost as light energy; and in apparatus of this kind could the analysis of the carbon monoxide and the waste gases be relied upon to give sufficient proof of perfect combustion?

A MEMBER asked whether it would be better to have a larger grate area and form a greater amount of producer gas, and thus cause less velocity in the combustion-chamber. Again, in the design of "eights" illustrated by Dr. Colman, could not a lot of the trouble be got over by increasing the width of the combustion chamber? Another question was as to the best time to test for gases.

The PRESIDENT mentioned the question of surface contact with the flame. In some experiments he recently made with gas-fired furnaces, he found that the surface contact decreased the temperature by about 20 per cent. In other words, by preventing the flames from coming into contact with the walls of the furnace, the temperature was 20 per cent. higher.

Dr. COLMAN, in reply, said he would not attempt to deal with all the points raised, owing to shortness of time. He infinitely preferred settings of six, eight, or ten in vertical rows of two. Six or eight in two's were easiest. Standardization was a very difficult matter. Undoubtedly, the tendency would be towards a standard burner; but, at the same time, there was always the danger that standardization rendered improvements difficult, and anything done in this direction must not be such that it would discourage improvement. There was still a dispute as to whether the mantle or the flame had the higher temperature; and there were supporters of both hypotheses. The answer to Mr. Bevington's first question was that it depended upon the design. As to transverse walls, theoretically he did not see why these should increase the fuel consumption; but he was inclined to think they had a slight tendency in this direction. As to the water-circulator, there would be a certain amount of carbon deposit from the luminous flame, escaping unburnt from the flames; but the weight would be very small in proportion to the amount of gas, and it would be possible to detect this by analysis of the waste gases. The widening of the furnace-arch in the design of "eights," as suggested, would mean widening the whole setting, and a considerable expense in land. By putting the nostril-holes more centrally, an improvement was effected. In this way, the gases got a straight run. He preferred to take waste gas samples two or three hours before or after clinkering. In answer to another question by Mr. Clark, with regard to mantle temperature, he said that whatever the relation between the flame and the mantle, the hotter the flame the greater was the amount of light.

A vote of thanks to the lecturer, proposed by Mr. D. J. WINSLOW, seconded by Mr. S. A. CARPENTER, was carried with enthusiasm.

Illuminating Engineering Society.

The next meeting of this Society will be held on Friday evening of next week, at the Society of Arts Rooms, John Street, Adelphi, at 8 o'clock, when a paper will be read on "Recent Progress in Electric Lighting," by Professor E. W. Marchant, D.Sc. The chair will be taken by the President, Professor Silvanus P. Thompson.

Pitot Tubes have been installed for measuring the water used by the Ontario Power Company; and in experiments to secure their rating, Professor H. C. Berry found that the conditions under which a tube is rated should be as nearly as possible those under which it is used as a measuring instrument.

Production of Natural Gas.—An American writer (Mr. H. A. Danne) states that the entire daily output of natural gas in the West Virginia oil-fields is estimated at 1300 million cubic feet, of which about 300 million cubic feet are wasted. The thermal efficiency may attain as much as 1134 B.Th.U. per cubic foot; but after compression of the gas, it falls to about 900 B.Th.U., owing to the deposition of liquefied hydrocarbons. It is employed for power purposes, zinc smelting, and the manufacture of glass, bricks, pottery, electrodes, and lamp-black. Judging from the fact that the oil and gas are accompanied by coal and salt water, and that the pressure of the gas is nearly always affected by seismic disturbances, the author considers that these hydrocarbons are generated from natural carbonaceous deposits, by the earth's interior heat brought into proximity to these deposits by seismic disturbances; that they are still being generated under enormous pressure; and that on the release of some of the pressure, and consequent changes in the temperature of the hydrocarbons, some of the constituents are deposited in the dips of the strata and in the pockets known as oil-bearing pools.

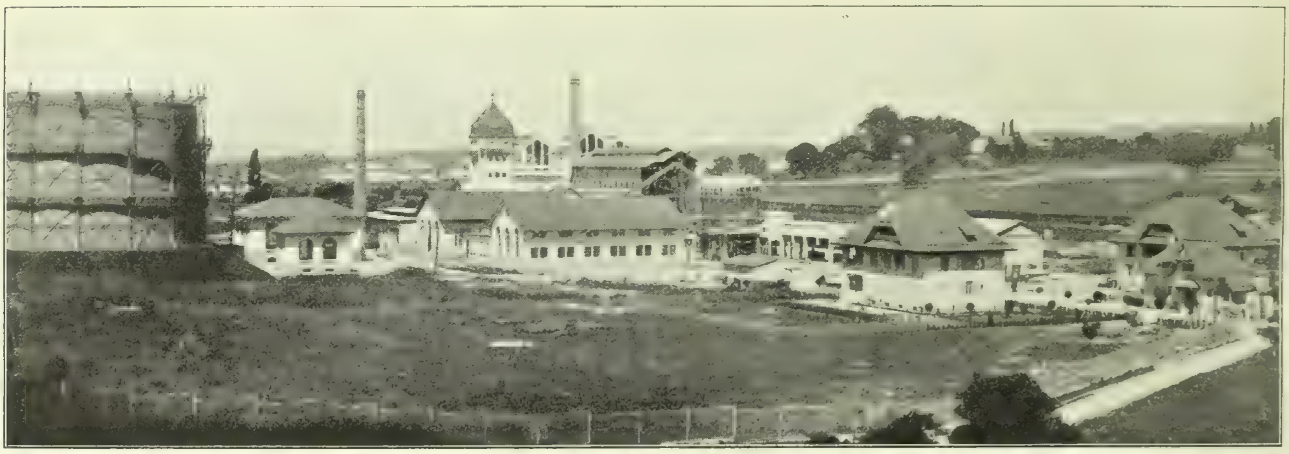
Thermal Conductivity of Fire-Clay.—This subject was recently dealt with by Messrs. J. K. Clement and W. L. Egy in an American contemporary. The test pieces were all made into cylinders about 40 cm. long and 12 cm. diameter, with a hole through the centre for the heating coil, and four longitudinal holes, about 3 mm. in diameter, for the reception of thermo-couples for the measurement of the temperature. The temperature inside was raised to between 400° and 900° C. during a period of three to five hours, and then kept constant for two or three hours more. When the outer couple showed a temperature constant to 0·1° C., the readings were taken. The cylinder was then broken across, and the distances of the holes from the centre measured. From these data, together with the voltage and current readings of the heating coil, the conductivity can be calculated. It was found that in the case of two coarse fire-clays the conductivity was constant at 0·00264 and 0·0036 Gm. calories per centimetre per second per 1° C. respectively, while for two finer fire-clays there was an increase from 0·0021 at 350° C. to 0·0022 at 600° C., and from 0·00245 at 500° C. to 0·0026 and 800° C. respectively. Knowing the thermal conductivity of brick, the dimensions of a furnace, and the outside temperatures of the walls, the quantity of heat transmitted through them may be calculated.

THE NEW GAS-WORKS AT LAUSANNE.

Installation of Woodall-Duckham Retorts.

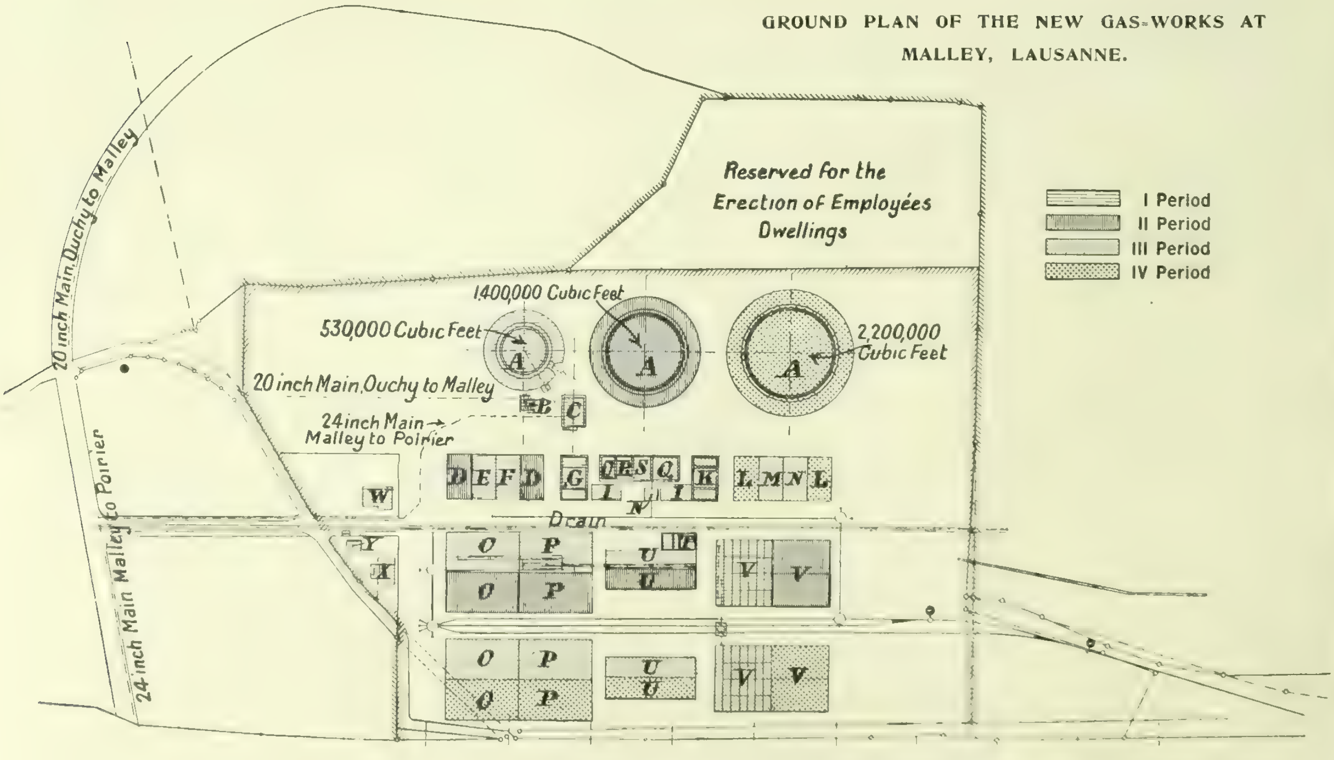
IT has already been mentioned in the "JOURNAL" that new gas-works have been in course of construction by the Municipality of Lausanne, and that a noteworthy feature of them is an installation of the Woodall-Duckham system of vertical retorts. As the works are now approaching completion, a few preliminary particulars just received from the Manager (Mr. J. W. Räber) will doubtless be of interest, pending the publication of fuller details in a subsequent issue.

The Coal Stores, Retort-House, and Coke Plant under Construction at Lausanne.



General View of the Lausanne (New) Gas-Works.

GROUND PLAN OF THE NEW GAS-WORKS AT MALLEY, LAUSANNE.



A. Gasholders. B. Filling Station for Smallest Gasholder. C. Meter and Governor House. D, L. Revivifying Sheds. E, F, M, N. Purifier Houses. G, K. Apparatus Houses. H. Water-Tower. I. Tar and Liquor Pits. O, P. Coke Stores. Q. Boiler Houses. R. Power House. S. Building for the Treatment of Ammoniacal Liquor. T. Men's Mess-Room, Baths, &c. U. Retort Houses. V. Coal Stores. W. Manager's House and Office. X. Foreman's Houses. Y. Porter's and Weigher's Lodge.

Lausanne is a town of about 60,000 inhabitants, situated, as many readers will be aware, on the north shore of the Lake of Geneva, from which it is approached *via* Ouchy, on the lake side, by a funicular railway. The old works, at Ouchy, have a capacity of 800,000 cubic feet per day, including carburetted water gas; but the exhausters, purifiers, &c., are only equal to dealing with 700,000 cubic feet. Last year the total output was 217 million cubic feet; and as the present daily make taxes the works to their utmost, the construction of new ones became urgent. As the town rises about 700 feet from the level of the lake, the old works were very well placed. Malley, where the new ones are being erected, is 300 feet above the lake, and about two miles from Lausanne; and this lower part of the town will be supplied from the holders at the old works through a set of compressors at the new ones. These were commenced in 1908; and they would probably have been finished by now had not troubles arising from the foundations (owing to the nature of the ground), accompanied by very unfavourable weather, interfered with operations. Their capacity will be 1,400,000 cubic feet daily, exclusive of the water-gas plant; and they represent the first of the four sections into which the entire works will be divided.

Water Tower at the Lausanne (New) Gas-Works.

The general arrangement of the works will be seen from the accompanying plan; and some of the plant is shown by the reproductions of the photographs. The coal-stores are similar to those at the Zurich Gas-Works, only they are in two stages. This has the double advantage of a shorter drop for the coal and less liability to heating. The bucket conveyor which fills the stores brings the coal up again to the retort-house conveyor. The coal-handling plant has been put in by the Simplex firm, of Paris. The Woodall-Duckham installation consists of twelve beds with 48 retorts. The erection was pushed on very rapidly by Mr. Duckham; and not only were English workmen employed, but French, German, Italian, and Swiss as well. Mr. Räber says that it was a perfect Babel, and at the same time an amusing example of an international *entente cordiale.*

WATER LEGISLATION IN 1910.

In the last number of the "Journal," the Acts obtained by Water Companies in the session of Parliament which has just closed were noticed. We deal to-day with some of the measures of Local Authorities containing proposals in reference to water supply.

By the Abertillery and District Water Board Act, authority is given for the constitution and incorporation of a Joint Water Board, consisting of representatives from the Councils of the urban districts of Abertillery, Abercarn, Risca, and Mynyddislwyn, in the county of Monmouth, with power to construct works, and purchase those belonging to the Councils named. The Board is to consist of nineteen members; nine to be elected by the Abertillery Council, four each by the Abercarn and Risca Councils, and two by the Mynyddislwyn Council. It is proposed to construct an impounding reservoir in the parish of Llanelieu, in the rural district of Hay, in the county of Brecknock; a catchwater drain in the same parish; a service reservoir in the parish of Abertillery; another in the parish of Abercarn; two aqueducts; and various road and railway works. The Board are given authority to collect, impound, and appropriate for the purpose of their works the waters of the River Grwyne Fawr, and all the streams and springs intercepted. After the Grwyne reservoir is completed, the Board are to discharge into the river not less than 750,000 gallons of water in a continuous flow every 24 hours. Ten years are allowed for the completion of the works. As soon as any of the water authorized to be taken is available for supply within the limits of the Act, the separate undertakings of the Councils represented are to be transferred to and carried on by the Board. The limits of supply are the respective districts of the Councils, and the Sirhowy portion of the urban district of Mynyddislwyn; and the rates are 8s. 8d. where the annual value of the premises supplied does not exceed £5, and 9 per cent. when it is above this, with an additional charge for a fixed bath capable of containing more than 50 gallons. Where the supply is by measure, the price is not to exceed 1s. 6d. per 1000 gallons. Borrowing powers are granted to the amount of £240,000 for the purchase of lands and easements and the construction of works, £7000 for a trunk main, £2000 for working capital, and such sum as the Local Government Board may sanction for new mains, extension of service-pipes, &c. For the two largest amounts sixty years, and for the working capital ten years, are allowed for repayment. Surplus revenue is to be apportioned among the Councils, who, of course, are to make good any deficiency in the water fund. Authority is given to the Board to provide dwelling-houses for any persons in their employ. [*Parliamentary Agents: Messrs. Lees and Co.*]

By the Bradford Corporation Act, which is a Various Powers Act, the Corporation obtain authority to hold lands in the parishes of Oxenhope and Denholme for the protection of their water and water-works, to require not less than 24 hours' notice before the connection or disconnection of a meter, and to impose penalties for injuring meters, &c. The words "domestic purposes" are not to apply to water supplied for use elsewhere than in, or in connection with, a dwelling-house. It is provided, however, that in the case of stables or premises in which horses, carriages, or motor-cars are kept for private use, and which are occupied and rated along with any private dwelling-house, the water supplied for domestic purposes may be used for such stables or premises if the water-rate is assessed upon the annual rack-rent or value of the private dwelling-house including such stables or premises; and no additional charge is to be made for water supplied to such stables or premises unless a hose-pipe or other similar apparatus be used, in which case the Corporation may make such additional charge therefor as may be prescribed by the scale of charges made by the Corporation for a tube for garden watering. The Corporation are also authorized to lay water-pipes in streets not dedicated to the public use; and they may borrow for lands for water-works purposes a sum of £15,000, repayable within sixty years. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Exmouth Urban District Council have obtained authority to construct a well and pumping-station in the parish of Colaton Raleigh, an aqueduct, conduit, or one or more pipe-lines connecting it with the River Otter, and others commencing at the pumping-station and terminating in the parish of East Budleigh, at the south-east corner of the Squabmoor reservoir. Seven years are allowed for the completion of the works. The Council are empowered to borrow £18,000 for the purchase of lands and easements and the construction of the works authorized. Forty years are granted for its repayment; and five years for money raised to defray the expenses incurred in connection with obtaining the Act. [*Parliamentary Agents: Messrs. Torr and Co.*]

The Fylde Water Board Act empowers the Board to construct additional works, comprising a covered service reservoir and a water-tower in the township and borough of Blackpool, eleven aqueducts or pipe-lines, an equilibrium basin in the township of Barnacre-with-Bonds, and a road diversion, all of which are to be completed within ten years. The Board are authorized to borrow £140,000 for the purchase of lands and the construction of the service reservoir, water-tower, and basin, and for the road diversion, £72,000 for the aqueducts and for the laying of high-level mains and the extension of existing mains, and £97,021 for paying off the amount owing on March 31, 1910, in respect of loans raised in 1904 for the construction of a reservoir and works in connection therewith. The first-named amount is to be repaid within fifty-five years from the passing of the Act; the second, within forty years from the date or dates of borrowing; and the third, within thirty-seven years from March 31, 1910. It is not to be obligatory upon the Board to commence the repayment (by sinking fund or otherwise) of any money to be borrowed for the purpose of the reservoir, water-tower, basin, and road diversion, until the completion of each of these works, or until the expiration of five years from the passing of the Act, whichever shall first happen. Provision is made for the appointment of a Secretary to furnish returns to the Local Government Board. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Authority is granted to the Mountain Ash Urban District Council to construct additional water-works, comprising two intercepting dams or weirs in the parish of Penderyn, in the county of Brecknock, a catchwater and a reservoir in the same parish,

four aqueducts or pipe-lines, an approach road, and a diversion of a stream. Permission is also given to cover the existing Darranlas reservoir. Ten years are allowed for the completion of these works. Borrowing powers to the amount of £75,000 are granted in respect of the purchase of lands and the construction of works, such sum as may be necessary for the purchase of land for protecting the works from pollution, £5000 for covering the Darranlas reservoir, and £20,000 for the general extension and improvement of the water-works. Forty-five years are allowed for repaying the first-named sum, a like period in respect of the money borrowed for the protection of the works, and thirty years for the rest. The Council are empowered to purchase or sell water in bulk, to sell meters, and to let fittings. The maximum charges for the supply of water for domestic purposes specified in the Council's Act of 1900 are altered. [*Parliamentary Agents: Messrs. Baker and Co.*]

An Act has been obtained to authorize the formation of a Joint Water Board representative of the Rhondda and the Pontypridd Urban District Councils, the acquisition of the undertaking of the Pontypridd Water Company, and the construction of works for the supply of water. The Board is to consist of the Chairmen for the time being of the Rhondda and Pontypridd Councils, six members of the former body, and four members of the latter; and the Chairman of the Board is to be elected by the members. The consideration for the transfer of the undertaking of the Water Company is to be £282,400, and a sum equal to the price at which the movable stock-in-trade, stores, and other materials of the Company stand in the books on the day of the transfer. The Board are also to pay the Company certain engineering costs and charges and other sums specified in the Act; also compensation to the Directors, Manager, and Secretary of the Company. The Board are empowered to maintain the existing works and also construct others, consisting of five aqueducts, conduits, or one or more line or lines of pipes, to be completed within seven years. The limits of supply, which are defined in the Act, include part of the Rhondda district, the Pontypridd district, the parish of Eglwysilan, in the urban district of Caerphilly, and the rural district of Llantrisant and Llantwit Fardre, all in the county of Glamorgan. The rates for the supply of water are to be 7½ per cent. upon the rateable value when this does not exceed £18, 6½ per cent. above this and under £40, and 5 per cent. above £40. But the Board are not to be bound to supply a house or part of a house for any less sum than 8s. 8d. per annum; and a second closet and a fixed bath are to be extras. When water is supplied by measure, the charge is to be according to the quantity taken per quarter—ranging from 1s. 6d. down to 6d. per 1000 gallons. Meter-rents vary with the diameter of the inlet and outlet pipes. Authority is given to supply fittings, to sell water in bulk, and to lay mains in streets not dedicated to the public use. The Board have power to borrow the amount necessary for the purchase of the Water Company's undertaking, and £377,000 for the purchase of land and the construction of works, to be repaid within fifty-five and sixty years respectively; for new mains, extensions, &c., £30,000, to be repaid within thirty years; for working capital £5000, to be repaid within ten years; and the sum necessary for defraying the costs, charges, and expenses of the Act—the last to be repaid within five years from the day of transfer. The miscellaneous provisions of the Act confer upon the Board power to acquire, hire, erect, and furnish such buildings and offices as they may need; also to purchase water in bulk. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Worksop Urban District Council have been granted authority to purchase the undertaking of the Worksop Water Company, and supply water within the urban district of Worksop and the neighbourhood. The purchase is to be either by agreement or arbitration under the Lands Clauses Act. The Company will, of course, carry on the undertaking and maintain it till the transfer has been effected, when certain officers of the Company are to be taken into the service of the Council. Provision is made for increasing the rates charged for water in order to meet expenditure; and after ten years from the date of the transfer of the undertaking the rates to be charged for water for domestic purposes are to be based on the rateable value of the premises supplied, instead of on the annual value. The charge for water supplied by meter is not to be more than 2s. per 1000 gallons, with a minimum of 10s. per quarter. The Act contains a provision to the effect that the owner of any dwelling-house which is not provided with a proper and sufficient water supply, who shall occupy or allow it to be occupied, is to be liable to a penalty not exceeding £5, and to a daily penalty not exceeding 20s., unless the dwelling-house was erected before the passing of the Act, and a supply of water was not then available. Authority is given to the Council to borrow such amounts as may be necessary for the purchase of the undertaking, and £5000 for improving the water-works; forty years being allowed for repaying the former, and thirty years for the latter. [*Parliamentary Agents: Messrs. Baker and Co.*]

Manchester and District Junior Gas Association.—The third lecture of the series arranged to be delivered in the Manchester University will be given by Dr. Harold G. Colman next Saturday afternoon; his subject being "Carbonizing." Mr. H. Kendrick, of Stretford, the President of the Manchester District Institution of Gas Engineers, will preside. Dr. Colman is certain to have something of interest to say on the subject he has chosen; and it is therefore to be hoped that there will be good attendance of members.

CALCUTTA PUBLIC LIGHTING CONTRACT.

Report on the Mansfield Inverted Burner.

In the "Journal" for the 8th inst. (p. 414), it was announced that the Corporation of Calcutta had placed with Messrs. Mansfield and Sons, Limited, of Liverpool, an order for a large number of their improved incandescent burners, as a first instalment towards the lighting of the city. The burner, which has already been described and illustrated in our columns [see *ante*, p. 195] had been tested by the Chief Engineer of the Corporation (Mr. W. B. MacCabe, M.Inst.C.E.), upon whose recommendation the contract was placed. The following is Mr. MacCabe's report to the Committee of the Corporation having charge of the matter.

I spent two days in the gas laboratory assisting Mr. Mansfield in the testing of his new inverted burner to consume 2 cubic feet of gas per hour; and as it is much more difficult to get high efficiency in a burner consuming a small quantity than in one consuming (say) 4 or 5 cubic feet per hour, we commenced work in the small burner. As it turned out, it is rather fortunate that we did commence with this small one. The results of the tests are as follows: Maximum illumination at an angle of 50° downwards, 50-candle power; illumination at an angle of 20° downwards, 40-candle power; mean illumination, 45-candle power, which works out at a maximum efficiency of 25 candles per foot, a minimum efficiency of 20 candles per foot, and a mean efficiency of 22½ candles per foot. This result is better than can be got at the angle of maximum illumination from a Kern burner consuming 3 cubic feet per hour.

I have also thoroughly examined the burner, and have the following remarks to make: It seems to me to be the most simple burner I have yet come across, and one which I cannot see any possibility of getting out of order. In addition, it contains plenty of brass; so that, even if the excess of ammonia is not removed from the Calcutta gas (but I trust it will be, as a result of Mr. Abady's visit here), it will take a long period for the ammonia to destroy this burner. If I might venture to guess, I should say that it will take at least three or four times as long to destroy this burner with ammonia as it will to destroy a Kern burner.

In addition, the burner possesses a peculiarity which I have never seen in any other burner without gauze or other flame-extinguishing device—namely, that it is impossible to get the burner to "light-back." This is a very important point, as it means that, if the pressure falls temporarily, the burners do not light-back, and when the pressure is restored again they give their full illuminating power; whereas with a burner which has "lighted-back," no further illumination can be got from it until it has been turned out and re-lit.

My opinion is that there should be no hesitation whatever in adopting Mr. Mansfield's burner for Calcutta. The illumination given by a 2-feet burner will suffice for the majority of the streets; while 3 feet per hour will do for even the wide streets, with possibly a high-power burner at the principal street-crossings.

Another peculiarity of this burner is that, with a considerable drop of pressure, there seems to be comparatively little falling off in the illuminating power; while raising the pressure from 2 inches to 3 inches gives a very great increase in illuminating power.

The burner possesses another good point—namely, that the same burner can be used with different quantities of gas by only altering the nipple and the nozzle; so that all-round it seems to me to be the most elastic burner which has yet been made, and I can now confirm my remark made in a previous report—that if Mr. Mansfield's statements were borne out by tests in Calcutta, this burner is a revolution in gas lighting. The saving effected by it will be in the neighbourhood of one lakh of rupees per annum for gas alone, as each cubic foot of gas per hour saved represents approximately one lakh per annum; and I also believe that mantles will last well on this burner—thus effecting a further saving.

As regards the burner to consume 3 cubic feet per hour, I regret to have to say that the test of this must be put off, as the gasholder has started serious leaks in it, and it will be impossible to continue the tests until the new holder is put up. But I have no doubt whatever in my mind that it will give a better efficiency than the 2-feet burner. I should therefore not hesitate to order sufficient burners for all the lanterns in Calcutta; the majority being for a consumption of 2 feet per hour—say, about 7000 in number—and the remainder for 3 feet per hour.

Calculating the Flow of Water in Pipes.—Readers who are interested in this subject may be referred to an article by Mr. T. G. Bocking in the current number of "The Engineer."

Preventing the Corrosion of Iron and Steel.—According to Mr. G. W. Thompson, writing in an American contemporary, corrosion is best prevented by applying successive coatings of paint to the clean metal surface. The pigments should contain no hygroscopic or water-soluble matter, nor substances capable (by reduction) of acting as depolarizers; and as far as possible they should be non-conductors of electricity and inhibitors of corrosion. Linseed oil as a priming coat is condemned. The metal should be thoroughly cleansed before the application of the paint.

SOCIETY OF BRITISH GAS INDUSTRIES.

Paper by Mr. Fred. J. West—Presentation to Mr. Charles Clare.

The Autumn Meeting of the Society was held last Tuesday, at the Waldorf Hotel, Aldwych. The attendance of members was equal to the best since the formation of the Society; and their number was supplemented by the presence of several gas-engineering friends. The President (Mr. J. H. Balfour-Browne, K.C.) occupied the chair; and he was supported by the Chairman (Mr. Fred. J. West) and most of the members of the Council. It was learned from the Secretary (Mr. Arthur L. Griffith) that the acceptances numbered about 140.

The whole of the sitting was occupied in considering a paper prepared by Mr. F. J. West, entitled—

THE SOCIETY OF BRITISH GAS INDUSTRIES: WHAT IT HAS DONE, AND WHAT IT CAN DO.

In conformity with the desire of the Council of the Society that the Chairman should contribute a paper, or introduce a discussion, at the half-yearly meeting, I have, after careful consideration, selected the foregoing title, feeling that, however feebly the work of the future may be outlined, the subjects covered should provoke a good discussion from many members of the Society.

What It Has Done.

What the Society has done involves a retrospect which is not difficult to make; and it is only fitting that this should commence by a reference to the distinguished Presidents, who have from time to time graciously and willingly come forward, at the invitation of the Council, and presided over our deliberations.

The names of Mr. Dugald Clerk, the late Sir George Livesey, Mr. Thomas Newbigging, Mr. Balfour-Browne, K.C., and, prospectively, Professor Arthur Smithells, comprise a combination of which we are naturally proud. Our Presidents have, in their turn, contributed addresses full of sound advice and encouragement, and have further rendered assistance which cannot be over-estimated, and which has contributed in no small degree to placing the Society of British Gas Industries in the sound and useful position it now occupies.

If there should be any of our members to-day who have some difficulty in estimating and appreciating the advantages of our Society, I venture to submit that any difficulty in this respect should be dissipated by a careful review of the following outline of the work accomplished.

But before making a rapid review of the past, let me say this: It should be laid down as a fundamental principle in the work of the Society that it is for the benefit of the gas industry as a whole, and not for any particular section of it. This I submit with one reservation, that we are able to act as a body with greater effect in advancing mutually beneficial ends than in the weaker capacity of individuals or individual firms. With respect to this reservation we may claim, by reference to our record, that we have walked, and are able to walk, circumspectly. Examined critically, what we have done has been for the good of the gas industry at large. As intelligent business men, we do not overlook the fact that anything that is not for the good of the industry as a whole must be derogatory to our own special interests. Our success has for its foundation the success of the gas-supply industry. If the industry is not successful, we cannot hope to be.

Realizing this, it follows that all we can do to produce economies in gas manufacture, distribution, and utilization is not only of advantage to the gas-supply part of the industry, but to us, in our several spheres of activity, in doing something to enlarge the range of our opportunities. We can claim, without fear that anyone will come forward with any well-founded denial, that we have done an extremely good part, through our work as manufacturers, in advancing the interests of the whole industry. And we would that this side of our operations, if I may venture to say so, as manufacturers, and as contributors to the improvement of apparatus and producers of economy, were given prominence equal to that of the fact that we trade.

But to our review. First and foremost stand out prominently the advantages of combination among our members, thereby providing facilities for conference and co-operation with the Institution of Gas Engineers, a very fitting reference to which was made by the (late) President of the latter body, Mr. James W. Helps, in his Presidential Address in June last.

Almost the first work accomplished by co-operation in this direction resulted in the drawing-up of standard clauses of contract; and it is satisfactory to record, especially to those having the responsible business relations that we have with the gas industry, that these clauses are being very generally adopted and referred to by members of the Institution. Those members of the Institution who were present at the deliberations in connection with the framing of these clauses fully appreciated the difficulties which contractors laboured under—let it be said, in a small proportion of the contracts carried out. The standard clauses agreed upon by both sides should, where adopted, produce fair, just, and honourable contracts, and to the mutual advantage of all parties concerned.

The several conferences held with the Institution and kindred institutions with regard to proposed gas exhibitions produce testimony as to the usefulness of our Society; and in the advantageous results of these conferences practically the whole of our members have participated.

The late Sir George Livesey, in his Presidential Address to the Society, referred in a most appropriate manner to this important question of gas exhibitions. He indicated that of all industries the gas industry seems the most given to exhibitions, and that great hardship has thereby been inflicted on manufacturers of gas appliances. The formation of this Society succeeded a very successful gas exhibition. The hardship of the past resulting from exhibitions floated by exhibition promoters at which traders were invited to show their goods at great cost for rent, fitting up, and other necessary accessories (from participation at which exhibitions they first refrained, but one or two yielding necessitated the rest following), has disappeared, and continued wise and effective co-operation in the future should produce beneficial results to the whole industry. The question of exhibitions will again be referred to later in this paper.

Useful work has also been accomplished by the Society, in consultation with the Institution of Gas Engineers and others, with reference to the amendment of the Sales of Gas Act, 1859, in relation to the testing of gas-meters, as well as in connection with the standardization of refractory materials and the attitude of the Home Office in regard to flueless gas-stoves. Through the Society, too, there has been consultation with the Gaslight and Coke Company in regard to the agreement of the gas-stove makers with the Company, in connection with the Company's scheme of business relationship with London ironmongers. We have done our part, also, in the furthering of the work that has for its object the improvement of the sanitary conditions of the atmosphere of our towns.

Other valuable work has been accomplished associated with parliamentary measures affecting our industry; and more recently the Society has taken part in the many deliberations which have resulted in the establishment of a Chair of Gas Engineering and Fuel at the Leeds University, fittingly and deservedly termed "The Livesey Memorial." The Society is represented on the Committee by Messrs. Dugald Clerk, T. S. Clapham, H. James Yates, and myself.

It is only possible to enumerate here a few of the outstanding features which have engaged the attention of the Society during the five years of its existence. There are many other less important but necessary subjects which have been considered with resultant benefits to the industry generally.

Apart, however, from the ground covered, the results achieved, and the subsequent advantages, the members of our Society will no doubt be the first to admit that a considerable benefit has been derived by association. In other words, there is now a much better feeling prevailing among contractors and manufacturers than that which existed prior to the formation of the Society; and the collateral advantages appertaining to this state of affairs are inestimable.

In concluding this section of my paper, let me ask, Would, or could, all this work have been accomplished had this Society not been brought into existence? Emphatically, the answer can be given—"No." Without a corporate body, our section of the gas industry would have been without any agency that could act or speak in its name, and without the machinery necessary for initiation and co-operation. We need not look very far beyond this statement for the negative result as opposed to the beneficial results which, fortunately, we are able to look back upon, and which will have a beneficial bearing on our interests in the future.

The Future: What the Society can Do.

But as to the future, let me say that I hold strongly to the opinion that the Society, useful as it has been in the past, can develop and progress on such lines that it may become still more the medium for advancing the industry with which our interests are all so intimately bound up.

Gas Exhibitions.—First of all, as before indicated, inasmuch as the Society was formed at the time of a successful gas exhibition, one of its principal functions will be to advise upon, and, when desirable, take part in, and control as far as it lies in its power, suitable exhibitions. In the past, there has been a feeling that exhibitions have been promoted which have not always been successful in achieving the objects for which they were organized, and which certainly have not been productive of business commensurate with the expenditure entailed. We want to avoid, by every possible precaution, a repetition of this experience.

The success, in my opinion, of a gas exhibition depends chiefly on four factors:

(1) A sufficient representation of well-known and progressive firms.
(2) The co-operation of gas authorities and their chief officials.
(3) Efficient and good management.
(4) The securing of public support.

As, however, success depends mainly upon the first two factors, it is only right and proper that those chiefly concerned should share with the management in the financial success or otherwise of an exhibition.

The Manchester Gas Exhibition, in 1907, is a notable example of the combination of exhibitors as represented by this Society, and of gas authorities as represented by the Manchester District Institution of Gas Engineers; and, in the future, it is in this

direction that similar exhibitions should be organized and conducted. Otherwise, we shall never get what we, as business men, desire from exhibitions, and that is full, or at any rate reasonable, value, in material benefit, for the amount of money expended.

Trade Matters.—In connection with the internal management of our business establishments, there must of necessity be many points in common in relation to the various trades covered in the manufacture of our many commodities; and I venture to submit that the Society can become a very useful medium for reference in regard to matters of wages and conditions affecting the different classes of workmen, and as to the line of demarcation between those various trades, over which line, in all industries, there has been a considerable amount of controversy, to say nothing of friction, in the past.

Very few of our members belong to the Engineering Trades Employers' Association, the members of which have reaped many advantages in this direction. There is a point for consideration here. Seeing that, in the manufacture of our goods, practically every branch of the engineering trade is covered, there must necessarily be many difficulties to encounter in the management of the men employed in those various branches.

And while admitting the important and useful functions the various Trade Unions perform in our industries, there are naturally many points of difference requiring another form of settlement from time to time; and in the settlement of these points, and in the guiding of the Trade Unions and workmen to a wise and fair decision, I submit that the usefulness of this Society could be very materially developed. The standard rate of pay, working hours, out-money allowances, the proportion of apprentices as compared with journeymen, overtime rates, and the manning of machines, are some of the points which, in the past, have probably arisen from time to time for discussion and settlement among members of the Society.

In the future, the Secretary might be the medium for obtaining useful information on these various points for the guidance and assistance of any member.

Technical Training.—If our industry is to maintain its proper position in competition with its foreign rivals, and its very keen rival electricity, it is essential that members of the Society should train and bring to the front their young men, to assist them in the development of their business. We cannot rely alone on our past success, nor upon the reputation we have made for good work. This introduces the much-discussed question of technical education, which has been a subject of a great deal of controversy, and upon which there is a wide divergence of opinion.

The training of our apprentices in a suitable way for efficiently carrying out their duties, is a question which involves both a technical and a practical training; and to what extent the former should be developed in regard to the latter, is a matter which it is very hard to determine. The practice many young men adopt of providing themselves with a purely technical education (in some cases obtaining engineering and scholastic degrees) is one which is open to severe criticism. In connection with them, we are faced by the fact that there are many who have excellent qualifications technically, who absolutely lack practical training, and who have reached that age at which they find themselves unprepared, and, moreover, are unsuited to adapt themselves to the drudgery incidental to the practical training.

The system in vogue at the Manchester School of Technology, which provides special day courses for engineers' apprentices, is one which commends itself to me very favourably. These courses provide that selected apprentices employed in engineering works are afforded facilities at special day classes for instruction in engineering subjects, which in the ordinary course of events, they could only receive at evening classes. In order, too, that the organization and the business arrangements of the works from which the apprentices are drawn may be disturbed as little as possible, the classes comprised by the courses are all held on one day—Monday. Before entering for this course, it is necessary for the candidates to give evidence as to their having a satisfactory knowledge of mathematics and mechanical drawing, thereby ensuring that they are in a position to take full advantage of the instruction offered. The course, which extends over a period of three years, in this way combines in a very efficient and satisfactory manner technical and practical training.

The number of apprentices to whom any firm would be prepared to afford facilities for attendance at this day course is naturally limited. In the case of the firm with which I am associated, in addition to a few selected apprentices already in attendance, as an inducement, the leave of absence necessary for attendance at this course is now being offered to those apprentices who have evinced marked ability in their former evening classes.

In the majority of towns, such a course as that indicated is not available. But certainly ample facilities are afforded to-day in almost every large industrial and commercial centre for apprentices to obtain a sound and thorough technical education at evening classes; and in this connection employers might practically insist that their apprentices should attend evening classes of the kind.

It is now one of the conditions of employment in the case of all the apprentices who come under my control that they shall take advantage of the facilities offered at the evening classes provided by the Municipal School of Technology and by the Education Department of Manchester; and a special inducement is offered to all apprentices to encourage them to use every effort to pass the various examinations at these educational centres. This inducement consists of an advance of 6d. per week, over and above the usual annual automatic advance, for success in either one of the Engineering Courses, or in any two engineering subjects; and since it is possible for an apprentice at the age of fourteen to obtain, in the period of his apprenticeship, successes at examinations for six years consecutively, it follows that, under this system, he could, at the end of his time, be receiving three shillings per week more than an apprentice who had not been successful.

While, however, this system has been taken advantage of by a number of apprentices, it must be confessed that there is wanting, with many, a spirit of enterprise; and reluctance is all too prevalent among a number to avail themselves of the excellent facilities provided at the Technical Schools.

Municipal and Local Government.—In connection with municipal and local government, the members of the Society can, and should, exercise the greatest possible influence.

With the expansion to-day of municipalization in many directions, the enterprise and scope of individual trading is being very seriously threatened, and is certainly already gravely handicapped; and the conditions under which contracts are required to be carried out have a tendency to become arbitrary, and in some cases almost impossible of fulfilment. The members of this Society should, therefore, be on the alert to influence municipal legislation, and to do their part in the effort to curb speculation by local authorities; so that the industries which they control, or in which they have their lot, may not be hampered by severe and illegitimate restrictions.

As an engineering training fits a man in one of the best possible ways for taking an active part in the local government of our various towns, the principals of the many firms represented in the Society should, in my opinion, be prepared to take a more active part in this matter than they have hitherto done. I do not know of any one with greater fitness than the men to be found in our ranks for serving the public interests, and at the same time for protecting local industry.

The administration of the chief department of municipal enterprise, comprising, as it does, gas, electricity, water, tramways, sewerage, all of which embrace more or less engineering questions, requires men with engineering training to guide and assist in the development and economical management of such departments; and yet it has to be confessed that engineering, as a profession, is numerically very sparsely represented in municipal councils at the present time.

Future Meetings.—Of domestic concern is the question of our own meetings. In my opinion, meetings of the Society could, with advantage, be considerably developed, and, in future, two or three days at least might be very profitably occupied by annual meetings. Apart from the reading and discussion of papers, visits to engineers' works and manufacturing concerns could be arranged, on similar lines to those adopted by the Institution of Mechanical Engineers, by the Iron and Steel Institute, and other technical associations at their annual meetings.

As a practical suggestion in this direction, an early meeting might be arranged at Leeds with a view of visiting the Leeds University, and inspecting there the arrangements in connection with the "Gas Chair," and at the same meeting a paper or papers could be read on a topical subject.

Advancement of the Industry.—Although this subject is left nearly to the end of the paper, the position must not be taken as representing any estimate of the value I attach to it. The importance of, and the advantages to be derived from, combination cannot be exaggerated; for it is not difficult to conceive that a burning question, menacing the whole industry, may appear on the horizon at any moment, and for such a contingency our Society must always be on the alert. The Society, however, does not fulfil its proper functions if confined only to a protective policy; and its whole strength should be directed to further the gas industry by a sound aggressive and progressive policy.

In combination with those whose interests are identical with our own, the smoke abatement question should receive our serious consideration; and new legislation affecting the interests of the gas industry should be carefully watched, and our active support or opposition be given in no half-hearted way. All sound projects for the sale of cheap gas for power and industrial purposes should be encouraged. Any proposals and movements of an educational nature, placing before the users of gas the advantages and proper use of this commodity, should receive our hearty support. It may possibly be argued that several of the subjects touched upon in this paper concern our members individually rather than collectively. It should, however, be admitted that one of the fundamental principles of a technical society, such as ours, should be the dissemination of views which may lead to the advancement of the whole of our various interests; and it is in this spirit that I have touched upon some of the subjects.

The Essential Dominating Spirit.—In conclusion, let me say that I have not prepared this paper with any view of exhausting a subject which I regard as of importance in, if properly considered, raising the status and dignity of our Society. The paper I want you to take as a mere foundation for discussion, from which I hope further suggestions will be forthcoming.

I hope I shall be pardoned for saying that loyalty at all times to the Society should be the keynote of all our members, with an absence of that spirit which only looks for individual gain and profit. With the right spirit, with high ideals, with loyalty and co-operation among our members, useful as our Society has been in the past, the future offers scope for the prosecution of fresh

work that will be mutually to our own interests, and that of the gas industry as a whole, and redound to our credit by contributing to the general good of our times, our contemporaries, and our circumstances.

Discussion.

The President said he was sure the members would agree with him that his first duty was to return to Mr. West, in the name of the members, a very hearty vote of thanks for his most interesting paper. In the earlier part, the author had indicated that the work of the Society lay in co-operation with the producers of gas, in order to achieve economy. It was by economy and by selling cheaply, that they and the gas industry must succeed. He (the President) found that an excellent method which had been tried in high quarters with failure had, according to the paper, been successful in their own case. He referred to the facilities for conference. The paper went on to mention the subject of exhibitions, and pointed out how useful these might be made by co-operation. There was a more controversial question under the heading of technical training. The author said: "If our industry is to maintain its proper position in competition with its foreign rivals, and its very keen rival electricity, it is essential that members of the Society should train and bring to the front their young men, to assist them in the development of their business." He (the President) could not help feeling that in these words there was a red herring drawn across his path, to induce him to say something about tariff reform. But he absolutely refused to be drawn. [Laughter.] With regard to the next matter dealt with in the paper—that of technical education and practical teaching—he was entirely at one with Mr. West. Technical education was an excellent thing in its way; but if it were separated from practical training, it seemed to him worse than useless. Universities had made a great number of scholars and book-worms, but very seldom men. It was the world that made men. In their apprentices in their workshops, they were forming a more important part of the character of the future than could technical education. Not that he would say that technical education was of no importance; what he did maintain was that it must go hand in hand and shoulder to shoulder with the practical work, and that there must not be separation. The author also invited criticism on the question of municipal trading. He (the President) would not follow him into this nice question, as Mr. West knew more than he about the municipal trading of cities like Manchester. [Mr. West: No.] It was, he agreed, the duty of members of the Society to take part in the municipal life of this country. There was an ugly word the Americans used, called mugwumps; and the less they adopted the policy of being mugwumps, the better. It was not only a question of choice and liking, but one of necessity, in these days. The real question of the future was as to whether they were to be governed in their municipalities, or even in higher quarters, by the intelligence of the country or merely by brute force. If intelligence folded its hands, and sat in an easy chair, brute force would have it all its own way. He hoped that day had not come for Britain. The functions of a municipality were, as pointed out in the paper, very closely allied with the lifework of members of the Society. Sewage, gas, water, electric power, roads, drainage, and other things, were all matters with which engineers had to do; and to have them conducted, on behalf of the community, by men technically and commercially qualified as were the members of the Society, was, in his view, most important. He should like to know what Mr. West meant by an aggressive policy. He said "aggressive and progressive;" and he (the President) did not understand the aggressive policy. With regard to smoke abatement, the members had done, and were doing—the gas industry were doing—a great work. Only last year the London County Council promoted a Bill for the purpose of removing the definition of the character of smoke emitted from the works of manufacturers, gas companies, and electric power companies. They were liable at present to punishment for the emission of black smoke; and the County Council brought in a Bill to delete the qualification "black," and leave merely smoke. It was pointed out by both the South Metropolitan Gas Company and the Electric Power Company at Lots Road that it was impossible to avoid smoke on certain occasions—occasions of accident, and when there was a large accession of demand for power, and additional boilers had to be suddenly set to work. Luckily the evidence went to show that the great companies and the great manufacturers had done much to mitigate the smoke nuisance in London, and that any manufacturer whose load was steady, and who could calculate what his load would be, could prevent the emission of smoke that would be a nuisance. The members of the Society were interested in this matter. The Bill of the London County Council, he was very glad to say, was rejected. But still there must be further progress; and the members knew the means for accomplishing this better than he did. He was certain Mr. West did not appeal to the members of the Society in vain for high ideals. They must all have regard not only to their business, but to something beyond their business; it was by these high ideals that their business must be regulated. He congratulated Mr. West on his paper.

Mr. H. James Yates (Messrs. John Wright and Co.) remarked that the paper their Chairman had contributed to the proceedings was one that opened up many topics for discussion. Mr. West had pointed out what the Society had done, and what it could do; and, in passing, in connection with what the Society had done, he might remind them of a very important matter accomplished affecting manufacturers. This was the question of railway rates. Some time ago, a certain section of the Society was very much oppressed by the class in, and the rates at, which their goods were conveyed. Some individual members appealed to the Railway Clearing House, but without success. A deputation from the Society waited on the Clearing House; and they were fortunate enough not only to get the class altered, but the rates reduced. This spoke volumes for what the Society could do through the members being united in their efforts. There was also the question of exhibitions. Here perhaps he (Mr. Yates) was treading on dangerous ground. But he thought frankness the best for all. There had been a tendency on the part of the gas companies to force gas manufacturers into exhibitions. Exhibitions conducted on fair lines were good things for the industry; but when the gas companies were not prepared to spend anything or do their share, and would not give the public an opportunity of acquiring goods shown, on reasonable terms, while asking the manufacturers to bear practically the whole of the expenditure, with no share in the profits of the exhibition, such an arrangement did not commend itself to him as being fair. Through the Society, however, they could meet gas engineers and discuss what were good and fair lines upon which to work in this connection. As to the question of technical training of young men, speaking from a fairly long experience in business, he must say he had had great difficulty in getting good men. And it was a sign of the times to find science and scientific training, coupled to practical training, much more the vogue than it used to be. Certain sections of the Society were, however, somewhat at a disadvantage; they were differently placed from gas companies. Gas companies could disclose one to another any success they had met with in new forms of carbonizing, or anything else in their ordinary work. But manufacturers were not always in this position; they could not disclose everything they would like to to their competitors, because they would lose by doing it. Still, looking at the general question in a broad and fair-minded way, much could be done to improve the youth coming along, both in scientific and in practical training.

Mr. Hugh F. Wright (Messrs. C. & W. Walker) said there were only one or two small matters to which he should like to refer. Certain references to technical training in the paper opened to their acceptance or following Mr. West's practices and good example. Certainly, it was a difficulty they all met with—the finding of young men who had both practical and technical training to tackle new subjects, new processes, or new manufactures which might be put before them for adoption. So far as he could see, it was only by coupling the technical with practical training that it was possible to really get the most advantage from the former. The suggestion of Mr. West, as to encouraging apprentices to attend classes, was a good one; and he (Mr. Wright) thought it would be to their advantage as manufacturers generally to copy it. There was a point upon which he should like to go a little further than Mr. West. He referred to municipal trading. He thought that as manufacturers they had entirely failed to take their due share in the work of municipal government. The proof of this was easy to discover. Taking the returns relating to local authorities issued by the Local Government Board every year, they found this going forward: First, as to the debt of the municipal authorities. Taking them together—county councils, borough councils, district councils, and guardians—their present outstanding loans aggregated 494 millions. This was a very large sum of money; and the position was really a difficult one. In their own business as manufacturers, they took a profit only after they had allowed not merely their expenses in finding material, but after they had also paid for the loans they might have used in their business, with due allowance for maintenance and repair of plant, and something in addition for depreciation. As prudent men, they knew the value of keeping their plant, machinery, and buildings up-to-date. They found nothing of this latter done in municipal trading businesses. They would find in the returns interest was paid at the rate of about 3 per cent. year by year; and that some of the municipal departments did pay something towards the rates. But they found also that they were paying off their loans at a very slow rate indeed. Taking the four so-called, or might be, reproductive undertakings—that was, gas, water, electric lighting, and tramways. These had at present allotted to them a capital expenditure of about 131 millions. The expenses during the last year for which the returns were available amounted to somewhere about 13 millions; and the receipts to roughly 21 millions. Out of the balance of about 8 millions, the authorities had to pay a sum of £4,200,000 for interest on the borrowed money—that was (say) 3·1 per cent. They also paid 2¼ millions towards the sinking fund. But they also took £1,900,000 out of the sinking fund; and the total towards the sinking fund did not exceed 1 million. At this rate, it would take 130 years to pay off the loans. The result of this was that year by year further loans were being obtained far in excess of the allowances put to the surplus funds in any way for depreciation or any such purpose. The rates were being increased out of all proportion to services rendered; and they were bound to go up until business men took a greater interest in municipal government, and pointed out to the men who were on their local governing bodies the folly of the course that was being pursued. In connection with this matter, he thought the members of the Society might do more than they were doing at present. Mr. West's remarks in this respect were certainly worthy of their serious consideration.

Mr. H. M. Thornton (Richmond Gas Stove and Meter Company) said that, after the paper they had heard, he felt that he was fully justified for having moved in the Council that the Chairman for the time being should have the honour and pleasure of reading a paper to the members of the Society, because he felt that the Chairman should not occupy such an honourable position without also doing some work in this connection. Mr. West had not disappointed him, because he was sure they must be all agreed that the paper had not only been admirable in its choice of subject, but also in its detail. It contained very much of value to the Society, as well as to the industry to which they mutually belonged. He was also quite sure that when they realized that the Society comprised some eighty or more firms, that the total capital involved or associated with these firms represented not far short of 30 millions of money, and, carrying the illustration even further, that they employed very many thousands of people in their various industries, it was apparent that the Society (which was now about five years old, probably a little more) should have had a paper of this kind referring to their past history and to the outlook for the future. He had no hesitation in saying that the Society had been a great success; and that, guided by good counsels, it was going to take a still more important part in the industry in the future. They had excellent men on the Council; and he felt that the Society was going to succeed even beyond the most sanguine expectations of the founder. He alluded, of course, to their friend Mr. Charles Clare, whom he was glad to see present. He should like to make reference to one or two points raised by Mr. West in the paper. Perhaps he (Mr. Thornton) was more particularly interested in the remarks the author had made with respect to municipal and local government work generally. Busy men, as a rule, were able to get through more business than men who were not busy; and he was therefore glad to hear the opinion of the President and the author that the business men represented by the members of the Society should take greater part in municipal government. He (Mr. Thornton) had heard the excuse made on so many occasions, "I have not the time." His own experience was (and he regarded himself as a busy man) that he had been able to find time to take part in local government work now for some years; and he could assure those present that, so far as he was personally concerned, the time had not been in any way wasted. It had brought him experience and knowledge that he did not before possess; and he could safely say that he was the better business man for taking part in the counsels of local government than if he had refrained from so doing. He would say this, too, that no man need consider it a loss of prestige to take part in local government. Looking back for twenty years, they found men then taking part in local government work of a type that was fast disappearing from the councils of to-day. This was a most unfortunate state of things; and unless something was done by business men, who had money to back them up, and could spare the time to take part in the work, he was afraid they were tending to a great deterioration in the intelligence of their local bodies, and this would be, and was, a loss not only locally, but to the nation at large. The smoke abatement question, too, was one upon which they could not dwell too much—not only from the national point of view in respect of damage or deterioration to their magnificent structures, and not only from the point of view of those to whom the beauty of their towns was a matter near to their hearts, but from the national point of view of health. It was the duty of everyone to, as far as possible, avoid what was to-day an unfortunate condition of things in the way of the smoke nuisance. In the future, they would have an enemy very much in front of them (he was speaking now of their friends the electricians and the electric light); and he felt that it was only by co-operation between the gas profession and the industrial portion of the industry they represented, that they would ultimately succeed in, at any rate, attacking the enemy, and in making greater progress. He urged the members to do their utmost to bring in other members, so that they might have such a body of opinion expressed through the Society that they would not only help the particular industry to which they belonged, but the industry as a whole.

Mr. T. S. Clapham (Messrs. Clapham Bros.) said there was no need to refer to the first portion of the paper as to what the Society had done; but with reference to that part, he must say that personally he was pleased he had been connected with the Society from its inception. Their membership and the sketch of the work that had been accomplished showed that they had high ideals, and that they were desirous of the good of the industry generally. His own points would refer to the latter part of the paper, as to what the Society could do. The Chairman had alluded to exhibitions. This was a matter that had often been before the Council; and they had done good service in being able now to control exhibitions somewhat better than they used to be. One practical point in regard to exhibitions. It had often struck him that there was too much repetition in them—in, for instance, gas-stoves. They saw row upon row of these; and he thought it a pity, and a little too bad. What struck him was that something might be done as was done at the Brussels Exhibition by the Bradford and Huddersfield people. They did not decide to show all their separate goods; but through their Chambers of Commerce, they agreed to have a combined display. The trades of these two towns were as busy as they could be to-day. Some such lines as these, or those followed by Mr. J. W. Helps in connection with the Franco-British Exhibition, would be better than all the repetition work they now saw at gas exhibitions. As to technical training, he came from a town that had taken a good deal of interest in this matter. He referred to Keighley. Thirty years ago, he believed they were pioneers in technical education; but in the engineering department they had been rather slow. But they were beginning now, having seen what technical education had done for the textile industries. He had asked the master of the Technical Schools to let him have a few particulars in view of this paper. He found that the textile department in 1902 had only 17 students. In 1909-10, it had 170. During the past four years, the department carried off three out of four Drapers' Scholarships in wool and worsted weaving; and these scholarships were worth £85 per annum for three years. They had also taken two of the three scholarships offered the last two years by the West Riding County Council. This was the way they were training the young men in the textile department. They were also training day-school boys in textile work, giving them about seven hours per week, instead of taking a general science course. In all departments, the Town Council and the County Council had good scholarship schemes which enabled the best boys to get an excellent evening school education free. This was a difficult matter to establish; but now the great majority saw the advantage of taking auxiliary subjects, and attended willingly. In conjunction with the Chamber of Commerce, they had a scheme for granting certificates, and many of the large employers paid the fees of their employees. Their own industry—engineering—seeing what had been done for the textile industry, became dissatisfied some three years ago. They wanted to dive more into iron and steel, and so on; and now they had a metallurgical class formed, and were getting young men trained to investigate such matters in connection with the engineering industry. They were also considering a large extension of the work of the schools, to cost more than £10,000; and they hoped to give equal advantages to members of all trades. Many of the boys trained at these schools now occupied important positions both locally and in other towns. He thought these particulars gave them confirmation as to the Chairman being on the right lines; and he (Mr. Clapham) considered that, by encouraging this sort of thing in their various spheres, they would be doing a good work. With regard to apprentices, he did not know whether the members generally had any trouble; but in his town they had found great difficulty. The industries were largely textile; and boys were put on to piece work—the result being that in engineering works they had the greatest difficulty to get boys to come and take positions as apprentices. These boys got better remuneration by taking up ordinary work in the textile factories; but they did not turn out skilled men—simply tools, and, when trade became bad they had no employment. The Chamber of Commerce, in order to get over the trouble of apprenticeship, were asked to frame some rules or recommendations. A Special Committee was appointed for the purpose, consisting of four members of the Chamber and the President of the Society of Engineers; and the following recommendations were drawn up:

(1) That a person who has been apprenticed to, and learned, a trade, is better than one who has not learned a trade.
(2) That a boy will have a better chance in life if he learns a trade.
(3) That the best way to learn a trade is for the boy to be properly apprenticed by indenture to his trade.
(4) That wherever possible attendance at a Technical School is necessary at the time of apprenticeship.

And as a means of raising up a class of efficient men for the good of Trade and Commerce, we suggest the following resolutions:

(1) This Chamber of Commerce recommends parents to have their boys apprenticed by indenture to a trade, and the apprentices to attend suitable classes at the Technical School at the same time.
(2) Advises that at the conclusion of the time (*a*) The employer shall sign and return the indenture to the young man, stating that the terms of the agreement have been faithfully carried out to his satisfaction, and the young man is a competent workman in the trade. (*b*) The head master of the Technical School shall also sign the indenture, stating what classes the young man attended, and what success he achieved at the Technical School. (*c*) This shall be further signed by the President of the Keighley Chamber of Commerce, and stamped with the seal of the Chamber.
(3) We recommend that no boy shall be indentured without first going on trial for six months, to prove if he is suited to the occupation.
(4) We recommend that all indentures should be properly drawn up and strictly carried out.
(5) We believe that, if this system can be carried out, a young man will have a certificate which will enable him to get a good class of employment.

This document, signed by the different firms, would be a testimonial to any young fellow who had attended the Technical College. It was also signed by the Chamber of Commerce; and the possessor went out into the world with a testimonial that would carry him anywhere. They were not selfish in this matter. It had been asked, What is the good of training men for other parts of the world? They took the broad view that it was well to train young men fit for service in the industry wherever they were engaged.

Mr. W. J. Jenkins remarked that nearly all the speakers appeared to have been considering the technical education question; but he did not think they would be doing their duty if they did not make reference to one thing they had done since the

Society started. He referred to the standard clauses of contract, which had been arranged so amicably between the Society and the Institution of Gas Engineers. Political revolutions generally began with certain grievances. But the man who first acted usually got locked up for a long time, or lost his head. Fifty years afterwards, the revolution perhaps was accomplished, and the first rebel was put on a pedestal, and the whole population rushed out to speak eulogies of him, and to put up monuments in his honour. But he had most probably died dishonoured and obscure. This Society was fortunate enough to collect a body of men to point out to the gas industry that certain grievances did actually exist, and that the call for revision in the conditions of contract was not an imaginary request of a mere malcontent. The success of this act alone, if it had been the only one the Society had performed, would have well justified its existence. He had intended to refer to the subject of technical education; but all he would say was that he referred as the type of technical education in which he believed to his former pupil, Mr. Fred. West. [Applause.]

Mr. T. B. Peattie (Messrs. John Wright and Co.) said he rose merely for the purpose of making a suggestion. They had heard a good deal at this meeting about technical education; and he felt the subject would be stimulated by the admirable way in which the matter had been dealt with in the paper. They had heard of the zeal and the means taken to encourage technical education at different places; and they had heard of what different firms belonging to the Society were doing in this way. It was a comparatively easy matter to suggest to other people what they should individually do; but he should like to make the practical suggestion that the Society as a body should offer some reward to young fellows, on a definite basis of work, and so in this way identify themselves with the encouragement of technical education. In this manner, they would realize one good result out of the paper. To be a little more precise, it occurred to him whether they, as a Society, could not offer some substantial kind of prize to be competed for, and awarded to the most successful student—say, in the City and Guilds annual examinations, or in some other form that the Council, after due deliberation, might consider to be wise. He felt very strongly that they should help in a substantial and tangible way this subject of technical education; and if there was no good reason against it, this was a matter he should like to see the Society take up.

Mr. James W. Helps, invited by the President, said it was very kind to give him, though only a guest, an opportunity of saying just a few words on this excellent paper by his friend Mr. Fred. West. He had appreciated very much indeed the remarks he had made with regard to the little he (Mr. Helps) had done in trying, as far as possible, to cement the spirit of co-operation between the Society and the Institution of Gas Engineers, which co-operation he believed to be productive of much use. If the Society only based its claims to existence on the work already achieved, he thought its existence would be more than justified. Mr. Jenkins had already referred to the excellent work, and (he might say) the very pleasant work, done by co-operation between the Institution of Gas Engineers and the Society in connection with the framing of the standard clauses of contract; and he was glad to hear from one or two members of the Society that the work then accomplished had not been thrown away, and that many engineers were using, if not wholly, at any rate in part, the clauses then drawn up. And he thought it was not only past work, but present and future work, which justified the claim not merely to existence, but to absolute indispensability of such a Society as this. Take, for instance, the question engaging the attention of principals and representatives of this body and the Institution of Gas Engineers—viz., the investigation of the question of refractory materials. A Committee was just now sitting, or rather it was sitting from time to time; and Dr. Colman would agree with him that it was doing excellent work, and bid fair to remove from the British manufacturer the slur cast upon him that he could not make retorts and other fire-clay goods so well as some of their Continental competitors. He (Mr. Helps) thought they were generally agreed that they had in England as good fire-clay material as could be found anywhere; and it only remained for research and experiment to be made which would help manufacturers to obtain the information that would enable them to mix clays and make refractory material which would stand the severest test applied in Germany or any other part of the Continent. There were one or two points he should like to touch upon. He could not refrain from speaking of technical training. It was a matter he had been interested in for many years. He had been Chairman of a technical body for 21 years; and therefore he had some little experience of the subject. It seemed to him that, in this matter, there were one or two main difficulties, and one was the question of examination. Mr. West had referred to the fact that he gave apprentices in his employ who passed certain examinations a stated gratuity each year in the shape of extra wages. But he (Mr. Helps) could not help feeling there was just the possibility of falling into error when they made the passing of a simple examination the basis of giving gratuities. They had had before them in the Council of the Institution the point of whether it would not be possible to alter the questions asked in the City and Guilds examinations. But the difficulty cropped up, were they going to base these questions on the possible knowledge of those in their employ, and who were engaged in doing practical work, or were they going to give any young fellow, whether he was practically engaged or not, an opportunity of going to classes and passing examinations, and afterwards getting positions without any practical knowledge whatever? He did not think any managers would allow that this sort of thing would be useful to them. Examination was a great factor in the question whether students would or would not attend technical classes. He had found it so. The question therefore was, Were they going to have this examination set to suit practical men or simply theorists? He had known of cases where young men had gone in for these examinations, and had passed with honours; and he believed that some of them would not know a gas exhauster if they met one walking down the street. [Laughter.] Another question was the lack of suitable teachers. From the students they were now making the suitable teachers of the future. But at the present time, they were hard up for really practical men who had the technical knowledge to properly instruct a class. He believed, touching a point raised by Mr. West, that one of the difficulties of getting students to attend classes was the many counter-attractions open to them. He was not against sport; but one of the great growing evils of the day was that amusements were made so very easy to the young. In his own town, he could count no less than 25 places of amusement. He would not go into the question of exhibitions. Mr. Yates had touched upon that; and he (Mr. Helps) agreed very much with what he had said. There was one matter, however, to which Mr. West had referred in the paper. He said: "Any proposals and movements of an educational nature, placing before the users of gas the advantages and proper use of this commodity, should receive our hearty support." He (Mr. Helps) thoroughly agreed with this. He wanted them to understand that the Institution of Gas Engineers thoroughly appreciated the truth of what he said. He did not think he was betraying any confidence in saying this matter had lately engaged the very serious attention of the Council of the Institution. They formed a very important Publicity Committee only a few days ago—a Committee composed of the whole of the Council of that body, and several influential gentlemen who had been asked to join. By this means, they would have a most influential Committee to deal with the work of publicity. It was felt to be very important that gas companies should have brought home to them the necessity of doing something, especially from the point of view of paying for the advertisements that were necessary if they were to hold their own. This influential Committee would ask the various gas companies to subscribe for the work a certain sum, based on so much per million cubic feet of manufacture, to provide a fund which would be used almost entirely for purposes of advertising and disseminating useful information. He suggested that the Society could consider whether it was not possible there was some way in which co-operation could again be brought into use, and be brought to bear upon this question from the side of the Society. He congratulated Mr. West upon the way he had introduced to the meeting the past and possible uses of the Society.

Mr. Dugald Clerk remarked that he was glad Mr. West had given such a thorough account both of what the Society had done and what it might be expected to do. As the first President of the Society, he (Mr. Clerk) had great pleasure in co-operating with the members of the Society in meeting the Council of the Institution of Gas Engineers, and discussing with them the question of standard clauses of contract. As Mr. Helps had said, the discussion was a most interesting one, and was also a most pleasant one. They argued as keenly as they knew how on both sides; and they arrived at a compromise with regard to many of the clauses which had proved to be just. With reference to technical education, this, of course, was an interesting and a burning subject. He was glad to find the Society and the Institution of Gas Engineers were taking a great deal of interest in technical education, because there was some little chance of getting on to the wrong track. As those present knew, all the Universities were practically taking up engineering classes; and the largest School of Engineering at the present moment, so far as the number of pupils were concerned, was that at the Cambridge University. Although Cambridge was one of the latest to take up engineering, it had gone ahead at a very rapid rate; and it was doing excellent work. The other Universities were doing the same thing. One little point he should like to bring to notice as to the way they could help the Universities. So far as an Engineering Chair was concerned, the Universities were generally so poor that they had no funds; and there was very little money for the modern engineering side. Whenever the Universities started an Engineering Chair, they always seemed to write to him, and ask him to present them with a gas-engine. [Laughter.] He had had some little difficulty in complying. But through the Company with which he was associated—the National Gas-Engine Company—he had always succeeded in presenting a gas-engine. He must confess that, in getting his Board to look at the matter in a proper light, he had had to use commercial arguments rather than scientific ones. He should like the members to think of Universities, and try to present them with suitable apparatus appertaining to the particular industry of the firm. Being more interested in the purely scientific side, he was glad to let them have examples upon which to practice thermodynamics. The commercial argument, however, was simply this. If they presented a piece of apparatus to a University, a great number of young men were brought up as engineers partly in connection with this piece of apparatus; and they became used to it. No matter what might be the part of the world to which these young engineers afterwards went, the advertisement obtained in this way was very much better than putting up plates at every railway station as

was often done nowadays. But as to technical education in relation to practical training. He had had a good deal of experience with his professor friends. They often sent young fellows along to him asking him if he could find an immediate post for them—young men with perhaps a B.Sc. degree in engineering. They had had a very fine scientific education, but no works' experience at all. Unfortunately they thought they were engineers, and nothing would satisfy them but an immediate post with a salary of at least £500 a year attached. He had to explain to them that though they had a University degree in engineering, unless they had considerable knowledge of workshop practice, they were not much good in the works, and many firms would rather pay £500 a year to dispense with their services than accept them. It was a hard state of things for one who loved science like himself to have to tell these young fellows this; but it was true. It was quite true they must have a man properly educated in the science of his day; and a young man could easily get in the modern technical school—such as the Manchester School of Technology—quite sufficient technical education for his purpose in the evening. In his own case, he entered his father's works at 16 years of age, and went through his college training afterwards. There must be a combination of scientific and practical training. The works should be taken first. Then a few years of purely scientific training, and then back again to the works and drawing office. When he was young, it was more difficult to get technical or scientific training. They had, however, in Glasgow very good evening schools; and as a young man, while he was at his father's works, he used to go two or three nights a week to study science, chemistry, physics, and all that sort of thing.

Mr. Thomas Marsh said he should like the Society to go in for some strong protective policy. He found that municipalities did not give fair or free trade to gas undertakings under any circumstances. If a municipality was the owner of the gas undertaking, the finance committee grabbed the last penny of profit that they possibly could from the gas committee. At Manchester, the Chairman of the Gas Committee (Alderman Gibson) had stated that the Gas Department was being slowly murdered by the extortions of other Committees for the purpose of keeping their municipal undertakings going and for hiding their speculations. No municipality had a right to go in for speculative enterprise. With gas more had been done to clear the atmosphere than with anything else. They had in summer a moderately clear sky and clean air, because in summer there was now comparatively little solid fuel used in their households; and if municipalities would only sell gas cheaply for heating and cooking, it would be used as much in the summer as it was in the winter. The atmosphere then would be cleared, and that very shortly. He was of much the same opinion as the London County Council, that the word "black" should not be in the Act dealing with the pollution of the atmosphere, but that any smoke should be stopped. But gas committees were not masters of the situation; and gas consumers were passive resisters. They were passive resisters, because in nine cases out of ten they resisted using gas in winter time owing to the restrictions corporations put in the way. If gas committees were allowed to manage gas undertakings with the aid of their gas engineers, he believed that things would go right. But the authorities would have the veto. What had to be done was to show the gas consumers that they could be masters of the situation. He believed the time had come when there should be a standard quality of gas throughout the country. He saw no reason why they should not standardize gas; and every town ought to have one standard. When they had one standard quality and one pressure of gas, the makers of gas appliances could supply standard apparatus. A constructive policy was what the Society should take into account. They ought to give such men as Alderman Gibson, of Manchester, the fullest support. He (Mr. Marsh) felt grieved when he heard him time without end crying out as one in the wilderness without anyone to support him. There was no town in the kingdom where, in his (Mr. Marsh's) opinion, the consumption of gas could not, within a reasonable time, be increased threefold if there was an inducement in the price to further use for heating.

Mr. West, in reply, said he hardly thought the discussion as it had developed called for any lengthy answer from him. He was agreeably surprised to find that practically the whole of the gentlemen who had spoken seemed to be quite in accord with his (the speaker's) remarks in the paper. Without exception, they all agreed with the points raised as to technical training and municipal trading; and he did not think it was necessary for him to add anything further, except with regard to a few words that fell from Mr. J. W. Helps, in which he did not quite agree that reward for passing examinations was altogether the best way to give encouragement. He (Mr. West) should like to add that, in the practice adopted at his firm's works, the reward for passing an examination was only given provided a regular attendance had been made, at a certain class, during the whole of the course. He thought this would meet Mr. Helps's objection. The President had given him the only nut he had to crack. He asked him to explain what was meant by the word "aggressive" in the paper. He thought he could best explain his meaning of an "aggressive policy" by referring to the work the Society had done, and give two concrete examples. First with reference to the standard clauses. When they originally brought the question of standard clauses before the Institution, he did not say they were met with a direct rebuff, but they did not meet with any great encouragement. In the course of time, he thought the engineers came to the conclusion that probably the contractors had a case; and they gave them a second hearing. The Society were pleased to again put forward their case. They amplified it, and gave a great many more details; and the result was the drawing up of an agreement in relation to the standard clauses. The second case he would cite was with reference to exhibitions, and the attitude of their Society with respect to the Manchester Exhibition when the Council, along with the Committee of the Manchester Institution of Gas Engineers, interviewed the promoter of the exhibition. They drew up a set of questions to put to him, and asked what terms he was prepared to arrange with the exhibitors. They indicated to him very clearly that they should expect a rebate with regard to the stand money—price charged for space—if the exhibition proved successful; and they also intimated that they would expect some proportion of the profit to be spent in different directions. These were concrete instances of what he termed an "aggressive policy." What he meant was that they should not, as contractors and manufacturers, merely mark-time as in the past. They should take the initiative in many movements which were for the advance of the industry. As to Mr. Peattie's suggestion, he would promise it should be considered by the Council. He could assure Mr. Helps—and he believed he could speak in the name of the members of the Society present—that they welcomed the idea that the Institution were going to put before gas authorities, as to something being done with the view to the publicity of gas. He believed that he (Mr. West) could safely say the members of the Society would not be backward in taking a proper part in publicity work. The only other point to which he would refer had been raised by Mr. Marsh. He had tried to draw him (Mr. West) into an argument as a member of the Manchester City Council; but he was not at the moment going to take up the defence of the Manchester Gas Committee. He thanked the gentlemen who had commented in such a very flattering way upon the paper, which it had been a pleasure to put before the meeting.

The President-Elect.

Mr. West, as Chairman of the Council, said he was sure that the members would be pleased to hear that Professor Arthur Smithells, of the Leeds University, had consented to be President next year, in succession to Mr. Balfour Browne. A letter had been received by the Secretary from Professor Smithells, in which he apologized for his non-attendance on this occasion, and explained that he had entered into an engagement for the day before he knew of the date of the autumn meeting. He added: "I regret my absence the more, because I am aware of the great honour for which I am designated by your Council; and it would have been very agreeable to me to have made an immediate acknowledgment."

ANNUAL DINNER—PRESENTATION TO MR. CHARLES CLARE.

The annual dinner was held in the evening; and the function was a great success. The President (Mr. Balfour Browne, K.C.) was in the chair; and to his right-hand side were Mr. Edward Allen, Mr. Dugald Clerk, F.R.S., Mr. James W. Helps, Mr. D. Milne Watson, Mr. S. Y. Shoubridge, Mr. F. W. Goodenough Dr. Colman, Mr. C. E. Brackenbury. To his left-hand side were Mr. R. G. Shadbolt, Mr. W. Doig Gibb, Dr. Rudolf Lessing, Mr. J. Alker, Mr. Arthur Barlow, Mr. W. St. David Griffith, Mr. Arthur L. Griffith. There was regret that the President of the Institution (Mr. Alexander Wilson) was unable to be present, as well as one of the Vice-Presidents (Mr. J. Ferguson Bell). But as already seen, the Senior Vice-President (Mr. R. G. Shadbolt) was fortunately able to attend. After dinner, toasts and music occupied the remainder of the evening.

Mr. J. W. Helps proposed the "Society of British Gas Industries." In the course of his remarks, he said the Society had done a considerable amount of good work since it was inaugurated. Mr. Thornton had mentioned during the afternoon that Mr. Clare had been present at the birth of the Society. He (Mr. Helps) was also present; and Mr. Clare would agree that they both talked over this matter a number of years ago; and it was partly due to this that the Society was founded. There was no doubt about it that the Society had not only done useful work, but it had great potentialities. A good many things that had been done it would have been practically impossible for one Association to do alone; it was only by the two that successful results had accrued. He said advisedly that such a Society as this was not only useful, but it was absolutely indispensable. There was one thing that had particularly made for its success; it had shown a wonderful power in inducing good men to occupy the position of President. He had great pleasure in asking all to drink to the success of the Society.

Right of Running Private Railway Waggons.

The President thanked Mr. Helps for the way in which he had proposed the toast. The Society, which he (Mr. Balfour Browne), unworthily, he was afraid, represented, had been exceedingly well represented in the paper that had been read that day by Mr. West. Some of the criticisms—they were scarcely criticisms, but eulogiums—were most interesting. Mr. Marsh complained that in his own city of Manchester the gas undertaking was used exclusively for subsidizing the rates, and he complained very bitterly of this. A change, however, was coming over the spirit of their dream in this regard. He supposed that Mr. Marsh was aware that in the case of Glasgow last year a proposal that Parliament should allow the Corporation to carry

a sum from the gas profits to the relief of the rates was absolutely refused. He supposed, too, Mr. Marsh knew that in regard to his neighbouring town of Salford, only two years ago, Parliament had declined to allow them to carry anything more than 1 per cent. to the rates. [The Corporation withdrew the Bill.] In his (Mr. Balfour Browne's) view, the change had come too late; but Parliament was now regretting having handed over to municipalities these great gas undertakings, and were trying to cut the wings of the municipalities. But it had come too late. It should not be the object of anybody in this country to make these things absolutely socialist machines. If gas undertakings were to be worked entirely for the benefit of the consumers (as Mr. Marsh seemed to desire), they were doing it entirely on the socialistic principle. The Socialists had all too long said, "It is not for profit, but for use, that these things should be worked." In one large town blind people were now carried on the tramways free; in New Zealand they were carrying school children free. By doing such things, undertakings were worked not as commercial undertakings, but as socialistic concerns. This introduced a very serious question. What he took it Mr. Marsh had in mind was that a municipality should not work one department against another. In one town of which he (the President) knew at the present time, the receipts that were going to the relief of the rates from gas were over £70,000 a year; but at the same time the ratepayers would have something to say if this were taken from them, seeing that they were faced by a deficit of £64,000 a year on water. The question raised by Mr. Marsh required much more consideration from the Society, as well as from that inferior Society called the High Court of Parliament. [Laughter.] Another member said he had been interested in the question of railway rates. He (Mr. Balfour Browne) was bound to say the question of railway rates would have to interest the Society far more deeply than it had done. Parliament had passed, at the instance of the traders of the country, a number of Acts which were intended to keep the balance true as between what had become to be the practical monopoly of railway companies and the traders of the country. He did not hesitate to say that, whenever these Acts came to be administered by the Courts, the Courts repealed them as far as they possibly could. In the case of *Spillers and Bakers, Limited v. Great Western Railway Company*, the Court of Appeal had that day decided what seemed to him to be a most serious case for the traders of the country. Spillers and Bakers, Limited, could not get from the Great Western Company waggons for carrying wheat and grain, and so they provided their own. The Court had held that the Railway Company were bound to carry the merchandize of Spillers and Bakers in covered vans or other suitable vehicles provided by them whenever a sufficient number of suitable vehicles were not from time to time provided by the Railway Company for the purpose. But otherwise the Railway Company were not so bound. There was £15,000,000 invested in private railway waggons in this country; and the Court of Appeal had decided that the owners of this £15,000,000 worth of waggons had no right to run them on the railways, except when the railway companies could not supply waggons. This being so, he thought the traders of the country were in a very awkward position. In conclusion, he thanked the Society for having had him as their President during the year, and for the support given to him while he had been President, which had not been a trouble but a pleasure all the time. [Applause.]

Presentation to Mr. Clare.

Mr. F. J. West said he deemed it a great honour and privilege, as Chairman of the Council, to have delegated to him the duty of presenting to Mr. Charles Clare a gift of a solid silver tray and tea and coffee service as a practical expression of the good will and appreciation of the members, and in recognition of the admirable duties he had performed as Chairman of the Council for four years. It would no doubt be in the recollection of many present that, at a meeting of exhibitors held at the close of the Earl's Court Exhibition in 1904, Mr. Clare, at the request of those present, occupied the chair. This meeting marked the initiatory movement which led up to the formation of the Society of British Gas Industries; and the members, in his opinion, showed their good judgment by selecting the right man for the right place when they asked Mr. Clare to become the first Chairman of the Council. Mr. Clare occupied this position for four years with great credit to himself, and with very great advantage to the Society; and although it was impossible to mention in detail the large amount of work that he successfully accomplished, he (Mr. West) thought specific mention should be made of his advice and assistance in the framing of the first set of rules, aims, and objects, of his tact, of his suggestiveness, of his work in securing their several esteemed Presidents, and of the admirable way in which he had attended to the duties at the annual meetings, and last but not least of the courteous and tactful manner in which he had presided at the many Council meetings. Mr. Clare was the last man in the world to accept any laboured eulogy of his work as Chairman of the Council; but he must say that not the least cause of Mr. Clare's success had been the spirit of self-effacement and modesty that had pervaded his work. Only those gentlemen who had had the privilege of coming into close contact with him in connection with the inner work of the Council could appreciate fully the debt that the members owed to him for the sound position the Society now occupied. Concluding, he said: In making this presentation to you, Mr. Clare, it carries with it the best wishes, kind regards, and everything that is good from the members of the Society, and their sincere and earnest wish that you may long be spared to take part in the deliberations and future work of the Society. Gentlemen, I ask you to join with me in drinking to the long life, prosperity, and happiness of Mr. Clare.

The toast was drunk with musical honours.

Mr. Clare, who on rising was received with loud cheers, thanked the members very sincerely for the flattering appreciation they had shown of the work he as Chairman had been able to do for the Society. The Society was, as those present knew, a sort of bye-product of the Earl's Court Exhibition of 1904. It arose out of a series of informal conversations with Mr. James Helps, with various exhibitors, and with members of the staff of the "Gas Journal."* He himself thought that it was a most extraordinary thing that, considering the Earl's Court Exhibition had been made by the contractors and manufacturers, the Institution of Gas Engineers, instead of coming to them through a body of their own, had to come to them through a third and outside party. Then, when the Society was formed, he had the good fortune, owing to having been the Chairman of the Preliminary Committee of the Exhibitors, to become the Chairman of the Council of the new Society; but he had had some excellent Presidents to pull him along in front. On one hand, too, he had Mr. Helps, on the other hand his Committee, and at his back, jumping him along, was an eloquent and powerful Press. Therefore he could not do anything else except go forward in the direct paths of integrity and virtue. He should like to say one word about his Council. He did not think it would have been possible to have had a better Council than he had had. Each man was disinterested and zealous for the work the Council had in hand; and each one was as much entitled to a beautiful present such as the one generously given to him as he was himself. He should like to add a word of appreciation of their Secretary (Mr. Griffith). He had done excellent work, had been of the greatest assistance to him (Mr. Clare), and had put his heart wholly into the work. He thanked them all for their individual kindness to him during the time he had been Chairman. He accepted with the greatest gratification this most beautiful present, not only on account of its intrinsic value, but on account of the friendly feelings that lay behind it; and in the years to come, when the Society attained the position to which he believed it would attain by its excellent work, it would be a proud thing to him and his to look on this memento of his connection with the Society as its Chairman and one of the founders. He from his heart thanked them all. [Cheers.]

The inscription on the present is:

> Presented to Charles Clare, Esq., Vice-President and Hon. Secretary, by the Members of the Society of British Gas Industries, in testimony of their appreciation of his strenuous labours in connection with the inception of the Society, and his service to the Society as the first Chairman of the Central Council—May, 1906, till February, 1910.
>
> *Nov. 22, 1910.*

Concluding Toasts.

Mr. H. J. Yates said the toast he had the honour to propose was "Prosperity to the Institution of Gas Engineers and Kindred Associations." He believed it was a source of regret to everyone present that Mr. Wilson, the President of the Institution, was unable to be present. It would have given them pleasure to have had him with them; and in his absence he was sure they were glad that the Institution should be represented by the President-Elect (Mr. Shadbolt), as well as a number of other members of the Institution, and of the other bodies that were associated with the toast. He thought it was Kipling who said that "East is East, and *West* is *West*, and never the twain shall meet;" and no doubt he came to this conclusion because their ways of thinking were widely different, and their interests had nothing in common. That was a state of things which, he was glad to think, had no parallel in the relations between the two great branches of the gas industry represented by the Institution of Gas Engineers and the Society of British Gas Industries. It appeared to him to be one of the most encouraging signs of the times, as well as a most hopeful augury for the future, that there was to-day a growing disposition to recognize the great extent of common interest that existed between all the enterprises that were represented in these two bodies, and the no small amount of work for the promotion of these interests in which they might engage in common cause and with mutual helpfulness. He was strongly convinced that, with such a spirit of co-operative understanding and effort, much could be done for the common advantage of the industry which neither the one nor the other, working singly, could hope to accomplish. The time was past when any one section of the industry could be sufficient unto itself; and if the new problems that confronted the industry to-day, both on the technical side and on the commercial, were to be grappled with quickly and effectually, he believed it would be by the combined effort of the best abilities and the best resources that the undivided industry could produce. No body of men could have recognized this more fully, or to better effect, than the Institution and the other kindred bodies throughout the country. They had not rested content with promoting a high standard of professional efficiency in their own membership—a standard which he believed was never so high as it was now. They had not rested content with this, but the work of their Research Committee and the individual researches that stood to the credit of well-known names in their ranks, indicated the breadth of the Institution's outlook; and the spirit in which it had encouraged the mutual interchange of opinion and experience with those who were engaged in the perfecting of gas appliances betokened a determination that in the competition with various rival illuminants and rival heating media, the whole gas industry should present one really united front. He for one strongly believed that, so united, it would wage a successful battle. The Institution had brought to the fight great resources of ability and enterprise. He believed that—particularly in these days when rule-of-thumb was being weighed in the balance and found wanting, and science was being so largely enlisted in aid of manufacture—the other branches of the gas industries had also a valuable quota to contribute to the common stock. And this reminded him of one other thing he wished to say. It was well to have common interests, and to co-operate in common efforts; but one wanted sometimes a common platform. That night they were not talking from different premises; they were meeting in the same room. And he was confident such opportunities of getting into actual touch with each other could only have the most useful effect. It was a very happy thing to have the Gas Institution and the Society of British Gas Industries associated at such gatherings, recognizing that they were not rival camps, but allied armies going to fight the same forces, and, he believed, by united effort, to defeat them. He did not suggest that their interests were identical all along the line; but if they went together three parts of the way, they would not make less keen bargains with each other for having each had the opportunity of knowing something of the conditions the others had to face. Contact with members of the Institution, for example, had led some of them to appreciate the great unfairness of the conditions affecting gas

* The original article suggesting the formation of the Society appeared in the "Journal" for Dec. 6 and 13, 1904 (pp. 755, 824).—Ed. J.G.L.

undertakings as in competition with electric light, in respect that, while the use of gas was subject to various official tests and restrictions, electric light was, in the nature of things, quite unhampered in these matters. No means of testing were available to the general public; and hence extravagant misstatements could be made as to the amount of light a unit would give, such as could easily be confuted if only people knew that the number of B.Th.U. in the unit of electricity was a fixed quantity, and if only they were able to work out a simple comparison of the respective number of B.Th.U. in gas and in electricity. This possibility of some degree of realization by each branch of the industry of the difficulties of the other, was yet another reason why he welcomed such a function as the present; and it was in the spirit of cordial co-operation for the general good of the industry that he asked those present to drink "Prosperity to the Institution of Gas Engineers and Kindred Associations."

Mr. R. G. SHADBOLT, in the unavoidable absence of the President of the Institution, replied to the toast. He expressed pleasure at seeing members of the Institution guests of the Society of British Gas Industries. It was notable that both organizations emanated from self-interest. The old British Association of Gas Managers was brought into being by the desire of the members for improvement—to improve their knowledge and their status as individuals, and, of course, to improve the status of the gas industry. Passing over forty years, they found this Society of British Gas Industries formed—again from the point of view of self-interest. It was a sign of the times in which they lived and in which the industry operated. They had responsibilities as individuals and societies not only to the industry they served, but to the great community that the industry served. The Institution of Gas Engineers, the District Associations, and the Society were all grappling with the problems that surrounded them. They were cramped to a great extent in their movements. But he believed the immediate future would see a great widening, a great broadening, and a great heightening of their endeavours and activities, and consequently of their usefulness. The Institution, as the premier technical organization of the gas industry, were striving, with their limited means, to discharge the duties devolving upon them. The signs of the times pointed to a great sphere of usefulness; but this could only be obtained by the slow infiltration throughout their boards of directors, committees, proprietors, ratepayers, and consumers of the feeling that the efforts and endeavours of their organizations were directed to promoting the great object they had in view, which was the simple one of providing the best service at the lowest possible price. Suffice it to say that the Institution yielded to no one—not even the Society of British Gas Industries—in the sincerity of their endeavours to, according to their light and circumstances, advance the great industry which was beneficial to them all so long as it continued to progress, as it promised to do.

Mr. EDWARD ALLEN, in the course of his response for "Kindred Associations," said the gas industry owed a great deal to the District Associations, and the country, he was satisfied, should also be grateful for the work they had done. He was sorry Mr. Kendrick, the President of the Manchester Gas Institution, was not present to respond to the toast as anticipated, as he would have been able to have spoken of the work done for the young men of the industry in association with the Manchester University. This was one of the ways in which they were conferring a benefit upon the country at large.

Mr. W. J. JENKINS proposed "The Visitors," and, in doing so, regretted that Mr. Charles Carpenter was unable to be present to respond to the toast. However, they had Mr. Doig Gibb with them; and he was a man who had been trained in a manner that would enable him to turn out gas at 1s. per 1000 cubic feet. [Mr. Gibb indicated dissent.] Dr. Colman, too, was a gentleman of high scientific attainments, attached to which was an equal knowledge of practical gas making. High scientific attainments were necessary in these days; and when they were combined with practical ability, they had the men whom they liked to welcome among them.

Mr. DOIG GIBB, in his response, reminded those present that, when he was President of the Institution, he felt very much the previous failure in bringing about a standard set of contract clauses; and he gave the matter somewhat severe criticism in his address. There was afterwards a reconstitution of the Committee to go thoroughly into the question; and this Committee were the means of bringing the standard clauses to a successful issue. With all that he had on his mind, he thought he had enough to occupy him without trying—at any rate at present—to produce gas for sale at 1s. per 1000 cubic feet.

Dr. COLMAN, in his acknowledgment, spoke of how strongly he felt at the present time as to co-operation in the widest sense between all the different branches of the gas industry.

The toast of "The Press" was proposed by Mr. H. J. DONKIN, who spoke in flattering terms of the technical gas papers of this country in comparison with those of other countries.

Mr. W. D. HELPS proposed "The President;" and Mr. BALFOUR BROWNE, in concluding his reply, said he wanted very sincerely to thank the members for having made him President, and for their support during his year of office. He wished the Society a prosperous future; and said he should never forget during the time to come his association with it.

The Late Sir F. Thorpe Mappin.—At an "At Home" given by the President (Mr. W. Appleyard) and Mrs. Appleyard at the Sheffield Reform Club last Thursday, an interesting event of the evening was the unveiling of a replica of a portrait of the late Sir Frederick Thorpe Mappin, who was for so many years Chairman of the Sheffield United Gas Company. The portrait, which will be hung in the dining-hall of the club, among the portraits of several other of Sheffield's notable citizens, had been subscribed for by members of the club as a tangible memorial to one whose name will always be honoured in the greatest cutlery city of the world. The memorial should have been unveiled by Sir Joseph Jonas; but in his unavoidable absence his place was taken by Sir William Clegg, who, in performing the ceremony, devoted himself mainly to Sir Frederick's political career.

MEDICAL OFFICERS AND GAS HEATING AND LIGHTING.

"Public Health" is the official organ of the Society of Medical Officers of Health; and in the November issue there is an article describing the gas lighting and heating arrangements of the Society's Meeting-Hall, in Upper Montague Street, W.C., as described in the "JOURNAL" for Oct. 18, pp. 179, 186. It is noted with interest that the matter, before the change was effected from electric lighting, had "considerable attention" devoted to it by the Council of the Society. After such thorough consideration, gas was adopted for heating in the Society's meeting room and in the two exhibition rooms—the apartments which are put to most use when members are assembled. Our electrical friends have done their level-best to minimize the change; and they have even gone so far as to make insinuations as to inaccuracy in the articles on the subject published by the "JOURNAL." At the risk of retraversing some of the descriptive points, we publish, as being confirmatory of our previous articles, the one that appears in the "official organ" of the Society.

Considerable attention has been devoted by the Council of the Society of Medical Officers of Health to the heating, lighting, and ventilation of the Society's Meeting Hall at 1, Upper Montague Street, Russell Square, London, W.C.; and the following is a description of the system which has been installed by the Gaslight and Coke Company, in conjunction with Dr. Glover Lyon's method of ventilation.

The hall is 24 ft. by 24 ft. by 15 ft. high, and is lighted by three windows. In the two spaces between the windows recesses have been formed; and in each of these recesses there are fitted three hospital-type hot-water radiators, superimposed vertically, one upon the other—each radiator having a heating service of 25 square feet. The radiators are connected up to two No. 13 and one No. 15 "Victor" gas-boilers in the basement, supplied and fitted by Mr. Thomas Potterton, Cavendish Works, Balham. At the base of each recess or shaft, and on the outside of the wall, is fixed a 1-ft. diameter fan, which drives air from outside up the recess, and, of course, over the heating surfaces of the radiators, into a cross channel, running along the whole width of the room, slightly below the ceiling level. The air so taken in from the outside is purified by being passed through cotton wool. It enters the hall through grids, and sweeps right across to the opposite wall, where it is extracted by a 2-ft. diameter fan, carrying with it the impurities that always tend towards the ceiling in such a hall. Each of the two 1-ft. diameter fans at the bottom of the recesses is capable of passing 2500 cubic feet of air per minute. But, though the recesses have been backed with cement, and have their sides lined with uralite, there is a certain amount of friction, and the actual working capacity is put at 1700 cubic feet; the two fans thus passing into the room 3400 cubic feet of air per minute. The 2-ft. diameter fan is capable of extracting 4000 cubic feet per minute. There is thus a surplus power to deal with the air entering the room through the ordinary ventilating openings.

As the foregoing description shows, the air drawn in is heated. If cold air were introduced in such quantities, it would fall through the the warmer and lighter air in the hall, on to the heads of the occupants. The result would not only be unpleasant, but the scavenging effect of the current of air across the ceiling would to a large extent be lost. This heating of the air can be conducted with the greatest nicety. One method of control is by means of the boilers. When the installation has been heated up, one of the boilers may be cut off; or, if the circumstances allow, two of the boilers may be put out of action, and the work left to the remaining one. For the sake of economy in the consumption of gas, this is the usual course. The total consumption with the three boilers going is 240 cubic feet of gas per hour; but, obviously, this consumption is only necessary for a short period after lighting up. The second and main method of control of the heat is by cutting out one or more radiators. The two series of radiators in the recesses are so connected up that the radiators may be put out of action separately; the valves being operated from outside by handles projecting through the casings. The lowermost one can be first cut out of circulation, and then the middle one in each of the two series. Thus the radiators may be used in a number of variations according to requirements and the difference in the temperatures outside and inside the hall. Though the radiators may be thus cut off in detail, for a time they would still retain their heat; and provision has been made for cooling them down immediately if necessary. At the top of the radiators in each recess is a flush-out pipe; and at the bottom, a cold feed-pipe. The flush-out pipes go down to a sink in the basement. To cool down a radiator, the tap on the flush-out pipe at the sink is turned on, and, the valves of the radiator having been adjusted, the cold water from the cold feed-pipe (which is always open) drives out the hot water, and cools the radiator immediately. Miniature doors are provided in the casings surrounding the radiators, so that one can easily ascertain if the cooling-down has been thoroughly done. As will have been gathered, there is a very delicate control over the temperature; and the manipulation of the whole installation is of the simplest.

An additional means of ventilation is provided by a new-pattern ventilating gas-lamp, in the centre of the ceiling, which has, in respect of lighting, been found an excellent substitute for the electric lamps previously employed. The lamp is fitted with five inverted burners. It is connected to a flue running across the ceiling, which, in turn, connects with chimneys either end. There is also a 21-inch "Salon" gas-fire. An additional hot-water radiator is also connected to the flow-and-return from the "Victor" gas-boilers, and is placed alongside the door, with the object of tempering any draught when the door is open. It can be put in or out of action by a turn of a valve.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Visit to Sugg and Co.'s Works.—Lecture by Dr. H. G. Colman.

The members of this Association, numbering some 40 or 50, visited last Friday afternoon the works of Messrs. W. Sugg and Co., of Regency Street, Westminster. The members were received by the following gentlemen connected with the firm: Mr. W. Sugg-Wright, Mr. H. J. Waller, Mr. J. Lofts, Mr. W. Mattock, Mr. M. Hankin, Mr. A. C. Russell, Mr. E. W. Nicol, Mr. P. Sugg, and Mr. A. Sugg. Each visitor was presented with a pamphlet giving a historical sketch of the concern, from which the following particulars are taken.

BUSINESS AND WORKS OF MESSRS. W. SUGG AND CO.

The business was established by the father of the founder of the present Company in the year 1837, in small premises in Marsham Street, Westminster. He was succeeded in 1858 by his son, the late Mr. William Sugg, who removed to a portion of the present site in 1866; and by his inventive genius, applied to the production of improved gas-burners, greatly expanded the business. His "London" argand gas-burner was introduced in 1869, and in the same year the Metropolitan Gas Referees adopted the size having 24 holes, then called the No. 1, as the standard test-burner for the Metropolis. Later it was adopted, under the Gas-Works Clauses Act of 1871, throughout the United Kingdom, as well as by the Colonies and the United States of America, as the standard burner for 16-candle gas. Mr. Sugg rendered great services to the gas industry in connection with photometry, and in 1868 to 1872 worked, in co-operation with the Gas Referees, at devising a new scheme of gas testing, requiring entirely novel apparatus, and in fitting up the London gas-testing stations. For these services he received a special testimonial from the Gas Referees, dated July 30, 1872.

During the first great electric lighting scare, about 1879, Mr. Sugg did great service for the gas world by the introduction of his "Christiania" flat-flame and other governor burners, which at that time were a great step forward in gas lighting, and which came to have a world-wide reputation; also by the bringing out of street-lamps of a better type, fitted with powerful argand or flat-flame burners. By this time the business had so increased that Mr. Sugg deemed it desirable, for its further expansion, that it should be converted into a limited Company; and he became the founder of the present Company, which was incorporated on June 30, 1881. He was the first Managing Director, and continued to hold this position till his death, in February, 1907.

During the successive modern revolutions in gas lighting, the Company took a leading part—first with regenerative gas-lamps, then with upright incandescent gas-lights, and more recently with the inverted gas-lights, which at present hold the field. This is sufficiently shown by the fact that no fewer than 79 highest awards, including 28 gold medals, have been gained by the Company for their specialities. In 1887 the premises were enlarged, and a portion of them rebuilt; and in 1905 a further extension took place. The business has advanced far beyond the scope of its early years, and now includes in its operations a very wide range of work. The present aggregate floor space of the various shops is approximately 65,300 square feet; and the average number of workpeople is 420.

The visitors, divided into parties of about twelve each, were conducted by the above-named gentlemen through the shops where the various processes of manufacture entailed by the work carried on were seen and explained. They comprised the following: Brass shops (Nos. 1 and 2), steatite shop, stores, brass, iron, and white metal foundries, smiths' shop, emery and polishing shop, stove shop, engineers' shop, engineers' fitting shop, stamping shop, photometer shop, and tin and paint shops. Special interest was taken in the brass and iron foundries, where demonstrations in castings were given by the workmen.

After the inspection, the evening now being well advanced, the party partook of tea.

The PRESIDENT (Mr. L. F. Tooth) proposed that the thanks of the Association be tendered to Messrs. W. Sugg and Co. for their kindness in granting the members the privilege of inspecting their works. The firm had not kept any secret from them, or withheld any information. The late Mr. William Sugg did much with regard to the ways and methods of lighting; and a paper prepared in 1905 by that gentleman, which was most brilliantly written, could be to-day referred to with profit.

Mr. T. F. CANNING (Senior Vice-President) seconded the proposition; stating that it was with very great pleasure that they found themselves at Messrs. Sugg's. It was indeed a visit of education and instruction for them all. They saw the results of great exertions and experiment, accompanied by the equipment of modern plant.

Mr. W. J. LIBERTY, being called upon, said he was present not so much because the works they had visited were a manufactory of various articles connected with the gas industry, as from the firm's connection with the honoured name of William Sugg. In the year that Queen Victoria came to the throne (1837), the firm of Sugg and Co. commenced in Westminster; and when in the late "fifties," William Sugg took upon himself the burden of the whole business, his motto was, first, "Experiment;" secondly, "Experiment;" and, thirdly, "Experiment." If then, he had not reached a conclusion satisfactory to himself, he still continued experimenting. To know the history of William Sugg would entail the reading of all the principal Gas Acts of private companies and municipalities throughout the United Kingdom and on the Continent, as well as of the Colonies, and the United States; and the name of Sugg in connection with the gas industry would go down to posterity with names like those of Clegg and Livesey. William Sugg was perhaps best known in the Committee-rooms of the Houses of Parliament. When their occupants were engaged upon the discussion of difficult and scientific questions in connection with Private Bills relating to gas legislature, he would be sent for, and would afterwards be found either in the witnesses' chair or collaborating with other eminent engineers upon the details of obscure problems. William Sugg was firstly and pre-eminently a scientist and engineer; and a personal acquaintanceship of many years caused him (the speaker) to mourn his loss and pay this tribute to his memory. Then the firm. Well, it existed not only for the manufacture of goods for general use in the industry, but was largely engaged, as of old, in catering for the scientific side of the gas profession. The variety of work shown to the visitors was simply amazing; and by this variety there was something which appealed to every man. They seemed to have everything present in connection with gas manufacture, except holders and retorts. Hence the instructiveness of the visit. A very good idea of the output of the firm could be gathered from the number of machines and lathes that had a continuous running on one small article alone. The copper spinning was very interesting. In conclusion, he desired to associate himself heartily with the vote of thanks.

The vote having been carried by acclamation,

Mr. W. SUGG-WRIGHT, in reply, thanked the members for coming to see their works, and for the kind remarks conveyed in the vote of thanks. He warmly appreciated the tribute that had been paid by Mr. Liberty to the memory of Mr. William Sugg; and he was sure the members of the family would do so, too. He deeply regretted the absence through illness of his brother (Mr. E. Sugg-Wright), the Managing-Director. When the news was conveyed to him of the desire of the Association to pay this visit, he expressed his great delight, and said: "Show them all there is to be seen." When the staff and workmen heard of the proposed visit, they all took up the matter with great enthusiasm, and said they would do their best to interest the visitors. It would be only fair to state that in this he had been heartily supported by Mr. A. C. Russell, Mr. M. Hanking, and Mr. H. J. Waller; the last-named gentleman having drawn up the whole of the programme. In conclusion, he said he could only add: "Appreciation is our reward."

Later in the evening, the members assembled in larger numbers at the Technical Institute, Westminster, to hear a lecture by Dr. Harold G. Colman. In addition to the members, there were some visitors connected with the gas industry; among them being Mr. A. F. Browne, Mr. H. O. Carr, and Mr. W. B. Farquhar.

Dr. Colman then delivered his lecture, which, with the remarks to which it gave rise, will be found on p. 635. At its conclusion, he was accorded a hearty vote of thanks.

Serious Accident to M. Coze.

We greatly regret to learn through the "Journal für Gasbeleuchtung" of the 26th inst., that a serious motor-car accident befel M. André Coze, the Manager of the Rheims Gas Company, on the 15th inst., and that at the time the report left it was impossible to predict what the ultimate result would be. M. Coze has an international reputation as the designer of settings of inclined retorts. He has recently been President of the French Gas Engineers' Association, and is President of the International Committee on the Standardization of Screw Threads. We join with his colleagues throughout the world in earnest wishes for his rapid and complete recovery.

Among the latest calls to the Bench of the Inner Temple we are pleased to notice Lord Robert Cecil, K.C., Mr. W. O. A. J. Danckwerts, K.C., and Mr. Ernest Moon, K.C. The last-named gentleman is Counsel to the Speaker of the House of Commons.

At the Parish Church, Halstead, Kent, on Saturday, the 12th inst., the marriage was solemnized of Mr. William Woodward, of "Crosbie," Bromley, the Engineer and Manager of the Bromley Gas Company, and Miss Mabel May, third daughter of Mr. and Mrs. Alfred May, of "Broke," Halstead, Kent. On the 21st inst., the marriage took place at Westminster of Mr. John F. Simmance, of Westminster Palace Gardens, and Miss Kate Abady (sister of Mr. Jacques Abady), of Broadhurst Gardens, N.W. Next day, Mr. William Langford, the Engineer and General Manager of the gas and electricity undertakings of the Longton Corporation, was married to Miss Lydia Mary Edwards, daughter of the late Alderman Aaron Edwards, who was seven times Mayor of Longton. Those of our readers who attended the meeting of the Midland Association of Gas Managers in the above-named town in the spring of last year, during the presidency of Mr. Langford, will have pleasant recollections of the generous manner in which they were entertained by the late Mayor. The wedding was very quiet; and after the ceremony Mr. and Mrs. Langford left for Torquay.

REGISTER OF PATENTS.

Pilot-Lights for Gas-Burners.

Horstmann, G. O. H., E. H., A., & S. A., and Edgar, W. T., of Bath.

No. 23,133; Oct. 11, 1909.

This invention relates to pilot-tubes of the atmospheric or bunsen type, and it particularly refers to: firstly, the provision of a non-corrosive gas orifice (such as a jewel hole, as used for bearings in watches) which will withstand all atmospheric conditions; and, secondly, the tube being made in two parts easily detachable from one another, to allow of access to the gas orifice. The object in view is to provide a bye-pass which can be easily cleaned and, when necessary, may be provided with a gas orifice which will not corrode, and can therefore be cleaned with an ordinary brush. It is also intended to provide the atmospheric portion of the bye-pass as a separate attachment.

Gas-Controllers and Other Timing Devices.

Horstmann, G. O. H., E. H., A., & S. A., and Edgar, W. T., of Bath.

No. 23,161; Oct. 11, 1909.

This invention relates to gas-controllers of the kind in which a dial-plate is made to rotate once in twenty-four hours, and which carries in its daily rotation one or more discharging arms or levers capable of adjustment (either automatically or by hand) to predetermined times; the object of the discharging arms or levers being to operate, either directly or indirectly, a gas-cock or other equivalent device at required intervals. It further relates to devices in which the twenty-four hour dial is maintained in its rotation during the process of restoring the motive energy which drives it—such as winding the clock.

It has been found, the patentees point out, that many devices of the above type have been incapable of accurately indicating time, owing to back-lash in wheelwork. The object of their invention is to provide means to enable the time to be accurately indicated by the hand or index exterior of the dial-plate; to provide means so that the dial-plate may be easy of adjustment in relation to this exterior hand or index; and, when the discharging levers are intended for hand adjustment, to provide simple means of setting the discharging levers in relation to the twenty-four hour dial and secure it without disturbing the relation of the dial to the exterior hand or index.

Process for Distilling Coal and for the Production of Fuel.

Richards, R. S., of Wraysbury, and Pringle, R. W., of Richmond, Surrey.

No. 25,019; Oct. 30, 1909.

This invention relates to the distilling of coal, by apparatus in which the coal is carried on a conveyor in thin layers through a distilling chamber at a low temperature. The object of the invention is to provide "an improved automatic process whereby purer distillates are obtained and a residual product is produced which can be used as a fuel, and has for such purpose improved quality and homogeneity." The process is characterized in that the coal is not disturbed as it is travelled through the distilling chamber, and in that it is subdivided into thin sections. Thus there is no great thickness of coal through which the heat has to penetrate; and all access of air to the distilling chamber is prevented.

Various attempts have been made, the patentees point out, to effect the distillation of coal by a continuous process in the production of coal gas; but these have all failed for various reasons, among which they mention the injurious effect on the moving parts of the high temperatures employed, and the coking action on the exterior layer of fuel, which forms a crust of more or less non-conducting material, and prevents the heat from uniformly penetrating the mass, and hinders the escape of the gases.

According to their process, they propose to distil the coal at a comparatively low temperature—say, not exceeding 650° C.—while it is caused to travel undisturbed slowly and continuously (or it may be intermittently) on a conveyor through a heated chamber from which air is excluded. The coal is disposed in a thin layer, which is subdivided so as to expose a large surface to the heat and so as to ensure that the thickness through which the heat has to penetrate, and through which the products of distillation have to pass, is reduced to a practical minimum. By virtue of the process and disposition of fuel, they say they are enabled to use fine coal dust, which is only employed with difficulty in other types of apparatus used in the distillation of coal; and, moreover, the process can be completed in a shorter time than is possible when the ordinary stationary retorts are used. A further advantage lies in the improved homogeneity and quality of the residual product.

A convenient apparatus for carrying out the process here described (the patentees say) is set forth in patent No. 15,643 of 1909—see "Journal" for May 3, 1910, pp. 320-21.

According to the process, therefore, the coal is introduced through a hopper (provided with an air-lock) on to a conveyor, and is carried thereby through a heated chamber where it rapidly absorbs heat, and is split up into distillates and a residual product. The distillates given off during its travel through the heated chamber are continuously collected, and the residual product is automatically discharged at the end of the travel. The process is carried on continuously without the necessity of opening and closing the distilling chamber. The distillates where purity is of importance are collected fractionally, in the order in which they are given off at different points along the length of travel; but where the purity of distillates is of lesser importance, they may be collected through one ascension pipe.

Each unit of coal, as it travels through the distilling flue or chamber, continually absorbs heat, and is free to give off its distillates separately without interference from neighbouring volumes of coal. The nature of the distillates and of the residual product obtained depends on the number of heat units which each unit of coal is permitted to absorb during its passage through the chamber; and thus a complete control of two factors—time and temperature—is obtained by regulating the amount of heat supplied to the chamber and the speed at which the conveyor travels. If the residual product is to be used as a fuel, the final temperature at which it arrives just before discharge at the end of its travel should not exceed 650° C.

They preferably allow the residual product to gradually cool in an atmosphere of gases evolved from the cooling substance itself, or in an atmosphere of inert gas such as carbonic acid supplied from elsewhere. Such cooling process may with advantage be proceeding while the residual product is being conveyed away from the distilling chamber. As an example, they may discharge the residual product on to a screw conveyor to permit radiation from its sides and filled with an inert gas.

The distillates prior to condensation may be collected through a series of ascension pipes into which they are aspirated—in this way preventing them from coming into contact with the fuel or other distillates being produced at different stages of the process. In this process, the coal travels to a different place as it rises in temperature, and, when pure distillates are desired, finds itself in the neighbourhood of an ascension pipe adapted to convey the distillates given off at that temperature to condensing apparatus. This largely increases the purity of the distillates. The residual product obtained by the process can be varied in character by regulating the speed of travel of the conveyor and the amount of heat supplied to the chamber—a method of collecting distillates not new in itself.

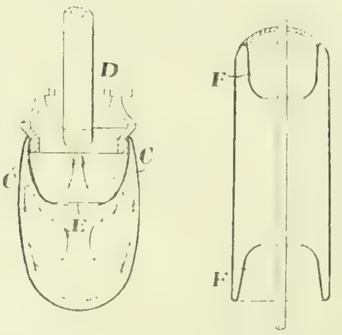
Incandescent Gas-Mantles.

Pudney, F., of Brixton, S.W., and Sadler, F., of Chancery Lane, W.C.

No. 26,432; Nov. 15, 1909.

This invention consists in the provision of means for use with either inverted or upright mantles, "whereby the heat of the flame is more effectively utilized."

In an inverted mantle a depending fringe or rim of incandescent material is attached to the holder or forms part of the mantle extending into the interior of the mantle and forming a smaller mantle, while in an upright mantle the proposal is to combine with the depending upper fringe another fringe at the foot of the mantle. The fringe or rim is attached to the usual burner fitting with the mantle, and it may be formed from the same piece of material as the latter—being turned inwards to the required extent for this purpose. When the gas enters and circulates in the mantle, "the fringe or rim assists in retaining the flame; thus increasing the heat and causing greater incandescence, and consequently effect, than with mantles heretofore constructed." By means of the invention, it is claimed that "the fringe or rim may be used for a small light by turning the gas nearly off, thus taking the light from the mantle to the fringe or rim."



Pudney and Sadler's Two-Light Mantles.

In the mantle for use on an inverted burner, C is the fringe or rim of incandescent material similar to that of the mantle and forming a portion of it; being doubled inwards so as to assume a conical or similar shape for this purpose. The rim terminates in a central hole or opening E through which the flame passes into the mantle. The burner D extends a short distance into the fringe, so as not to obstruct the free passage of the air between it and the mantle holder. The flame passing through the fringe into the mantle circulates in the latter, as shown by the arrows, and is retained by the fringe, "which becomes highly heated and thus considerably increases the light of the mantle." When the gas is turned low, the light is retained by the fringe alone, "thereby economizing the gas and at the same time giving sufficient light for ordinary purposes; and in the event of the mantle being broken or destroyed, the fringe itself still continues to provide a light."

In the upright mantle there is an incandescent rim or fringe F formed both top and bottom or may be connected thereto, or to the burner, in any suitable manner.

Street and Analogous Lamps.

Parkinson and W. & B. Cowan, and Cheshire, W., of Birmingham.

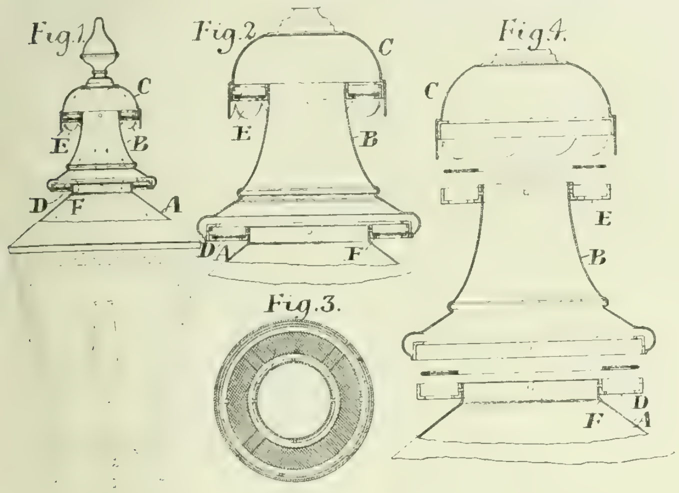
No. 29,093; Dec. 13, 1909.

This invention has reference to street and outside lamps, particularly for use in tropical countries and other places much infested with insects; the lamps being so constructed that, while the air required for supporting combustion at the burners and ventilating the interior of the lamp is freely admitted, it is impossible for even small flies or insects to obtain access to the interior.

Fig. 1 represents a part section of a street-lamp provided with the

insect-baffles. Fig. 2 is an enlarged vertical cross section through the head of the lamp, with (fig. 3) a horizontal cross section through the upper part. Fig. 4 represents the several parts of the lamp-head separated from one another.

The body or glazed portion of the lamp is entirely enclosed—that is to say, the bottom and sides have no openings whatsoever through which even the smallest insect could make a way into the interior; and both the intake for the air which supports combustion and the outlet by which the combustion products escape are arranged in the head. This comprises a base A, upon which are fitted two circular metal spinnings B C, of which the former constitutes a central flue or shaft leading from the burner space, while C constitutes a top closure cap. These spinnings are arranged so that their lower edges overhang the upper portion of the adjacent parts and form two annular apertures D E, disposed in horizontal planes, and of which the lower aperture forms an opening for the inlet of the air for supporting combustion, while the upper one is a means for the escape of the combustion gases.



Parkinson and Cowan's Insect-Proof Lamp.

B is supported upon the base portion of the lamp-head through the medium of an open-bottomed gallery or frame F carried by the upper end of the base, while the cap C is similarly supported by an open-bottomed gallery carried by the upper end of the middle part. Each gallery has upwardly turned edges round the inner and outer sides, forming a kind of annular tray; the inner edges being secured to the upper ends of the parts A or B, and the outer edges serving to directly support the parts B or C respectively. The enlarged overhanging lower ends of the latter detachably socket over the galleries, and are fitted with internal rings having inturned rings, which rest on the tops of the edges of the galleries. The outside portions of the galleries are connected to the inside parts by a number of radial arms, leaving the greater part of the bottom open. Fitted within each gallery, so as to cover the open bottom, is a wire gauze ring carried by a removable frame, which rests upon the annular flanges or ledges constituting the solid portion of the bottom of the gallery; the gauze thereby completely filling the aperture D. E constitutes a baffle to prevent insects passing beyond it into the interior of the lamp, although allowing of the free admission of air for supporting combustion or of the free exit of the products of combustion, as the case may be.

Vertical Gas-Retorts.

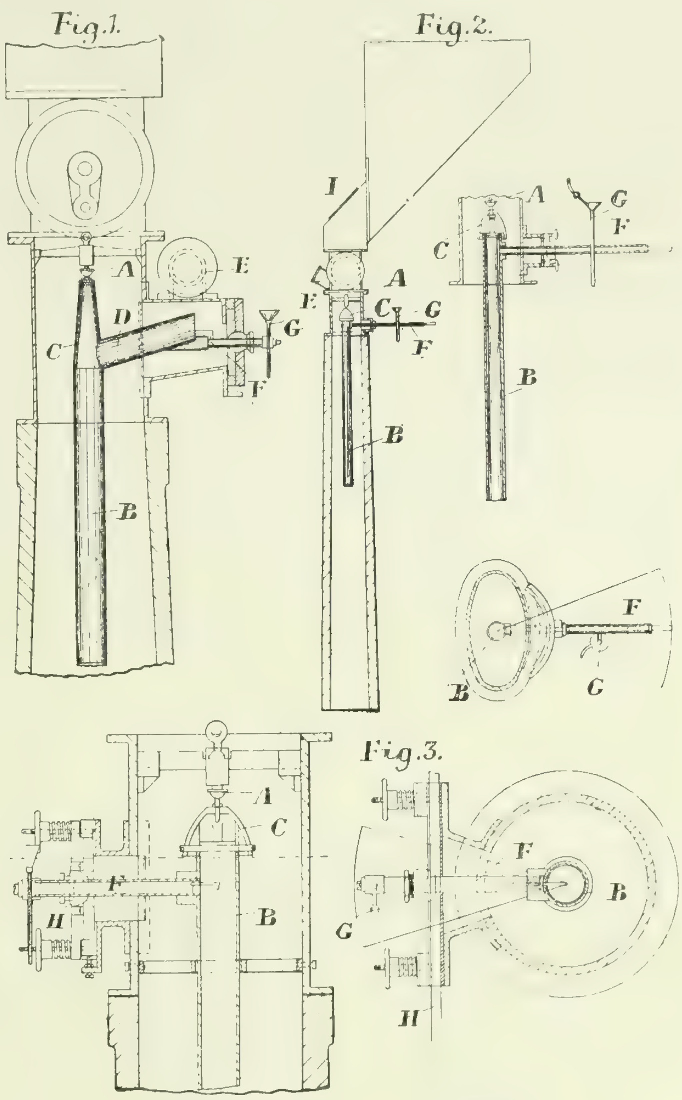
SMITH, A. H., and SHAW, F. G., of Darwen.

No. 29,313; Dec. 15, 1909.

This invention relates to continuously operated vertical gas-retorts; the object being to facilitate the passage of the gas generated in the retort to the outlet, to prevent the coal adhering to the retort, and to ensure its descent or regular downward course during the carbonizing process. The gas generated is allowed to pass from the retort "without having to find its way through as great a quantity of tarry coal as heretofore; and its illuminating power is thus increased." The use in combination with a vertical retort is proposed of a centrally suspended core-pipe, with extraneous means of actuating it "either by hand or mechanically, and provided with a steam-supply pipe or water-supply or drip, which, generating steam in the retort, ensures a freer passage of the gas through the coal."

Fig. 1 is a sectional elevation of part of a vertical retort fitted with a branch pipe type of core-pipe. Fig. 2 shows a vertical retort with plain core-pipe and means for manipulating it by hand. Fig. 3 is a sectional plan view of the retort and core-pipe, illustrating a means of mechanically oscillating it; also a sectional elevation showing the core-pipe fitted with a detachable cap or cover.

The retort (made in the ordinary manner) is continuously supplied with coal from a hopper above. Inside the retort, and suspended by a chain from a hopper or by a ball-and-socket coupling or joint A from a cross-bar, is a central hollow core or pipe B extending about one-third of the distance down the retort. The core is either cylindrical, conical, or slightly tapered. It is open at its lower end; and may be provided with openings or masked slots at intervals. The top of the core is provided with a detachable cap or cover C in which are outlet ways, in the form of holes or notches or a branch pipe or pipes such as D, by means of which the gas is conveyed to the outlet E of the retort, or if no branch pipe is provided, then the gas may have to pass through a small quantity of coal after leaving the core by way of the cover C. This cover, being detachable, provides means of access to the interior of the core for cleaning purposes when necessary; and in fig. 1 the cap and the branch pipe D can be removed for this purpose or to facilitate the withdrawal of the core from the retort.



Smith and Shaw's Vertical Gas-Retort.

At its upper end, the core is united to, or provided with, a cross pipe or hollow handle F passing through a stuffing-box above the retort. To prevent the possibility of the core being blocked by tarry coal adhering to it, or being stopped or choked, a water drip-pipe G is provided; the water being conveyed to the interior of the core through the handle F. Being generated into steam by the heat of the retort, the steam clears the interior of the core, and, in practice, it has been found also "to maintain interstices through the coal and thus provide a clear passage for the gas to the outlet." The movement or partial rotation of the core prevents coal sticking either to the inner surface of the retort or to the core itself; and the coal is allowed to fall downwards in the retort during the carbonizing process.

The hollow handle or cross-bar F may be operated by hand or mechanically. In the latter case, the handle is connected with a slide H connected by link to a crank or eccentric or other device for imparting reciprocating motion to the slide; and the handle moving in its stuffing-box or slide, no leakage from, or into, the retort can take place.

The core can be entirely removed from the retort, when desired, through a door or cover I provided in the hopper and vertically above the core itself.

Gas-Lighting Apparatus.

GAS-LATERNEN-FERNZÜNDUNG, SYSTEM DR. ROSTIN, G.M.B.H., of Berlin.

No. 4627; Feb. 24, 1910. Date claimed under International Convention, Feb. 24, 1909.

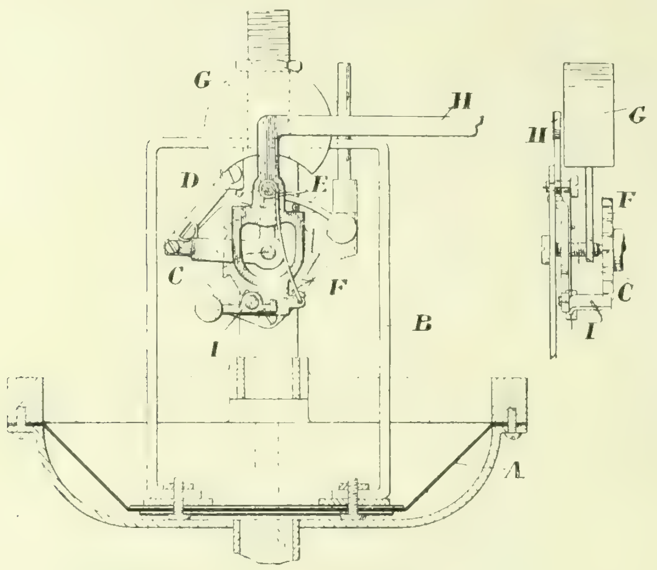
This apparatus is of the type provided with a weighted lever which is vertical in the position of rest and swings from this position on an increase of pressure, and in which the valve is operated by a predetermined maximum pressure in the gas-supply pipe and will not again be operated until the pressure has been reduced to normal and raised again to the maximum. The invention is a modification of the apparatus described in patent 25,081 of 1909.

In this earlier patent, the counterweight carrying lever is horizontal in the position of rest; so that, on the swinging of the lever from this position, the effective leverage is reduced; and consequently the force opposed to the gas pressure is also reduced. This reduction of the opposing force, it is pointed out, means that assistance is given to the pressure of the gas at the time when a movement of the gas supply valve is desired.

According to the present invention, the lever which actuates the ratchet wheel through the pawl is vertical when in the position of rest, and any movement of the diaphragm causes the lever to swing from the vertical position—thus increasing the effective leverage of the weight, so that more force is available to rotate the ratchet wheel and overcome the internal resistance of the valve.

A diaphragm A (for which a bell or piston may be substituted) is,

under the action of the gas, supplied through the socket below, and imparts its motion by a yoke B to a bent lever pivoted on the pin C. The horizontal arm of this lever is attached to the yoke by the rod D. A pivoted pawl E, carried on the rod D, engages with the teeth of the ratchet wheel F, so that any motion of the lever is transmitted to the ratchet wheel by the pawl E. A catch prevents the ratchet wheel from being unintentionally rotated backwards. The movements of the ratchet wheel are imparted to the gas-valve connected with it, so that the latter is alternately moved into its open and closed positions during the corresponding movements of the ratchet wheel F.



Rostin's Improved Gas-Lighting Apparatus.

The vertical arm of the bent lever carries a weight G, which is shown in the principal figure in the inoperative position. In this position, the counterweight has no operative leverage, and only acts as a dead-weight on the yoke.

When the diaphragm is raised by an increase of pressure in the pipe (the diaphragm may be separately weighted so that the load on the diaphragm is equal to a predetermined fixed increase of pressure in the pipe), the lever swings from its inoperative position and the ratchet wheel F is rotated by the pawl E; the internal resistance of the apparatus being overcome by the increased force acting on the ratchet wheel due to the increased effective leverage of the weight.

Thus, by the increase of the effective leverage of the weight G, assistance is given to the pressure in the pipe to overcome the frictional resistance of the gas-valve without the pressure in the pipe having to undergo any further increase.

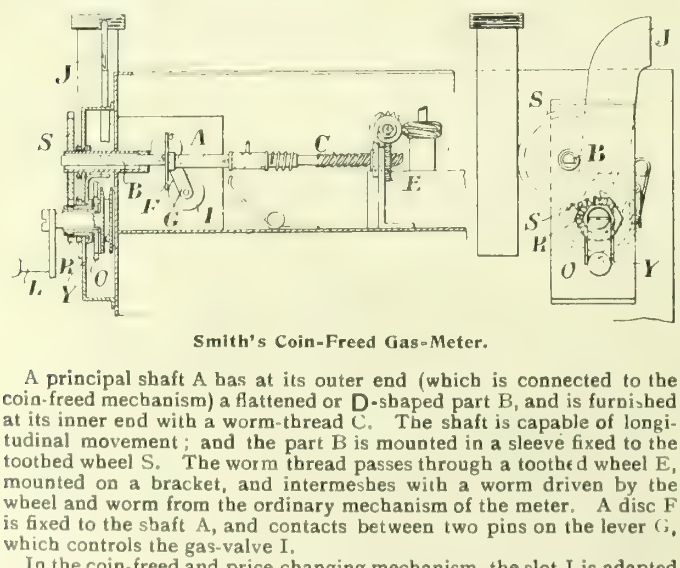
For turning on the gas by hand, the bent lever H is pulled down. This lever carries a pawl I, which engages with the teeth of the ratchet wheel F. A spring serves to bring back the lever into its original position when the chain is released.

Coin-Freed Gas-Meters.

Smith, E. W., of Kennington Park Road, S.E.

No. 13,184; May 31, 1910.

This invention relates to prepaid gas-meter mechanism of the kind in which price-changing arrangements are used in combination with coin-freed measuring-out mechanism—more particularly to the price-changing mechanism. The measuring-out mechanism is of the kind described in patent No. 9961 of 1908.



Smith's Coin-Freed Gas-Meter.

A principal shaft A has at its outer end (which is connected to the coin-freed mechanism) a flattened or D-shaped part B, and is furnished at its inner end with a worm-thread C. The shaft is capable of longitudinal movement; and the part B is mounted in a sleeve fixed to the toothed wheel S. The worm thread passes through a toothed wheel E, mounted on a bracket, and intermeshes with a worm driven by the wheel and worm from the ordinary mechanism of the meter. A disc F is fixed to the shaft A, and contacts between two pins on the lever G, which controls the gas-valve I.

In the coin-freed and price-changing mechanism, the slot J is adapted to deliver a coin into a carrier behind a ratchet-wheel O, which is furnished with a locking recess adapted to engage a pin on the end of a spring-controlled lever in such a manner as to prevent the rotation of the ratchet-wheel more than once for each coin inserted. An external operating handle L is fixed to the coin-carrier, and a pin on the carrier is arranged within a slot in the ratchet-wheel O to allow for some free movement of the carrier in relation to the ratchet-wheel, and to enable the wheel to be turned by the carrier when the limit of the free movement is reached. Particular features of this invention are that the ratchet-wheel is furnished with a sleeve and is adapted to receive an interchangeable toothed wheel R which is held to the sleeve by a nut. This sleeve (with the ratchet, coin-carrier, and its spindle) is adjustably mounted in a slot Y in the frame which supports the mechanism.

The operation of the mechanism is as follows: The coin inserted falls into the carrier and upon the rotation of the handle L is carried against the pin and caused to press it out of the recess, thus enabling the ratchet-wheel to be turned—the coin falling into the coin box (not shown) and permitting the pin to re-engage the wheel when it is completely turned.

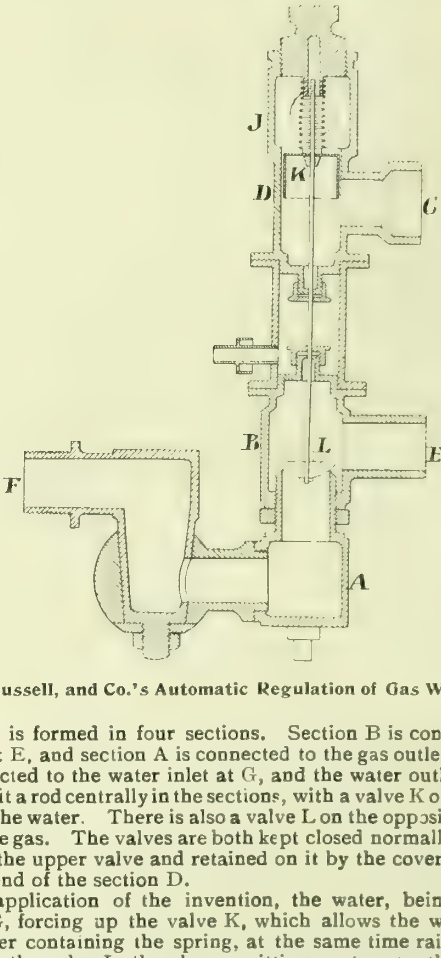
The wheel R is changeable with other wheels, and the former is fixed at such position in the slot Y as may be requisite for its proper meshing with the wheel S. The rotation of this wheel is transferred to the shaft A by the sleeve, and turns the shaft with a longitudinal movement through the wheel E, and simultaneously opens the gas-valve. The returning movement is effected from the ordinary mechanism of the meter by the rotation of the wheel E around the worm C on the shaft A.

Gas and Water Valve.

Fletcher, Russell, and Co., Limited, of Warrington.

No. 30,271; Dec. 28, 1909.

This is an improvement in the apparatus described in patent No. 23,457 of 1907, in which the gas supply is controlled by the water required for the purpose of supplying hot water to lavatories and like places—the gas for heating the water being turned on when the water is turned on, and turned off when the water is turned off.



Fletcher, Russell, and Co.'s Automatic Regulation of Gas Water-Heaters.

A casing is formed in four sections. Section B is connected to the gas inlet at E, and section A is connected to the gas outlet F. Section D is connected to the water inlet at G, and the water outlet at J. The patentees fit a rod centrally in the sections, with a valve K on one end controlled by the water. There is also a valve L on the opposite end, which controls the gas. The valves are both kept closed normally by a spring placed on the upper valve and retained on it by the cover screwed into the outer end of the section D.

In the application of the invention, the water, being turned on, enters at G, forcing up the valve K, which allows the water to enter the chamber containing the spring, at the same time raising the rod, and with it the valve L, thereby permitting gas to enter the chamber in B, and pass through the outlet F to the burner, where it is ignited by a pilot light.

Plymouth Water-Works.—Mr. F. Howarth, the Water Engineer to the Plymouth Corporation, in his annual report on the position of the undertaking, states that the revenue for the year ending March last amounted to £33,372; being an increase of £847 on the previous year. The expenditure for upkeep, management, &c., was £9942, or £315 more than the previous year—an addition to the rates accounting for £144 of this sum. The gross profit of £23,429 was £532 higher than for the year 1908-9; while the net profit was £5918, or an increase of £407. There was a reduction of £242 in the capital charges for interest and sinking fund; but the income-tax went up £367. An increase of £239 was realized in the supplies by meter; and from those in bulk the income showed an advance of £137. The average price received for all the water which left the storage reservoir for supply purposes was 3·47d. per 1000 gallons; while the average cost for upkeep and management was 1·02d. per 1000 gallons, and for interest on capital, sinking fund, and income-tax, 1·88d.—leaving a net profit of 0·57d. per 1000 gallons. Last year, £1433 was spent on capital account; making a total capital expenditure of £393,530, of which sum £120,282 has been repaid or is in the redemption fund. The quantity of water supplied during the year was 2,243,168,000 gallons—an average of 6,121,000 gallons per day—equal to 39·49 gallons per head.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mr. Philip Hunt's Good-Bye.

Sir,—On the eve of my return to Australia, will you kindly allow me, through the columns of the "Journal," to express my sincere and appreciative thanks to the members of the gas profession, both in Great Britain and on the Continent, for the hospitable way with which they have received me, and the kind manner in which information on all matters has been freely placed at my disposal.

In the gas profession there is a willingness, which is probably unequalled in any other profession, to give information; and my inquiries clearly indicate that this exists to an extent which is surely no small factor in the general advancement of the gas industry.

My visit to the Old Country has not only enabled me to see many old friends, but has also brought me many new ones. To all, may I say, not "good-bye" but "au revoir."

P. C. Holmes Hunt.

15, *Victoria Street, S.W., Nov.* 26, 1910.

Standard Specifications for Refractory Materials.

Sir,—There have been some inquiries made recently with regard to the publication of the standard specifications which the Refractory Materials Committee reported at the last meeting of the Institution of Gas Engineers were to be undertaken; and I shall be glad, therefore, if you will allow me to state that the specification for retorts has now been drawn up by the Committee, in collaboration with the representatives of the Retort and Fire-Brick Section of the Society of British Gas Industries, and will be published early in December.

The specification for fire-bricks and blocks, &c., will not be ready until the spring of next year, as a considerable number of tests in connection therewith have yet to be carried out.

F. J. Bywater,
Hon. Secretary, Refractory Materials Committee.

Gas-Works, Saltley, Birmingham, Nov. 23, 1910.

Burner Adjustment.

Sir,—In Mr. Arthur Valon's letter, on the above subject, in your issue of the 22nd inst., are the following words: "It will be interesting, when the experience is available, to learn how the burner of Mr. C. C. Carpenter behaves with a gas containing a percentage of water gas."

I can assure your correspondent that if the burner is equal to the average burner on the market, it will be found "quite all right;" and I will go further and say that gas may be consumed varying from 8 to 16 candle power without being voted a nuisance by the "Man in the Street"—pressure being the governing factor. It has been the practice here for years, and the instructions to fitters have been, "Adjust the air supply to suit local conditions when fixing. If trouble arises later, see that pipes and nozzle are clear, and the pressure normal; but don't 'fiddle' with the air regulator."

The above applies to gas-fires. Anyone may try the experiment; many have seen the results.

It is surprising what observation and deduction therefrom may do in this or any other direction; and we may perhaps some day hear what useful purpose the so-called incombustible gases serve when gas is consumed under high pressure.

S. Carpenter.

Gas-Works, Dorking, Nov. 24, 1910.

Detection of Nitrogen in Coal Gas.

Sir,—In your issue of Nov. 22, there is an extract from the "Journal des Usines à Gaz" which criticizes Mr. Bell's carbonizing figures.

In this connection, the following figures may interest some of your readers. They were calculated from the analyses as given by Mr. Bell and reported in the "Journal" for June 21 last.

	Per Ton of Coal. 8-Cwt. Charge.	12-Cwt. Charge.
Gas made	11,820 cub. ft.	12,091 cub. ft.
Weight of 1 cubic foot	0·03684 lbs.	0·03341 lbs.
,, ,, gas made	435·4 ,,	404·0 ,,
,, ,, CO_2	34·9 ,,	37·2 ,,
,, ,, SH_2	15·7 ,,	18·0 ,,
,, ,, CS_2	1·0 ,,	1·1 ,,
,, ,, coke	1596·0 ,,	1596·0 ,,
,, ,, tar	12·4 ,,	13·9 ,,
,, ,, liquor	34·7 ,,	36·4 ,,
Weight of products	2130·1 lbs.	2106·6 lbs.
Weight unaccounted for	109·9 lbs.	133·4 lbs.

On looking through these figures, the question naturally arises, How is it that there is a greater apparent loss of material in the heavy than in the light charges?

The coal used by Mr. Bell contained 30·2 lbs. of nitrogen to the ton, for both light and heavy charges. The weight of nitrogen present in the gas from a ton of the coal was 48·3 lbs. in the case of the light charges and 26·66 lbs. in the gas from the heavy charges.

O. W.

Charlton, Nov. 24, 1910.

Ammonia Recovery Apparatus.

Sir,—With reference to Mr. S. B. Chandler's letter published in the "Journal" for Nov. 22, I should like to point out that the washer referred to in my paper is known as the patent "Standard" washer. Mr. Chandler may be interested in the patent; but I have never known the washer by any other name than the "Standard." The reference in my paper to "Kirkham" was intended for Messrs. Kirkham, Hulett, and Chandler; and it was so expressed for shortness.

W. H. Johns,
Superintendent, Saltley Gas-Works,

Birmingham Nov. 28, 1910.

PARLIAMENTARY INTELLIGENCE.

FURTHER PROGRESS OF PRIVATE BILLS.

In the House of Lords on Monday last week, the Chairman of Committees informed the House that the opposition to the Warrington Corporation Bill had been withdrawn, and the Bill was committed. The Dundee Gas Commissioners Order Confirmation Bill was read the third time, passed, and sent to the Commons. On Wednesday it was returned from the Commons agreed to.

In the House of Commons the Dundee Gas Commissioners Order Confirmation Bill was read the first time on Monday, considered next day, and read the third time and passed.

An Important Water Return.

In the House of Commons last Thursday, on the motion of Mr. Herbert Lewis, the Member for Flintshire, a return was ordered showing, as regards every water undertaking in England and Wales, (*a*) the powers, if any, under which the undertakers are authorized to supply water; (*b*) the limits within which the undertakers are authorized to supply water; (*c*) the places actually supplied; (*d*) the sources of the supply, their nature and sufficiency; and (*e*) particulars as to the works and the quantity and quality of the water supplied. Also, as regards every district in England and Wales, (*a*) the area and population of the district, and the number of houses therein; (*b*) the number of houses supplied with water from a piped service; (*c*) the names of the undertakers providing a supply of water; and (*d*) the source, nature, and sufficiency of the supply where there is no piped service.

NOTICES GIVEN FOR BILLS (SESSION 1911) RELATING TO GAS, ELECTRICITY, AND WATER SUPPLY.

Ashborne and District Gas.—Application will be made for the dissolution of the Ashborne Gas Company, and the incorporation of a new Company to carry on the undertaking with the usual powers in regard to the supply of gas. Authority will be sought to maintain the present works and construct new ones. The Bill will contain provisions relating to the quality and testing of the gas, the pressure at which it is to be supplied, its sale in bulk, &c. Permission will be required to apply for an Electric Lighting Order.

Bedwellty Urban District Council.—The Urban District Council of Bedwellty, in the County of Monmouth, will apply for the confirmation of an agreement entered into by them for the purchase of the undertaking of the New Tredegar Gas and Water Company, Limited. The Bill will define the limits of gas and water supply, and sanction agreements or arrangements between the Council and the Rhymney and Aber Valleys Gas and Water Company in regard to an exchange or alteration of their respective areas of supply, and enable the parties thereto to carry any such arrangement into effect. Authority will likewise be sought for the purchase by the Council, by agreement, of the undertaking of the Blackwood Gas Company; and provision will be made in the Bill for the transfer of part of the undertaking to the Mynyddyslwyn Urban District Council.

Belfast Corporation.—A General Bill of which notice has been given by the Belfast Corporation will contain a clause conferring powers upon them with respect to the prices to be charged for gas, and particularly enabling them to charge for gas supplied for power and manufacturing purposes a lower rate than that charged for ordinary domestic or lighting supplies.

Bicester Gas.—The Bicester Urban District Council intend to apply for power to supply gas, purchase (by compulsion or agreement) any existing gas-works in the district, and erect new works. The Bill to be promoted will contain provisions as to the quality and pressure of gas and the price to be charged.

Blackburn Corporation Water.—Confirmation will be sought by the Blackburn Corporation for water-works already commenced, and also authority to construct a reservoir, several conduits, a culvert, and other works. It is proposed to ask for an extension of time for the completion of the Brennand and Whitendale reservoirs, and works connected therewith, authorized by the Blackburn Borough Gas, Water, and Extension Act, 1877, as amended by Acts obtained by the Corporation in 1885 and 1898. Additional borrowing powers will be required.

Chapel-en-le-Frith, Chinley, and District Gas.—Authority will be sought for the dissolution of the Chapel-en-le-Frith and District Gas Company, Limited, and for the incorporation of a new Company to acquire and carry on the undertaking. It is proposed to ask for the repeal of the powers now possessed by the Buxton Urban District Council to supply gas to so much of the village of Dove Holes as is within the parish of Fairfield, and for the confirmation of any agreement which may be entered into between the Company and the Buxton and Fairfield Urban District Councils in relation thereto. Power will be required to maintain the existing works and construct new ones, to define and increase the capital, and to apply for an Electric Lighting Order. The Bill will contain the usual provisions incidental to the supply of gas.

Chasetown Gas.—The Chasetown Gas Company, Limited, intend to apply to be dissolved, and to have their undertaking vested in a new Company, with power to supply gas to Chasetown and other places and portions of parishes in the county of Stafford. Additional capital and borrowing powers will be required. The sites of the existing gas-works are to be confirmed, and authority will be sought to maintain and extend the works. The Bill will contain provisions in regard to the illuminating power and price of gas, the regulation of its supply, and its sale in bulk beyond the limits.

Chesham and District Gas.—Application will be made by the Chesham Gas and Coke Company, Limited, to be dissolved and re-incorporated with additional powers in regard to the supply of gas in Chesham

and the neighbourhood. The Bill will contain, in addition to the usual provisions, others for the transfer of the undertaking of the Wendover Gas Syndicate, Limited, to the promoters, on such terms as may be authorized by the intended Act. Authority will be sought to make provision in respect of the capital and borrowing powers of the Company, and the raising of more money.

Chester Water.—The Chester Water Company will apply for the confirmation of their existing works for drawing water from the River Dee, and of the acquisition of lands and the expenditure of capital in connection therewith. They will also seek authority to construct and maintain other works, consisting of a subsiding-tank or reservoir in Chester and an aqueduct or pipe-line from it to an existing main of the Company. Provision is to be made for the supply of water in bulk and for the prevention of its pollution; and it is proposed to consolidate and convert the existing capital and raise more.

Chesterfield Gas and Water Board.—The Chesterfield Gas and Water Board intend to apply for authority to construct new works, consisting of aqueducts, dividing weirs, pipe-lines, &c., and extend their limits of gas supply. Additional capital will be required.

Chichester Gas.—Application will be made by the Chichester Gas Company for an extension of their limits of supply so as to include certain parishes and parts of parishes in the county of Sussex, and for authority to exercise therein all or some of the powers they now possess, levy rents, rates, and charges in respect of the supply of gas within the extended limits, and, if thought fit, provide for levying others in different portions thereof. It is proposed to repeal so much of the Petersfield and Selsey Gas Act, 1901, as authorizes the Petersfield and Selsey Gas Company to supply gas within the parish of Donnington and portions of the parishes of Hunston and North Mundham. Additional capital and borrowing powers will be required. Provision will be included in the Bill with regard to the apparatus for, and the mode of, testing the illuminating power of the gas, as well as the inspection and specification of pipes and other appliances, the supply of gas in bulk, the erection of dwellings for the employees, &c.

City of London (Various Powers).—The Corporation of the City of London have given notice of a Bill which will contain a clause to provide for the payment by any company or authority to whom any gas, water, or electric, hydraulic, or other mains, pipes, wires, manholes, ducts, boxes, or other apparatus belong, of the expenses of the removal or alteration of the position of any such mains, pipes, wires, or other works or apparatus which may be necessitated by any street or other works undertaken by the Corporation; and also to make provision for the purpose of imposing on the Metropolitan Water Board, the London Hydraulic Power Company, or the owner of any such water mains or pipes, the liability to repair the roadway or pavement of any street which may be damaged by reason of the bursting of any mains or pipes or the escape of water, or by reason of the breaking-up of the street for the purpose of repairing such mains or pipes. It is proposed to repeal, alter, or amend the provisions of the Acts of the Gaslight and Coke Company, the Metropolitan Water Board, the London Hydraulic Power Company, and other companies.

Ely Water.—Authority will be sought for the incorporation of a Company with power to construct works and supply water within the rural district of Ely and the parishes of Fordham and Soham. The Bill will define the capital and other powers of the Company, and make provision for its administration and the carrying on of the business.

Enfield Gas.—The Enfield Gas Company intend to apply for authority to purchase lands in the parish of Enfield, and manufacture and store gas upon them. The Bill to be promoted will contain provisions in regard to the quality and testing of gas, the conditions of supply to persons having a separate service of electricity, and other matters. Further capital and borrowing powers will be required.

Felixstowe and Walton Water.—Application will be made by the Felixstowe and Walton Water Company for authority to construct new works, consisting of two pumping-stations, a covered service reservoir, and three pipe-lines, in the rural district of Woodbridge, in the county of Suffolk, and for the confirmation of certain works now in existence. Additional capital will be required.

Gaslight and Coke Company.—The notice given by this Company, of their intention to apply for authority to amalgamate with the Barking and Chigwell Gas Companies and extend their area of supply, was dealt with in the "JOURNAL" last week (p. 581).

Gloucester Corporation.—In a General Powers Bill, of which notice has been given by the Gloucester Corporation, authority will be sought for the construction of new water-works, consisting of a well and pumping-station, a line of pipes therefrom to the outlet-pipe of one of the reservoirs at Madams Wood, and an approach road. Provision will be made for securing the purity of the water, and for the raising of more capital.

Halifax Corporation.—The Corporation of Halifax require (*inter alia*) authority to make further provisions in regard to the supply of gas. They propose to require a person who has a private installation of gas for power or other purposes to pay a minimum charge for it; and to make certain changes in respect of the illuminating power, purity, and testing of the gas, and the apparatus to be used therefor. The Corporation also wish to be empowered to construct water-works, consisting of a pipe-line in the parish of Wadsworth, in the West Riding of York, and a wall in extension of the existing wall of the dam of the Walshaw Dean lower reservoir. The Bill will contain provisions with respect to the alteration of the dates for the payment of the water-rates, and also to the period of error in meters used for registering electrical energy. More money will be required.

Harrogate Corporation.—The Corporation of Harrogate will apply for an extension of time for the completion of the works authorized by their Water Act of 1901; also for authority to alter and increase their water rates, rents, and charges, and to raise more money.

Hastings Corporation.—In a Water and Finance Bill, of which notice has been given by the Corporation of Hastings, they will seek authority for the compulsory purchase of the lands upon which the existing pumping-stations and works at Forewood, Crowhurst, and Pebsham are constructed, and for the purchase of additional lands adjoining them, and the construction of further works thereon for the improvement of the existing water supply of the borough. These comprise three pumping-stations, a service reservoir, and six conduits or pipe-lines. The Bill will contain the usual provisions as to the supply of water, and also for the raising of more money.

Hornsea Urban District Council.—The Urban District Council of Hornsea purpose applying, in a General Bill, for authority to make better provision in regard to the supply of water, particularly in respect of the charges for trade purposes and by measure. They wish to be enabled to make bye-laws for the prevention of the waste or misuse of water, and provide that the undertaking shall continue to be carried on under the Public Health Acts. Additional borrowing powers will be required.

Ipswich Corporation.—Application will be made by the Ipswich Corporation for power to construct a pumping-station and a conduit or pipe-line in the parish of Whitton, extend their limits of supply so as to include a number of places in East Suffolk, and levy rents, rates, and charges within the new limits. The Bill will contain the usual provisions in regard to water supply, and the term "domestic purposes" is to be limited and defined. More money will be applied for.

Kingston-upon-Hull Corporation.—Application will be made by the Kingston-upon-Hull Corporation for authority (*inter alia*) to construct new works, comprising a pumping-station, two water-towers, and several conduits or pipe-lines, extend their limits of supply, and sell water in bulk to Hedon, Hornsea, Withernsea, and elsewhere. Additional borrowing powers will be required.

London County Council (General Powers).—The Bill for which the London County Council have given notice will contain provisions enabling them to regulate and control lamps, signs, &c., projecting from buildings, and to prevent the construction under streets of subways or other structures without their consent.

Luton Gas.—The Luton Gas Company require authority to purchase certain lands by agreement, raise additional capital, form a special purposes fund, &c. The Bill will include provisions relating to the illuminating power and testing of gas, the inspection of fittings, the supply of gas in bulk, the provision of houses for their workmen, and various other matters.

Luton Water.—It is the intention of the Luton Water Company to apply for authority to purchase additional land by agreement, raise further capital, increase their borrowing powers, form a special purposes fund, and lay mains and pipes in undedicated roads.

Margam Urban District Council.—Authority will be sought by the Margam Urban District Council to purchase, by compulsion or agreement, the portion of the gas-works and plant belonging to the Aberavon Corporation which lies within the Council's district, also to construct new works and supply gas. Provision will be made in the Bill for the Corporation continuing the supply till the new works are completed. The necessary money powers will be required.

Marple Gas.—The Marple Urban District Council intend to apply for power to acquire certain lands for the manufacture and storage of gas, alter the illuminating power of the gas and the provisions relating to testing it, and prescribe the apparatus and burner to be used. More money will be needed.

Merthyr Tydfil Corporation Water.—The Corporation of Merthyr Tydfil intend to apply for authority to construct an impounding reservoir and other works, and appropriate the waters of the Taf Fechan. It is proposed to ask for the repeal or modification of existing provisions with regard to compensation water and the size of works, as well as with reference to the Pentwyn reservoir; and certain agreements are to be annulled. The Bill will contain a number of general provisions bearing upon the supply of water and sanctioning the raising of more money.

Metropolitan Water Board.—Application will be made by the Metropolitan Water Board for authority to construct a number of water and other works in the counties of Buckingham and Middlesex. They include eight storage reservoirs in the neighbourhood of Wraysbury, Staines, and Datchet, a service reservoir in the parish of Greenford, another in the parish of Wembley, and numerous conduits or pipe-lines, aqueducts, and cuts. The Board require power to purchase lands for filter-beds, utilize the water of the Colne Brook for generating electric or other energy, and divert the water of the brook and of the Thames. It is proposed to revive the powers for the construction of certain works at Walton authorized by the Southwark and Vauxhall Water Act, 1898. Authority will be sought for making agreements with the Conservators of the Thames with respect to the abstraction of water from the river, and for consolidating the Board's powers of abstraction. It is intended to ask for permission to apply the existing funds for the purposes of the Bill, and also to raise additional capital.

Northampton Corporation.—In a Bill to be promoted by the Northampton Corporation, they will ask to be empowered to enter into agreements with the owners, lessees, and occupiers of lands within the drainage area of any of the existing reservoirs or water-works for the purpose of draining such lands, or for preserving the purity of, and collecting and conveying, the water the Corporation are authorized to impound and appropriate. The Bill will also contain provisions in regard to the waste, misuse, and contamination of the water, and to the protection of the works, fittings, and property of the Corporation.

Oystermouth Water.—The Urban District Council of Oystermouth purpose applying for authority to purchase, by compulsion or agreement, the undertaking of the Oystermouth and District Water-Works Company, Limited, and supply water within limits defined in the notice. They will also ask for power to construct new works, consisting of a service reservoir in the parish of Oystermouth and two pipe-lines, and to raise the necessary money.

Paignton Urban District Council.—Power will be sought by the Paignton Urban District Council to construct new water-works, consisting of two filter-houses and filters and an aqueduct or pipe-line. The Council will also apply for the sanction of Parliament for the construction of filters and a filter-house, a storage reservoir, and other existing works, and for power to maintain, alter, and renew them; and they will ask to be authorized to make better provision for the

supply of water, and to alter their rents, rates, and charges. Additional borrowing powers will be required.

Rhondda Urban District Council.—Application will be made by the Rhondda Urban District Council for an extension of the period limited by their Act of 1905 for the construction of such of the water-works authorized by the Ystradyfodwg Urban District Council (Gas and Water) Act, 1896, and the Rhondda Urban District Council Act, 1899, as have not been completed, or any of them, and further powers for the Council in relation to these works. They will also ask for authority to construct new works, consisting of two service reservoirs, a tank, and four aqueducts, conduits, or pipe-lines, and for the confirmation of works already carried out. More money will be required.

Rhymney Valley Water Board.—Application is to be made for authority for the establishment of a Water Board for the Rhymney Valley, and for power to acquire compulsorily the water undertakings of the Rhymney and Aber Valleys Gas and Water Company, the New Tredegar Gas and Water Company, Limited, the Rhymney and Caerphilly Urban District Councils, and the St. Mellons Rural District Council, and the Pentwyn reservoir and other water-works of the Merthyr Tydfil Corporation. It is proposed to construct two service reservoirs (one a high-level) and several aqueducts, conduits, or pipe-lines; and power will also be sought to impound numerous springs, streams, and waters. A Committee of members of the Merthyr Tydfil Corporation and the Board is to be established, with powers and obligations as to the construction of works, &c. The Bill to be promoted will contain provisions in regard to the shares, debenture stock, and mortgages of the above-named Companies, and the compensation to be paid to them and to the other bodies whose works are to be acquired. The usual powers granted to suppliers of water will be applied for, as well as others sanctioning the borrowing of money, the application of revenues, and the apportionment of any deficiency. The proposed area of supply includes a number of places in the counties of Glamorgan, Monmouth, and Brecknock.

Rotherham Corporation.—The Corporation of Rotherham will apply for an extension of their gas limits so as to include the parishes or townships of Catcliffe, Treeton, and Wickersley, in the rural district of Rotherham, and for further powers in regard to the quality and testing of the gas supplied by them. They will also ask for authority to construct a reservoir, and for further powers in respect of their water undertaking. More money will be wanted.

Salford Corporation.—The Corporation of Salford intend to apply for further powers in connection with their gas undertaking. They relate to the holding and use of lands for gas-works, the manufacture, storage, and testing of the illuminating power and purity of gas, the application of gas revenue, and other matters. Additional borrowing powers will be required.

Sidmouth Gas and Electricity.—The Sidmouth Gas Company, Limited, wish to be dissolved and re-incorporated with power to supply gas and electricity. Authority will be sought to maintain the existing and construct new gas-works, as well as a generating station and works for the supply of electricity; and the Bill to be promoted will contain provisions incidental to the supply of both illuminants in the ordinary way or in bulk and the charges to be made, the pressure and testing of gas, the supply of fittings, &c. The present capital is to be defined and increased.

Slough Urban District Water.—The Slough Urban District Council will apply for power to acquire the undertaking of the Slough Water Company, maintain and enlarge the existing works, and make better provision for the supply of water in the existing limits of the Company, or in such others as may be prescribed by Parliament. In the event of the Council's proposal being sanctioned, the Company will be wound up and dissolved. Authority will be required to raise the necessary money.

Southampton Corporation Water.—Authority will be sought by the Southampton Corporation to purchase, compulsorily or by agreement, the undertaking of the South Hants Water-Works Company, and amalgamate it with that of the Corporation. It is proposed to alter the rates and charges in the borough, sell portions of the undertaking to local authorities within the limits, and supply water in bulk. More money will be applied for.

St. Helens Corporation.—In a Various Powers Bill to be promoted by the St. Helens Corporation, further provisions will be contained in regard to the supply of gas and water. The Corporation wish to fix the standard quality of gas to be supplied by them, and to provide for the better testing of it. It is proposed to repeal the existing provisions of the Act of 1869 in this respect. Another matter connected with gas is a proposal to require persons having separate or private supplies for power or other purposes to pay a minimum charge for gas, and to impose conditions in connection with such supply. One of the provisions bearing upon the supply of water is that "domestic purposes" shall not include a supply to stables or premises in which horses, carriages, or motor-cars are kept.

Swansea Gas.—The Swansea Gas Company have notified their intention of applying to Parliament for various powers in connection with their undertaking. They include the purchase of additional lands by agreement; the construction and maintenance of works for the manufacture and storage of gas; the imposition of a minimum charge for gas where electricity is supplied; the inspection of fittings; the testing of the illuminating power of the gas, and the apparatus employed therefor; and the alteration of the date of the annual general meeting. The Bill to be promoted will contain provisions for the formation of a special purposes fund, a scheme of profit-sharing by the employees, and the granting of superannuation and other allowances. Additional capital will be required.

Tamworth Gas.—Application will be made by the Tamworth Gas Company for further powers, and an extension of their area of supply so as to include the parishes of Polesworth and Shuttington, in the county of Warwick. It is proposed to acquire a piece of ground adjoining the lands now belonging to the Company, and erect works thereon. Provision will be made in the Bill for the formation of a special purposes fund, and also for enabling the Company to adopt the most recent methods for testing the illuminating power and pressure of gas. Additional capital will be required.

Thames Conservancy.—The Conservators of the River Thames intend to apply for authority to increase the payments made to them by the Metropolitan Water Board towards their funds in respect of water abstracted from the Thames; to alter the statutory and other regulations with regard to such abstraction; and to have it enacted that, from and after a date to be prescribed by the Bill, it shall no longer be lawful for the Board to take water from the river without regard to its flow for the time being. The Bill will remove the existing restrictions upon the use which the Board may make of water abstracted by them from the Thames, and enable them to use all such water for any purpose for which they are entitled to use or supply water, without regard to the point at which, or the powers under which, it is taken. The Board are to be enabled to alter the position and number of their intakes; and it is proposed that they shall be called upon to provide additional storage accommodation for water.

West Cheshire Water Company.—Application will be made by the West Cheshire Water Company for the confirmation of their existing works in the hundred of Wirral, in the county of Chester, and also for additional borrowing powers.

Weston-super-Mare Gas.—Application is to be made by the Weston-super-Mare Gas Company for authority to raise additional capital, hold lands for the manufacture and storage of gas and residual products, and adopt the "Metropolitan" No. 2 burner in substitution for the one now in use for the official testing of the illuminating power of their gas.

Whaley Bridge Gas.—Authority will be sought for the incorporation of a Company for the supply of gas in Whaley Bridge and the neighbourhood, and for the acquisition of the Whaley Bridge Gas Company, Limited. The Bill will contain provisions for maintaining and extending the works, supplying fittings, &c., testing the illuminating power of the gas, and defining and increasing the capital.

Wirral Water.—The Wirral Water Company intend to apply for the confirmation of their existing works in the hundred of Wirral, in the county of Chester, and also for additional capital and borrowing powers.

PROVISIONAL ORDER APPLICATIONS (SESSION 1911).

Board of Trade, under the Gas and Water Works Facilities Act, 1870.

Alfreton Gas.—The Alfreton Gas Company will apply for power to purchase additional lands, and manufacture and store gas and residual products thereon.

Barnstaple Gas.—The Barnstaple Gas Company wish for an extension of their limits of supply so as to include the parish of Instow. They also desire to be authorized to make further provisions in regard to the price and quality of gas and the testing of its illuminating power, the payments to be made by persons having a separate supply of gas or electricity, and other matters. More capital will be required.

Blandford Water.—The Blandford Water Company, Limited, intend to apply for authority to extend their limits of supply so as to include certain parishes in the rural district of Blandford, for the confirmation of their existing works, and for power to construct others. Additional capital will be required.

Burnham Gas.—Authority will be sought by the Burnham Gas Company, Limited, to maintain and continue their gas-works at Burnham-on-Crouch, in the county of Essex, and supply gas in the urban district, and also in the parishes of Creeksea, Althorne, and Latchingdon, in the rural district of Maldon. The Order will contain the usual provisions in regard to the testing and supply of gas.

Busby and District Gas.—Authority will be sought by the Busby and District Gas Company, Limited, to maintain and continue their existing gas-works, situated in the parishes of Cathcart and Mearns, in the county of Renfrew, and manufacture and supply gas within the latter parish and the parishes of East Kilbride and Carmunnock, in the county of Lanark. The capital and borrowing powers of the Company are to be regulated.

Cannock Gas.—The Cannock, Hednesford, and District Gas Company, Limited, will apply for an extension of their area so as to include part of the parish of Norton-under-Cannock, in the urban district of Brownhills; and also for authority to acquire lands for the manufacture and storage of gas, and make further provisions with regard to its price and quality, and the pressure at which it is supplied. Additional capital will be required.

Clay Cross Gas.—The parties carrying on business as the Clay Cross Gas Company intend to apply for an extension of their limits of supply so as to include portions of the parishes of Woodthorpe, Heath, Ault Hucknall, and Ashover; and also for authority to make further provision in regard to the supply of gas. The applicants will need additional capital.

East Hants Gas.—The East Hants Gas Company, Limited, will apply for confirmation of the expenditure upon the undertaking authorized by the Woolmer and District Gas Order, 1908, in excess of the amount thereby sanctioned, and for the fixing and regulation of the dividends that may be declared upon such capital. They will also ask for additional borrowing powers.

Guisborough Water.—The promoters under the Guisborough Water Orders of 1871 and 1880 intend to apply for authority to raise additional capital, and to alter their rents, rates, and charges, &c.

Herne Bay Gas.—Application will be made by the Herne Bay Gas Company, Limited, to acquire lands and construct and maintain additional works.

Holyhead Gas.—The Holyhead and North Wales Gas and Water Corporation, Limited, purpose applying for the authorization of their existing works, and for power to make and supply gas, fittings, appliances, and artificial light other than electric, and to raise additional capital.

Hythe and Sandgate Gas.—The Hythe and Sandgate Gas Company will apply for authority to increase their capital and borrowing powers, and make further provisions in regard to the supply of gas. One of these is that, notwithstanding anything contained in the Hythe and Sandgate Gas Act, 1868, or in the Hythe and Sandgate

Gas Order, 1876, a No. 2 "Metropolitan" burner shall be substituted as the test-burner for illuminating power; and, if necessary, the Act and Order named are to be amended accordingly. Another provision is that the Company shall be authorized to levy special or different rates and charges, if desirable, for the supply of gas for power, cooking, and heating.

Launceston Gas.—The Launceston Gas Company, Limited, intend to apply for authority for the maintenance and continuance of their gas-works at Launceston; the supply of gas in the borough, and in parts of the parishes of St. Thomas the Apostle Rural and St. Stephens by Launceston Rural, in the rural district of Launceston; the acquisition of lands, and the laying down of mains, pipes, and works; and the levying of rates, rents, and charges. Provision will be made in regard to the Company's capital and borrowing powers.

Lichfield Gas.—The Lichfield Gas Company intend to apply for an extension of their limits of supply so as to include the parish of Ogley Hay Rural, in the rural district of Lichfield.

Llangefni Gas.—The Holyhead and North Wales Gas and Water Corporation, Limited, intend to apply for similar powers to those mentioned in connection with their application in regard to Holyhead.

Llanrwst Gas.—The Holyhead and North Wales Gas and Water Corporation, Limited, intend to apply for similar powers to those mentioned in connection with their application in regard to Holyhead.

Longford Gas.—The Longford District Gas Company, Limited, purpose making application for authority to maintain and continue their works, manufacture and supply gas in the town of Longford and the neighbourhood, in the county of Longford, manufacture and deal in residual products, and do all things necessary to carry on their undertaking, including the raising of additional capital.

Mexbrough and District Water.—The Mexbrough and District Water Company, Limited, intend to apply for power to raise additional capital, acquire lands by agreement, and make general provisions in regard to the supply of water.

North Pembrokeshire Water and Gas.—Authority will be sought by the North Pembrokeshire Water and Gas Company to issue all or part of their unissued capital as preference shares or stock, and define the amount of dividend to which such capital shall be entitled. They will also ask to be empowered to make a number of provisions in regard to the supply of water and gas—including, in the case of the latter, price, quality, and testing; and in that of the former, detection of waste and misuse, and the definition of "domestic purposes."

North Warwickshire Water.—The North Warwickshire Water Company will apply for authority to issue all or any part of their unissued capital as preference shares or stock, and define the amount of dividend to which such capital shall be entitled. They will also ask for an extension of their borrowing powers, and for permission to make better provision in regard to the supply of water within their limits.

Petersfield and Selsey Gas.—The Petersfield and Selsey Gas Company intend to apply for authority to raise additional capital and make further provisions in regard to the illuminating power, purity, and testing of gas, and other matters.

Preston Gas.—The Preston Gas Company intend to apply for authority to alter and reduce the illuminating power of their gas, make further provisions in regard to testing it, form special purposes and reserve funds, &c.

Pwllheli Gas.—The Holyhead and North Wales Gas and Water Corporation, Limited, intend to apply for similar powers to those mentioned in connection with their application in regard to Holyhead.

Sheringham Gas and Water.—It is the intention of the Sheringham Gas and Water Company to apply for additional capital and borrowing powers, and for authority to make provision for the payment of dividends on different classes of stock.

Uxbridge Gas.—The Uxbridge Gas Company will apply for an extension of their limits of supply so as to include certain places in the counties of Buckingham and Hertford, and for authority to purchase the undertaking of the Amersham Gas Company and use their capital for the purpose.

Local Government Board, under the Public Health Act, 1875, and the Gas and Water Works Facilities Act, 1870.

Chipping Norton Gas.—Application will be made by the Corporation of Chipping Norton for authority to construct and maintain gas-works, and supply gas within their district; also to acquire by agreement the existing gas-works and undertaking now or lately the property of the Chipping Norton Gas and Coke Company, Limited, or of the Mid-Oxfordshire Gaslight and Coke Company, Limited. The Corporation will ask for the usual powers granted to suppliers of gas; but they wish to be exempt from penalty for "insufficiency of pressure, defect of illuminating power, or excess of impurity of the gas supplied." It is proposed to apply existing funds to the purposes of the Order; and the Corporation will ask for authority to raise more money.

Cudworth Gas.—The Cudworth Urban District Council will apply for authority to construct gas-works within the limits of the Cudworth Gas Order, 1903, and manufacture and supply gas and sell residual products. The proposed Order will contain the usual provisions relating to the supply of gas; but, as in the case of the Chipping Norton Corporation, they wish to be exempt from liability to penalty in cases of insufficiency of pressure or illuminating power, or excess of impurity. Borrowing powers are required.

Droitwich Corporation Gas.—The Droitwich Corporation intend to apply for authority to purchase certain lands by agreement for the purposes of their gas undertaking; to construct gas and other works; and to make further provisions for the supply of gas in the borough.

Preesall Gas.—Application will be made by the Urban District Council of Preesall, in the county of Lancaster, for authority to construct gas-works, manufacture gas and residual products, and supply the former in their district. The necessary borrowing powers will be required.

Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899.

Aberdeen Corporation.—In an Order of which notice has been given by the Aberdeen Corporation, they will ask for the amendment of the Aberdeen Extension and Improvement Act, 1883, relating to their railway connecting the gas-works with the rails of the Aberdeen Harbour Commissioners, for the purpose of affording further facilities for the traffic in connection with the works. In particular, they wish for the amendment of section 53, so as to enable them to lengthen the trains, increase their speed, and remove the limitation against the working of traffic during certain hours.

Dundee Water.—The Dundee Water Commissioners intend to apply for power to enlarge and raise the level of their Lintrathen reservoir, and carry out other works, including several road diversions. The Order will contain provisions in regard to the alteration of the existing rents, rates, and charges, and the raising of more money.

Dunfermline Burgh Extension.—The Town Council of Dunfermline intend to apply for an extension of the boundaries of the city and Royal burgh, an enlargement of their powers with regard to the supply of gas, and authority to extend the works and use additional lands for the purpose.

LEGAL INTELLIGENCE.

ACTION FOR TRADE LIBEL.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Nov. 18.

(*Before Mr. Justice* WARRINGTON.)

B. Cars v. Bland Light Syndicate, Limited.

Mr. BUCKMASTER, K.C., Mr. CAVE, K.C., and Mr. R. REEVE (instructed by Messrs. Harris, Chetham, and Cohen) appeared for the plaintiff; Mr. CLAUSON, K.C., and Mr. O. THOMPSON (instructed by Messrs. Spyer and Son) represented the defendants.

At the close of the proceedings in this action reported last week (p. 582), Counsel called the following evidence in support of

The Defendants' Case.

Mr. *W. R. Francis* said he was in the service of the Davis Gas-Stove Company, Limited, who in September, 1909, were agents in Manchester and the North of England for the Bland Light Syndicate. Mr. Squires was his assistant; and, having received a report from him as to an interview he had had with Mr. Brooks, he gave him certain instructions. He did not authorize him to make any statement with regard to the Bland patents.

Mr. BUCKMASTER objected to this evidence.

His LORDSHIP remarked that it could not have anything to do with the question before him.

Cross-examined: The Davis Company did a substantial trade in the Bland burners. The exhibit "G.B.[1]" was a fair specimen; and "G.B.[4]" was practically the same. There was a difference in the stuffing-box, and he could not see the nipple. The adjustment was different; but the general appearance was the same. "G.B.[4]" was not known as the Bland burner in the summer of 1909. It had been known and sold under this name; and they might have had a few of the burners left on hand from the previous season. An alteration was made for the autumn season of 1909. There were improvements in the nipple and in the nozzle, which was made of steatite. Up to then "G.B.[4]" was the Bland burner. There had been one previous to it, which was made of iron. The new type was made of brass.

Mr. *Charles William Bland*, Managing-Director of defendant Syndicate, said they carried on business at Little Trinity Lane, London, and also in Manchester. He started business in 1905; and in 1906 he took a partner, and traded as Bland and Co. The present Company was registered in 1908; one department of the business being the sale of inverted incandescent gas-burners. Before the Company was formed, he sold burners under the name of Bland obtained from Mr. Schmitz, of Hamburg. For the autumn of 1908, the Company entered into an agreement with Schmitz to take from him, up to July 15, 1909, at least 15,000 assorted burners, at certain scheduled prices; and they took this number before the end of December, 1908. After that date they took no more burners of the type in question from Schmitz; and the whole of them were sold—probably before the end of January, but certainly before the middle of February. They were all stamped "Bland," and sold as Bland burners. Schmitz stamped them "Bland burner; Schmitz patent." After February, 1909, they had not sold any of those burners. In 1908 they arranged with Messrs. Thomas Glover and Co., Limited, to manufacture burners according to their own ideas, which differed in many essential particulars from those they had been getting from Schmitz, and which were most unsatisfactory. In the first place, they were made of iron, electro-brassed. Again, one essential feature was the regulating nipple. They had a great deal of trouble with this, as the button was put on in such a way that when the nipple became heated the button would turn independently of the spindle, and it thus ceased to be a regulator. They had the button riveted, so that it could not move. Further, the stuffing-box leaked and allowed an escape of gas. They altered this so as to make it gas-tight, and tested it up to a pressure of 14 inches. Again, it was essential that the actuating needle should be as nearly as possible in the centre of the nipple; otherwise it became choked, the gas was not completely consumed, and the burner blackened. They introduced a special device for keeping the needle central, and had the nipple made in one solid piece, instead of two pieces; and this was a great improvement. The nozzle in the Schmitz burner was not satisfactory, and they made an arrangement with an English firm to supply steatite nozzles which cost three times as much as the others did. All these improvements were embodied in the stock made by Messrs. Glover for the 1909

season. They took steps to obtain two patents in the names of themselves and Messrs. Glover—viz., No. 26,961 of 1908, for the improvement in the stuffing-box; and No. 11,826 of 1909, for the regulating device. The Company had also registered certain designs. Their first agreement with Schmitz terminated on July 15, 1909; and in December of the same year they came to terms with him, which involved his stopping the sale of these burners in England through anyone but the defendants. Under this agreement, they were bound to take a certain number of burners; but they had not taken any, and since December, 1909, they had not sold any foreign-made burners. In February, 1908, he and his partner brought an action against a Mr. Edgar to restrain him from passing off other burners as Bland burners. This was the action referred to in the advertisements.

Cross-examined: He first knew Schmitz in December, 1905, and from that time down to December, 1908, sold his goods in England. They were sold as Bland burners. Within six weeks of making the agreement with Schmitz in August, 1908, they were selling the Glover-made burners. The greater portion of the 15,000 Schmitz burners were sent abroad. He did not intend people to understand by the advertisements that any patents had been infringed. The Schmitz burners sold by plaintiff did not infringe any of his patents. When they failed to come to terms with Schmitz in July, 1909, he threatened in effect to ruin the business. He did not know the plaintiff until Schmitz mentioned him.

Tuesday, Nov. 22.

Mr. *Bland* was further cross-examined. He produced notes he had made from the books, showing that 13,000 Schmitz burners were delivered before November, and they were all of the particular type in question—"G.B. 4." The other 2000, under the contract to take 15,000, were of a different pattern. Of the 13,000, more than 4000 were sent abroad; but there were no entries in the books that would prove this. They were all sent out within a day or two of being received. This applied to those received from Mr. Schmitz and from Messrs. Glover; they were both sold as "Bland Burners." The 5000 purchased from Messrs. J. & W. B. Smith were taken to pieces and altered—new nipples and nozzles being affixed to them. They were all sold before February; a great many being sent to the East. They also purchased two gross of Schmitz burners from Messrs. Catterson. He had no recollection of telling Mr. Catterson that they were an infringement of the Bland burner; but he would not swear the word "infringement" was not used. They paid Catterson's the invoice price for them, imposing a condition that they should not import any more; and this they agreed to do in a letter of Sept. 22. On looking at the letter, he agreed that he must have used the word "infringement." These burners were sold as Bland burners after new nipples had been put to them. He inserted the advertisement in the "Journal of Gas Lighting" because he was anxious that the Schmitz burners should not be sold as Bland. After a good deal of hesitation, he admitted that he wanted to prevent them being sold at all in England. It was not correct to say that the Bland Syndicate had sought the assistance of the Courts; it was their predecessors, the Company. The Company had not any patents, so far as he could recollect. Witness was then cross-examined at some length on the circular-letter sent out by Messrs. Brombead. He admitted that he had no knowledge of the Bland burner being copied; but he said he feared it would be, as Schmitz knew of the improvements they had made. The burners imported by the plaintiff did not infringe either the Bland patents or the registered designs. In regard to the letter of Oct. 1 to Messrs. Gratrix Bros., the information came to him from their agents, the Davis Gas-Stove Company, by telephone; he did not think there was any letter. He understood from Mr. Squires that Mr. Brooks had told him he had been offered a burner similar to the Bland, or which could be sold as the Bland; but he did not say from whom the offer came. By referring to a German firm he meant Schmitz. He did not know plaintiff at that time. The burner Schmitz was selling in London was the same as they had been selling for some time as the Bland; but the Bland burner they were then selling was vastly superior. When he wrote "Whatever type of burner it is, it is not the Bland," he meant that it was not the Bland as altered for the 1909 season. He could not explain how a burner made in 1908 could be an imitation of one made the following year. The report made to him was that Mr. Brooks said the burner could be sold as the Bland burner, not that it was the same as they had previously sold as the Bland. He did not write the letter himself, though he took all responsibility for it, or probably he should have worded it differently. He did not think the word "pirated" necessarily referred to a patent; it meant passing off other burners as theirs.

Re-examined: He had an interview with Mr. Schmitz in July, 1909, and endeavoured then to negotiate for a continuance of their mutual arrangements. They really wanted to keep Schmitz off the English market; and the ultimate arrangement made had this effect. But they were not bound to take, and did not take, any more burners from him. He showed Mr. Schmitz the improvements they had introduced, and the patents. Cattersons were importers, in the same position as the plaintiff, and competitors of his. They did not keep burners long in stock, for there was such a good demand for them that they went out very soon after they came in. The first invoice from Messrs. Glover for the new burners was received on Sept. 4, 1908; and from then down to December they had 28,332 from them.

Mr. *Frederick John Gould*, the Manager to the defendant Syndicate, said he wrote the letter of Oct. 1 to Gratrix. He first knew of Mr. Cars being concerned in the gas-burner trade towards the end of 1909, subsequently to Oct. 1. When he used the words "a German firm," he did not refer to the plaintiff. He could not say whether he referred to Schmitz or to some other firm in Germany with whom he might be in communication. He wrote the letter in consequence of a telephonic communication from Mr. Squires. In December, 1909, on the instructions of Mr. Bland, he called on plaintiff, and offered to take off his hands any burners he might have made by Schmitz, and give him a profit of 25 per cent. Plaintiff declined the offer, and said he should make the burner himself if he could not get it from Schmitz. Referring to the offer of a profit of 25 per cent., he said it was not a question of hundreds to settle the affair. He made an appointment for the following day with Mr. Bland and another Director; but owing to Mr. Bland having to go out of town, the meeting did not take place. In December, 1909, he recollected being rung up by Mr. Tobey, who told him he had bought a burner which was very like the Bland; and he (witness) replied that he must not sell it as the Bland burner. There were a few bantering remarks made in good humour, and the conversation ended. The Horley Gas Company were, and had been for some time, good customers of the defendants. He did not say Mr. Tobey had better take care or he would be sued, or anything of the sort.

Cross-examined: He had known Mr. Cars for many years as connected with the sale of oil-lighting apparatus, but not as connected with gas-burners until the end of last year. He had nothing to do with the preparation of Messrs. Brombead's circular, but supplied a list of names to whom it should be sent, in which he included the plaintiff, because he was an importer. He was mistaken in saying he did not know that he was an importer of gas-burners until after October; he must have known it in September. He wrote the letter dated Oct. 1 in consequence of Mr. Squires' telephonic message, which came to Mr. Bland. He knew nothing about the burner referred to in the conversation between Mr. Brooks and Mr. Squires. He presumed it might be a cheap imitation, or a pirated burner. He had not seen the burner, and did not believe Mr. Squires had seen it either. The only reason for referring to a cheap imitation, or pirated burner, was that Mr. Bland (and he also) thought that Mr. Schmitz would take steps for putting a burner on the market after what had taken place; and when they heard of this burner in Manchester, they thought the war had commenced. He could not mention any other ground for thinking that the Manchester burner was an infringement of defendants' patents. He had not been told that it was a Schmitz burner. He never dreamed it could come from an English source. He did not suggest that Mr. Tobey invented the conversation he referred to, but that he misunderstood it. He had no reason for misrepresenting what had been said. The evidence of Mr. Tobey's assistant as to witness saying he would go into the box and deny saying something was not true.

Mr. *Alfred Squires* said he was in the employment of the Davis Gas-Stove Company at Manchester, and knew Mr. Brooks, of Messrs. Gratrix and Co. He recollected calling on him in October to ask for an order for Bland burners, as they had not had any very recently. Mr. Brooks said a German firm had offered him a burner which could be sold as a Bland; but he would not say what firm it was, and he (witness) did not see the burner. He went back and reported what he had heard to Mr. Francis, who immediately telephoned to London, either to Mr. Gould or Mr. Bland. He could find no trace of a letter having been written about it. On Mr. Francis's instructions, he called on Mr. Brooks again, when he said the matter was still under consideration; but he did not mention the name of the firm offering the burner. Witness referred to the Bland burner being well known all over the country through the advertisements which had been issued. Mr. Brooks admitted that it was well known as the Bland burner, but said, if he could get a similar article, why should he pay more for it? He told him he would make a big mistake if he supplied this German burner for a Bland; and that Mr. Brooks promised not to sell any other than the one they were offering. Nothing was said about patents.

In cross-examination, witness said he had sold many thousands of the Schmitz burners for defendants under the name of Bland. He understood that the burner which had been offered to Mr. Brooks was the same kind of burner in appearance as the Bland; he did not see it. He believed the dates of the two interviews were Oct. 4 and 6—a Saturday and Monday. He denied that he took up a burner from the table in Mr. Brooks's presence; that was before Mr. Brooks came into the office. There were four or five on the table; and when he picked up one, and the assistant said he must not touch it, he said it came from the firm that he represented, which he really thought it did. Mr. Brooks did not see him with the burner in his hand, and did not know he had touched it. There was no conversation at all with reference to any particular burner; and he had no idea that Mr. Brooks was referring to the burner on the table. No reference was made to Mr. Cars; and he did not know he was supplying any burners. He thought all the burners he saw were supplied by defendants. He denied the accuracy of Mr. Brooks's evidence as to the interviews. He did not use the word "infringement." He said if any burner was sold as the Bland burner defendants would take steps to protect themselves. He would swear he never used the word "patent;" he had no reason to. He could not suggest why Mr. Brooks should have written to plaintiff on Oct. 7 saying he had been told that this burner was an infringement of the Bland patent. When Mr. Brooks said he had been offered a burner exactly the same as the Bland burner, he said to him: "If they are sold as Bland burners, our people will take steps." Mr. Brooks never referred to the sample burners which were lying on the desk. He thought they were burners which had come from the Davis Gas-Stove Company, and told Mr. Francis so when he went back.

This concluded the defendants' evidence.

Mr. Clauson then addressed his Lordship on their behalf, submitting that no special damage had been proved, which was necessary in such a case, and that, even if his Lordship came to the conclusion that the plaintiff had made out any case at all, seeing that three items in the statement of claim had been abandoned, and only one of any substance established, the amount of damages could only be nominal, and that an injunction should not be granted.

Judgment.

Mr. Justice Warrington, in delivering judgment, first stated the facts, and then referred to the advertisement which the defendants issued in the "Journal of Gas Lighting" dated Aug. 10, 1909, and which his Lordship felt satisfied would lead anyone to understand that they had discovered an infringement of their patent, and that they had taken steps to stop it. His Lordship then referred to the letter issued by the defendants' Patent Agents, and addressed to, among others, Messrs. Gratrix and Co., who were customers of the plaintiff, which he was clearly of opinion contained a threat within the meaning of section 36 of the Patents Act, 1907, and therefore gave a right of action. He was further of opinion that the letter was intended, quite independently of any claim under the patents, to stop, if possible, the sale of the Schmitz burners in this country, and to prevent customers

of any importer of these burners from doing business with the importer. At that time, it appeared that the plaintiff was the only importer of these goods into England; and the letter therefore was a direct attempt to interfere with the plaintiff's trade in these burners. He was further of opinion that the letter was malicious, because it was issued with the desire to stop the sale of these goods, and, as Mr. Bland had himself admitted, the real object was partly to stop their sale altogether, as well as to stop their sale as the Bland burner. But there was not a suggestion in the letter of anybody attempting to sell them under that name, or that the real object of the letter was to stop such sale. He also thought it was malicious, for the reason that it contained statements for which there was not the slightest foundation, because the defendants had no reason to believe that their burners were being copied by any importer, and it was not the fact that two of their British patents, or three of their designs (about which he had heard nothing) were being copied. He found, as a fact, notwithstanding the denial by the representative of the defendants, that he (Mr. Squires) told Mr. Brooks (the representative of the firm of Messrs. Gratrix and Co.) that he must not sell the Schmitz burner, because it was an infringement of the Bland burner. Defendants then sent out another letter, dated Oct. 1, 1909, which he thought was written in pursuance of the same design, when they found they could not put an end to the sale of the Schmitz burner in this country; and he was satisfied, again notwithstanding Mr. Squires' denial, that Mr. Squires knew that the burner with reference to which the question arose was the one which he saw in Mr. Brooks' office, which was the Schmitz burner. He felt inclined to think also, notwithstanding the statements made by those who were responsible for the letter, that "German firm" in the letter meant a firm who, to use their own expression, were about to, or had, put the burner on the English market—namely, the plaintiff. This letter contained two false statements. It was the burner which had been known to the trade as the Bland burner; and it was not a cheap imitation of the Bland burner. It was cheap; but the Schmitz burner was not an imitation of the Bland burner. What could the reference in the letter to "a pirated burner" mean, except that it was one constructed and sold in violation of some rights of the defendants'? Otherwise, why should they refer to "the substantiation of their English patent rights?" He thought the letter amounted to a threat against those who sold the burner to which it referred; and he thought the statements made to Mr. Brooks, both by letter and by word of mouth, coupled with the threat, were calculated to produce uneasiness in his mind and fear of legal proceedings, which would prevent his dealing in these goods, with the result that the plaintiff did not deal in the goods, and so lost any profit he might have obtained if he had, without being improperly interfered with, obtained these goods and put them on the market. Another incident which confirmed him in his view was that in December the defendants, through their agents, told Mr. Tobey, then representing the Horley Gas Company, pretty much the same thing as they had told Mr. Brooks—namely, that he was not to sell the Schmitz burner, because it was an infringement of their patent rights. The defendants had asked him to believe that all they said was that Mr. Tobey must not deal with the Schmitz burner in any way as and for a Bland burner. But Mr. Tobey wrote, the day after his interview, that he had been given to understand by the Bland Light Syndicate that he was not under any circumstances to sell the Shell burners as recently purchased from the plaintiff, and, further, that action was being taken to prevent their being sold. This letter, coupled with Mr. Tobey's statement, proved conclusively the nature of the statement made to him on the 16th of December. The conclusion he came to was that defendants had persistently attempted, by means of malicious and untrue statements, to interfere with the plaintiff in his trade; and he thought the plaintiff was entitled to the injunction he asked for in the first part of the first paragraph of the prayer of the claim. He thought, too, the plaintiff had established his claim to restrain the defendants from continuing threats, founded on a statutory right of action under the Patents Act, but not in such wide terms as he asked for. He was quite satisfied that the plaintiff had proved that he had suffered substantial damage in his trade; and, as the plaintiff had asked him to assess the damage, he thought, in order to mark the opinion of the Court that it was not a merely nominal injury which the plaintiff had suffered, he would be doing justice by ordering the defendants to pay £50 damages, together with the costs of the action. With regard to the plaintiff's claim to an injunction against threats, he thought this should be limited to "any letters patent the defendants possessed in the months of September and October, 1909."

On the application of Mr. Clauson,

His Lordship directed that the costs, so far as they were increased by the statement of claim alleging cases of interference with plaintiff's trade (since abandoned), should be paid by the plaintiff, as a set-off.

Fixing Gas-Stoves on Consumers' Premises.

At the Wood Green County Court, on Monday last week, Dr. de Gebert, of Wood Green, brought an action against the Tottenham and Edmonton Gas Company to recover £7 10s. for damage alleged to have been done at a house at Bounds Green Road, Wood Green. Mr. A. S. Hurst was Counsel for the plaintiff; Mr. Windsor appeared for the Company. Mr. Hurst stated that, when the plaintiff's tenant left his house, he discovered that a gas-stove had been fixed by defendants on the landing; and, as a result, the wall-paper and ceiling were damaged. Plaintiff admitted, in correspondence, having given his consent for the meter and pipes to be fixed, but not the stove itself. The defendants had submitted that the tenant was responsible. In answer to the Judge, Mr. Windsor said he disputed all liability. For the sake of peace, the Company made an offer in respect of carrying out the repairs; but at no time had they admitted responsibility. They had to place the fixtures according to instructions. His Honour remarked that if the tenant wanted something placed right in the middle of his drawing-room the Company would be supposed to put it there. Mr. Windsor said that was so. His Honour held that the plaintiff had no case. He said it was the duty of the Company to carry out instructions. There was no evidence that the alleged damage had been done by them in fixing the stove. He would nonsuit the plaintiff, but would give leave to appeal, because the question was an important one to users of gas.

CLAIM IN RESPECT OF PROFESSIONAL SERVICES.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, Nov. 24.

(*Before Mr. Justice* Pickford.)

Painter v. Petersfield and Selsey Gas Company, Limited.

This was a claim for the balance of an account for professional services; and it was originally set down in the Common Jury list. By consent, however, the Jury was dispensed with.

Mr. Ralph Bankes, K.C., and Mr. Gerald Hill (instructed by Messrs. Crawley and Co.), appeared for the plaintiff; Mr. Scott Fox, K.C., and Mr. Spokes (instructed by Mr. R. S. Barnes) represented the defendants.

Mr. Hill, in opening the case, said the plaintiff was a gas engineer; and he claimed a balance of account for professional services, out-of-pocket expenses, and commission, amounting to £104 7s., beginning in the year 1906, and going down to 1909. The defence was a general traverse; and there was a counter-claim for damages arising from alleged neglect on the part of the plaintiff to properly supervise the various works on which the commission was charged—in particular, with regard to the erection of six retorts at Petersfield in 1906, and two at Selsey in 1908—and also as to the improper construction of a setting of six retorts at Selsey. The plaintiff was Engineer at the Selsey Gas-Works in 1901, in which year they were taken over by the present Company, which was then incorporated, and obtained a Private Act; and by a minute of Oct. 9, 1901, he was appointed Engineer to the Company. There was no definite arrangement made with him for his remuneration; but from the outset he continued to send in his account on the same basis as he had rendered it to the Selsey Company—viz., 1½ guineas for each day he visited the works, out-of-pocket expenses in travelling and for postages, &c., and 2½ per cent. commission on the sums expended in laying new mains, or constructing new plant under his supervision. This he did down to the end of 1908, and no objection was ever raised to it. The last time he visited the works was at the end of December, 1908. Early next year he was taken ill; and in April Mr. T. E. Pye, of Chichester, was appointed to act temporarily in the supervision of new works, on the terms of 2 guineas per visit, inclusive of expenses, and 5 per cent. commission on the expenditure. The plaintiff, however, still continued to receive at his office in London weekly statements from the local managers, and special reports from time to time; and for this clerical work, which had formerly been covered by his commission, he charged 12 guineas. Counsel read various letters which had passed dealing with imperfections in the works, and submitted that the plaintiff was not responsible for them; he being simply the Consulting Engineer, not a Resident Engineer, and that the local managers were the parties really answerable.

Friday, Nov. 25.

On the resumption of the proceedings this morning,

Mr. Scott Fox stated that the question of the Petersfield works would not be insisted upon.

Mr. *Alex. F. Painter*, the plaintiff, was called and gave evidence in support of Counsel's opening statement. Cross-examined in great detail on the alleged defects in the working of the plant, he admitted that if the foundations of a retort-setting were defective, the setting might drop, throw the flues out of place, and cause irregular heating, but not that these things had occurred. It was quite true that defective retorts or furnaces would cause excessive expenditure for fuel and a deficiency in coke. But defective stoking would produce the same results; and he had nothing to do with that. If his attention had been called to a deficiency in the coke, he should have inquired into the cause of it; but he looked principally at the make of gas, and this was satisfactory. In May, 1906, he agreed to a small deduction from his account, and the same in 1908. He claimed his commission on the aggregate of the invoices, which all passed through his hands. In one year he took it from the figure in the balance-sheet, which he assumed, from his previous experience, did not include labour; but he could not be sure. In 1909, he did no supervision, and had not charged anything; but he continued receiving reports down to October, and prepared estimates, for which he charged 12 guineas.

In re-examination, witness put in a list of the work done in 1909, and a bundle of documents connected with it. He said it would be absurd for an engineer to go down from London to supervise a £17 job. There were thirteen retorts in all at Selsey—settings of six, two, and five. Whenever he was there, some of them were at work—enough to produce the gas required; but he could not remember which particular ones.

Mr. *A. A. Hardy*, of Messrs. Bale and Hardy, spoke to the erection of the setting of two retorts at Selsey, and also the setting of six in 1906. In that case there was a concrete bed, which appeared perfectly satisfactory. The work was finished in August. The life of such a setting would depend on how it was worked. If it were worked by day and banked-up at night, the life would be about 600 days. No complaint was made until about three years after the settings were put up. They were pulled down; and he went and inspected the foundation. There was no defect in it, and no cracks appeared in the side walls. A make of from 9000 to 10,000 cubic feet of gas per ton of coal showed that the retorts worked satisfactorily. He had been asked more than once by Mr. Pye to estimate for other works.

In cross-examination, witness admitted that in the first setting of two retorts at Selsey there were a few bad bricks which had to be replaced; and his firm paid the cost. He was not responsible for the foundation for the setting of six at Selsey. He did not examine it until it was pulled down in 1909; in one place there was a little loose rubble. There were more than two pieces of retort about 4 feet long lying in the yard; showing that they had not been used up.

Re-examined: The setting at Selsey produced more gas than was required for the consumption, and consequently on any one day one or more retorts would be out of action. But the furnace would have to

be kept going; and, of course, the percentage of coke required for fuel would be increased.

Mr. *H. A. Hardy*, brother of the last witness, said he put in the setting at Petersfield and the setting of two retorts at Selsey; and they were properly constructed.

Mr. *Tarrance*, a retort-setter in the employ of Messrs. Bale and Hardy, said he put up the setting of six at Selsey. The concrete foundation was already in; he had to cut it out for the ash-pit, and found it very hard. Mr. Jarvis was the Manager at the works, and saw the progress of it. He did not make any complaint.

Mr. *Webb*, Manager of the Sunbury Gas-Works, and formerly for thirty years with the Staines and Egham Gas Company, said the life of a retort-setting depended on how it was worked. For small works, he should say two years was a good life. Anything over this would be above the average. The consumption of fuel also depended upon the mode of working. In such works as those of Selsey, he should say 4 cwt. of coke for sale per ton of coal carbonized was a good return. The make of gas per ton was very satisfactory.

Cross-examined: If the two bottom retorts were cool and the top ones overheated, he did not agree that it would necessarily cause waste of fuel, as a good deal depended on the stoking.

Mr. *A. E. Broadberry*, Engineer and Manager of the Tottenham and Edmonton Gas Company, said the yield of coke per ton of coal carbonized would be 8 cwt. as a maximum in large works. In such works as those at Selsey, if regularly run night and day, it would be about 6 cwt.; but if worked intermittently, about 4 cwt.

Cross-examined: He agreed with the last witness that it would take practically as much fuel if only four retorts were in use as if the whole six were at work. He was a Director of the St. Margaret's Gas Company, who had small works. A director of such a company would know if two retorts were permanently out of use, because it would be reported to him by the works manager. Otherwise, he might not know it; one could not tell by a mere inspection.

Re-examined: Retorts might be bricked-up to save fuel if they were not required. The make of gas per ton of coal was the best test of good working.

This concluded the plaintiff's case.

Mr. *P. J. Jarvis*, formerly Manager of the Petersfield Gas-Works, said he was in charge of the Selsey works in 1906, when the setting of six was erected. The concrete foundation was, in his opinion, defective; and he spoke about it to the foreman, who said he had his instructions from Mr. Painter. When the setting was finished and had been dried, it was put to work. He found that the two bottom retorts did not heat properly; and after trying about ten weeks, he bricked-up the two bottom ones. He saw the plaintiff on the works in September; but he did not see the retorts. He told him in March, 1907, that they were not working satisfactorily; and he said they must do the best they could with them. About December he discontinued the use of this setting, as they had had the old setting of five relined and found that it worked better. The setting of six was used again from about August to November, 1907 (the two bottom retorts being still bricked-up), while the bed of five was taken out. In November, 1907, he went to Petersfield.

Cross-examined: He did not report to either the Company or Mr. Painter that the foundation was defective. He made weekly reports to the plaintiff. The average make all the time he was at Selsey was from 9000 to 10,000 cubic feet. He did not write many letters to Mr. Painter because he could not get any answer. Mr. Painter only spent about two minutes at the works when he came down; he used to stay at the Selsey Hotel. He was not at the works all day himself. The most Mr. Painter did was just to put his head in at the door, and go away again. He could not say whether or not that was swindling the Company.

Cross-examined: He only saw the plaintiff at Selsey four or six times, and never at Petersfield, except at the general meeting—never on the works. At Selsey he had to go several times to the hotel to see the plaintiff, who said it was not necessary for him to come to the works.

Mr. *Richard Radford*, the Manager at Selsey since November, 1907, when Mr. Jarvis went to Petersfield, said there were then in work four retorts out of the bed of six, and the repairing of the bed of five was just finished. He took the bricks out of the two bottom retorts, and tried about three days and nights to heat them, but he could not get more than a dull, red heat. The two top ones heated very well. He then bricked-up the two bottom ones again. In February, 1909, one of the top retorts split and dropped, and he had to partially brick it up. In March or April, 1908, the plaintiff came to the works on a Sunday morning, and witness pointed out to him the difficulty with the two bottom retorts, but plaintiff did not say what should be done. He thought this was the only time he saw plaintiff at the works. The bench of two retorts was dismantled when he went to the works. From Christmas, 1907, to August, 1908, he was working the bed of five. He got the bed of six ready for August, and used it up to February, 1909. Between August and Christmas there were very good heats on the top, which made up for the ordinary heats on the middle retorts, and produced a good make of gas. When they were taken down in April, 1909, the foundation of the bench was found to be only beach shingle and lime.

Cross-examined: He was not now at the works at Selsey, but in the office. They charged the retorts twice a day in the winter months, and three or four times a day in the summer, when there was more demand for gas owing to the visitors. He complained several times to the plaintiff about the quality of the coal used. When the coal was good, and they were working well, he could get 10,000 cubic feet of gas per ton. Anything he had to complain about would be found in his letters or reports. He spoke to the plaintiff several times when he saw him in Selsey looking after the mains and other matters.

Mr. *T. E. Pye*, Engineer and Manager of the Chichester Gas Company, said he was called in in April, 1909, to inspect the Selsey Gas-Works. The bed of six retorts was not then in use. A fortnight afterwards he found the setting had been taken down; and the conclusion he came to, judging as well as he could from what he saw, was that there had been intense heat currents passing over the top of the back wall, indicating a space between it and the arch, where there had been short-circuiting, which would cause the two bottom retorts to lose their heat. He thought the foundation might have been made with some sort of inferior lime; but the appearance was simply that of loose rubble. There might have been lime, which deteriorated under the influence of heat. In his opinion, the amount of coke for sale per ton of coal should be about 6 cwt. in works of the character of those at Selsey. He should think that having a much smaller quantity returned ought to have led the plaintiff to make inquiry. The life of a setting should be from 900 to 1000 working days. A new bench of six retorts had been put in recently; and the average return of coke per ton of coal for sale was 5·8 cwt. He did not know what the figure was before the setting in question was put in.

Saturday, Nov. 26.

Mr. *Pye* was further examined this morning. He said a mixture of shingle and blue lias lime was not suitable for the foundation of a retort-setting. It might set very hard at first, but under the influence of heat it would disintegrate. Portland cement ought to be used in such a situation. In his opinion, a visiting engineer if he did his duty, ought to have ascertained how the retorts were working. He had made the calculations on which the counter-claim was founded, and he handed in the figures.

In cross-examination, witness stated that when he was in charge of the Selsey works, in November, 1909, the amount of coke available for sale was a great deal less than 6 cwt. per ton. There was generally a slight shrinkage in a retort-setting after it had been at work some time, and this would make the wall part from the arch. He was not a practical retort-setter, but he had had experience of building such settings. The cost of rebuilding the setting (£85) was taken from the figures supplied to him. He made out from information his report on the setting; and the report stated that the Contractors had pulled out a good concrete foundation, and replaced it with rubble. He had only recently found that this was a mistake; in fact, he did not know now. The suggestion was that it was a time contract, and this made the job last longer. His information was that it was an old foundation which was removed. He knew now that it was not a time contract. He admitted that he had heard that Mr. Williams had been to see the setting, and said the dropping of the retorts was not due to a bad foundation. There was a suggestion of an action for damages against Messrs. Bale and Hardy, the Contractors; but he thought it unwise to proceed with it. He did not know how it was that the allegation of negligence in connection with the six retorts was not included in the particulars given in April, and was not made until October.

In re-examination, witness said the figures of one particular week were no test of the percentage of coke. When a bench was first put in work, there might be no surplus coke at all.

Mr. *Owen Walker*, Secretary to the defendant Company since 1905, said the plaintiff for some time occupied a seat in the Company's office. Afterwards he had his own office, but was still looked upon as the Superintendent Engineer, and visited the works when he thought proper, and gave instructions. For 1908 the plaintiff claimed commission on £780, the amount appearing in the balance-sheet for new works; but this included labour. The total amount for materials, including several items not ordered by plaintiff, but by witness himself, was £397 6s. 4d. He could only account for the claim with regard to the retort-setting at Selsey not appearing in the first particulars, by the Solicitor in some way confusing the Selsey works with those at Petersfield; but he could not be sure about this.

Mr. *A. W. Elton*, Engineer and Manager of the Littlehampton Gas Company, said he visited the Selsey Gas-Works on the 5th of November with Mr. Pye. He saw and examined some pieces of broken retorts. They did not appear to have had much heat applied. One piece was about 4 feet long; and it did not seem to have been much worked. In such a situation as Selsey, his experience was that 3 or 4 feet thickness of good cement concrete was necessary as the foundation for a retort-house. Blue lias lime and shingle were quite unsuitable; the best material was old broken retorts and portland cement. In his opinion, the Engineer ought to see that the foundations were all right. If he could not be present himself, it was usual to appoint a clerk of works. He thought the defects in the retort-bench would be accounted for by a sinking of the foundation. This would lead to an opening between the wall and the arch, short-circuiting, and a failure to heat some of the retorts. An engineer who understood his business would easily find out the cause of the defect; and when it was found, it could be remedied without much trouble or expense.

Mr. Scott Fox, on behalf of the defendants, said the only point in the plaintiff's claim now in dispute was the amount of commission on the new work in 1908—whether his Lordship thought the fee of 12 guineas for what he did in that year was a fair one. It seemed to him that the commission could only be charged on £397; and this would reduce the claim to £95. Then there remained the counter-claim, on which he submitted that the plaintiff had the responsibility for all the works executed for the Company, and that the damage occasioned to them by his neglect was, on the figures before his Lordship, £100—viz., £55 for loss on the sale of coke, and £45 the cost of remedying defects.

Mr. Bankes, in reply, pointed out that the plaintiff's claim was now admitted, within a very small amount, to be correct, and that the counter-claim was never set up until after the plaintiff had repeatedly asked for payment, and had been obliged to bring an action. Up to then, no complaint had ever been made of plaintiff's conduct; and the orginal complaint with regard to Petersfield had been abandoned when the parties came into Court. He submitted that the case with regard to the coke had entirely broken down.

Justice Pickford, in giving judgment, said, the claim being now admitted at £95, he need say nothing on this point. The case really depended upon the counterclaim for negligence. It was started with regard to three charges. But the Petersfield case had not been prepared; and though he had heard something about the two retorts at Selsey, in his opinion no case on this had been made out. It only remained to deal with the bench of six retorts at Selsey, which it was said had been put on a bad foundation, in consequence of the negligence of the plaintiff. Through this bad foundation, there was a

settlement and a short-circuiting of the heat, so that two retorts could not be used, and considerable loss thereby accrued to the defendants. Curiously enough, this claim was not put forward in the original particulars—in fact, not until about a month ago—although the pleadings were closed in April. It also seemed to be the fact that Mr. Painter had on several occasions written asking for payment; and no case of negligence was then set up. With regard to the foundations, he could not accept Mr. Jarvis's evidence that he considered them to be as bad as he had said, or he would have made some communication either to the plaintiff or to the Company. When Mr. Pye went to see the place, he was given an account of the way in which the foundations were put in which was absolutely incorrect—viz., that the Contractors, in order to make a longer job of it, had taken out a concrete foundation, and put in one of lime and rubble. But, at any rate, from some cause, the two bottom retorts did not act properly; and had to be bricked up; and the question was whether the plaintiff ought to have found out the badness of the foundation, and the fact that the two retorts were not acting. It seemed clear that he did not go, and was probably not expected to go, to the works very often; but he relied, and the Company knew that he was relying, on the reports he had from the managers, whom he presumed to be competent. It seemed clear that Jarvis never reported anything wrong, because the only letters from him were to the effect that things were going on well. Unless the plaintiff's attention was called to something, there was no negligence in not finding anything wrong in Jarvis's time. Radford, who was a much more satisfactory witness, sent up proper reports weekly, and he found these retorts referred to only two or three times, and then the reference was to some slight defects which were being attended to. Then it was said that all through this time the yield of coke had fallen so much that the plaintiff ought to have known that there was something wrong going on. But the evidence on this point was not very satisfactory. There was no evidence that when these retorts were being used the yield fell compared with what it had been previously; and he could not help thinking that if there had been any striking difference in this matter, it would have been noticed by the Directors, who looked after the commercial affairs of the Company. Further than this, there were complaints from time to time of the quality of the coal, which would affect the yield of coke. On the whole, he came to the conclusion that the charge of negligence had not been made out. There would be judgment for the plaintiff on the counter-claim, as well as on the claim for £95, and costs would follow the event.

Islington Public Lighting.—The Borough Engineer of Islington, replying to a question, at the last meeting of the Borough Council, stated that the amount spent in the borough per annum for public lighting, including the cost of maintenance, is £28,337. About 100 miles of streets are lighted by gas, at a cost of £13,112; and 24 miles of streets are lighted by electricity, at a cost of £15,225.

AFFAIRS OF MR. E. O. PRESTON.

Unsecured Liabilities between £25,000 and £40,000.

At the London Bankruptcy Court last Friday, a sitting was appointed to be held, before Mr. Registrar Brougham, for the public examination of Mr. Edward Oxenford Preston, described as a financier, of No. 4, Tokenhouse Buildings, E.C., and West Lodge, Cookham, carrying on business as E. O. Preston and Co. The debtor had been in business for 27 years, and had been principally engaged in financing and floating gas, water, and other companies. At the date of the failure, he was interested in a contract with the Bungay, Eye, and Harleston Water Company, of Bungay; and another contract with the South Lincolnshire Water Company, of Spalding. The statement of affairs had not been completed; but the debtor had returned his unsecured liabilities at between £25,000 and £40,000, against assets consisting of landed and house property, and various shares and debentures in gas and water companies. The immediate cause of failure was attributed by the debtor to loss arising from loans to the amount of £16,000, which he advanced, without security, to certain gas and water companies, with a view to the forwarding and protection of his clients' interests. The debtor had further stated that he was also interested in the promotion of several electric theatres, from which he had received substantial profits.

The Assistant-Receiver (Mr. Walter Boyle) applied for an adjournment of the examination, on the ground that the debtor had not filed a statement of his affairs. It was promised within a few days; and it was intimated that the case would occupy some considerable time. Under these circumstances, he suggested an adjournment over the Christmas Vacation; and the 13th of January was fixed for the hearing.

Liquidation of the Mid-Oxfordshire Gas Company.

In the Chancery Division of the High Court of Justice last Friday, Mr. Justice Neville had before him a motion, in the action of *Burroughs v. Mid-Oxfordshire Gaslight and Coke Company*, for the appointment of Mr. Thornton as Receiver, on behalf of the holders of the £21,000 of debenture stock. Mr. Bovill said there had been an order to wind-up the Company, and he understood that the Liquidator did not intend to appear, nor did the other defendant, who was the surviving Trustee of the deed. There had been three special issues of debentures, in respect of which actions had been commenced and Receivers appointed. But he wanted someone to protect the interests of his clients, and to intervene when the inquiries directed in the other three actions had been taken; and he was asking for the appointment of the Liquidator. After a short discussion, his Lordship made the appointment as asked, without prejudice to the rights of the Receivers appointed in the other actions.

MISCELLANEOUS NEWS.

GAS CHARGES IN SALFORD.

The Case of the Prepayment-Meter Users.

The Salford Town Council spent several hours at a special meeting last Wednesday discussing the question of the quantity of gas for 1d. to be allowed to users of prepayment meters. It may be remembered that at the June meeting of the Council a series of recommendations from the Gas Committee were approved, including the re-imposition, after a lapse of sixteen years, of meter-rent charges, a reduction from 30 to 27 cubic feet in the quantity of gas supplied for 1d. through automatic meters, and a concession in price to large consumers. At the October meeting, the meter-rent charges were abolished; and it was now proposed to rescind the two clauses relating to automatic meter supplies and the concessions to large consumers. A heated discussion took place on the matter; and in the end a resolution was adopted, by 21 votes to 19, adjourning the debate for a week—the Gas Committee meanwhile to prepare a full report for consideration by members.

Mr. PURCELL, who spoke in favour of the restoration to the old condition of 30 cubic feet of gas being supplied to slot-meter users, pointed out that during the last fifteen years the Gas Committee had handed over out of profits a sum of £400,000 in relief of the rates; and he argued that this was a policy which benefited the rich at the expense of the poor. The Council should not forget, he added, that the slot-meter consumers paid for the gas before they had it; and in this way were a lucrative source of profit to the Corporation. Incidentally, he mentioned that during the past five years the total sum lost from the automatic meters by robbery was £423—an average of £84 12s. per annum; while the amount lost by renewals, bankruptcies, &c., in the same period in ordinary meters was £2240, an average of £448 per annum. Putting it in a nutshell, this meant that the Corporation lost five times more a year by the ordinary meter users than by the penny-in-the-slot consumers. Consequently, it was his contention that the latter were a good investment, and entitled to consideration. They were not justified, in his opinion, in using the people who wanted gas for lighting their houses to relieve the burdens of large consumers.

Mr. BURNLEY (the Deputy-Chairman of the Gas Committee) reminded the Council that the resolution involved the question as to how the work of the Committee had to be carried on; and he said it should not be forgotten that the department ought to be worked so as to secure a reasonable return on the capital expended.

Alderman Sir W. STEPHENS said that, according to a report of the Gas Committee, the slot-meter users had an advantage over him of ½d. per 1000 cubic feet now; and if they reverted to the 30 cubic feet for 1d., as was proposed, they would gain 3⅝d. more over him. Then if they went farther, and put up the price of gas 1d., the slot-meter users would have an advantage over him of 5⅛d. per 1000 cubic feet.

Alderman JACKSON reminded the Council that the day was not far distant when corporations would be told that they must stay their hand from making large profits from municipal undertakings. If money was wanted, it would have to be obtained out of the rates, and not out of profits made by the gas or any other municipal undertaking.

The Case for the Gas Committee.

In a report drawn up by the Gas Committee, it is pointed out that when purchasing the supply of coal for the twelve months ending May, 1911, they found they were obliged to pay £7209 more than in the preceding year. In consequence of this increased outlay on coal and other abnormal expenditure on depreciation account, the Committee, in framing their estimates for the year ending May next, were not able to promise the Finance Committee a larger contribution than £6000. The Special Committee appointed by the Council to deal with the estimates of the different departments considered this sum an inadequate return to the Salford ratepayers upon the large capital of £962,616 employed in the gas-works, and they therefore required the Gas Committee to contribute £15,750, which represents 1·63 per cent. on this capital.

The Gas Committee gave the matter careful consideration; and, believing it was undesirable to raise the price of gas, they decided to reconsider the scale of charges for gas generally. They arrived at the conclusion that, as increased revenue had to be raised, the fairest way was to impose rents for ordinary meters the property of the Corporation, to reduce the quantity of gas supplied for 1d. to consumers by prepayment meters, and to make certain reductions to consumers of large quantities of gas. The effect was as follows: Meter-rents for nine months, £6549; increase in prepayment meter rental for nine months (less £450, the cost of changing wheels), £2330—making a total of £8879. Allowing for the reductions to consumers of large quantities for nine months, £2553, there was left a net total of £6326. Adding this to the £6000 previously mentioned, the profit would be £12,326 towards the £15,750 asked for by the Special Committee. It was hoped to raise the balance of £3424 by additional business and the increased value of residuals.

In the event of a resolution being adopted by the Council to revert to the 30 cubic feet of gas allowed for 1d. to slot-meter users, the Committee point out that the cost of altering the meters will amount to £450, and that part of the £2330 proposed to be raised from this class of consumer would therefore be lost. It is also set out that, though the slot-meter user at the present time pays 10·04d. per 1000 cubic feet more than the consumer by ordinary meter, he is supplied with apparatus for service costing 10·60d. per 1000 cubic feet more than an ordinary consumer. The consumers by prepayment meter thus get an advantage of 0·56d. per 1000 cubic feet over consumers by ordinary meter. By whatever sum per 1000 cubic feet the price of gas may be increased to the ordinary consumers, to make up the loss incurred by

the abolition of meter-rents, the slot-meter user will be to this extent better off per 1000 cubic feet, even under the present arrangement of 27 cubic feet for 1d.

The Gas Committee add that if Mr. Johnson's motion is adopted, the advantage to the slot-meter user will be greater to the extent of 3·71d. per 1000 cubic feet—being the difference in the price if 30 instead of 27 cubic feet are supplied for 1d. Therefore, assuming (say) an advance of 1d. per 1000 cubic feet to ordinary consumers to make up the loss from the abolition of the meter-rents, the 0·56d. becomes 1·56d. per 1000 cubic feet. If, in addition thereto, by the adoption of Mr. Johnson's motion, the 3·71d. is added, it makes a total difference of 5·27d. in favour of the slot-meter user. The consumption through prepayment meters is 224,719,000 cubic feet. These figures, multiplied by 5·27d. work out to £4934 per annum in favour of the slot-meter users; and this the ordinary consumers would have to make up in an increased price. As the total net profit realized per 1000 cubic feet of gas sold during the past year amounted to 3·09d., the consumers by prepayment meter (not only within but also outside the borough) would be supplied with gas at a dead-loss of 2·18d. per 1000 cubic feet, which obviously must be paid by the ordinary consumers.

An analysis of the prepayment meter users by rental of houses occupied by them shows that of the total number in the borough 1289 persons live in houses rented at less than 4s. a week; 4989 in houses at 4s. and under 5s.; 9219 under 6s.; 3972 under 7s.; 2098 under 8s.; 921 under 9s.; 313 under 10s.; and 223 are rented at 10s. and upwards—a total of 23,024. In the out-districts, the total number of slot-meter users is 5938.

The Gas Committee also state that of the sum of £2553 reduction to large consumers, the Lighting Committee, the Education Committee of the Salford Corporation, and the Salford Poor-Law Guardians would obtain £1670 during the current financial year. If the prices revert to those formerly in force, these public authorities will have to pay the increased charges, and levy supplementary estimates to meet them.

GAS FOR ILLUMINATING AND HEATING PURPOSES.

Testimony to its Economy.

The "Manchester Courier" for Monday last week contained a three-column unsigned article on "The Economy of Gas for Illuminating and Heating Purposes." If the readers took the trouble to peruse it carefully, they would have learnt more about this subject than they ever knew before, and would probably have put down the paper with far different views from those previously held on the value of coal gas. The article is so good a statement of the case for gas, that an indication of its scope may be of interest.

The writer begins by pointing out that the history of modern gas supply may be said to date from about 1895, when it began to be realized that Welsbach's revolutionary discovery, the incandescent mantle, had come to stay. In order that the reader may understand the profound change that came over the practice of gas manufacture at that time, the writer briefly indicates the position of affairs prior to the introduction of the mantle, and shows how the illuminating property of gas, which was so valuable when it was used with the old types of burner, had to give place to its heating property. This has led to the gradual abandonment of the 16 to 20 candle gas of a past time, and the adoption instead of a 14-candle lighting standard, in conjunction with a calorific one of 446·5 B.Th.U. per cubic foot. He lays stress upon the point that it is units of heat that are wanted for lighting, for gas-cookers, for gas-fires, and for gas-engines; and he cites the case of the Gaslight and Coke Company as the first parliamentary recognition of the fact. He says it has been estimated that 90 per cent. of the town's gas now employed is required for heat, inclusive of the quantity used in incandescent gas lighting. Therefore it is beginning to be realized that there is now no longer any need to so order methods of manufacture as to produce a gas with a high illuminating power in itself.

The writer next deals with the lighting bill, and points out that the price of gas depends almost entirely upon two questions—the market for coal and the market for residual products. This being so, he says one must limit consideration of the position of the gas industry to the conditions of the moment. For this purpose, he takes the more or less arbitrary figure of 2s. 6d. per 1000 cubic feet, which happens to be 3d. more than is charged in Manchester. But 2s. 6d. may, he thinks, be accepted as a fairly general figure. With every desire in the world to avoid odious comparisons, he feels constrained to enter into one. There are competing lights in the field. Therefore it is essential that a clear idea should be had as to what these lights can offer. The only essential is that the comparison should be fair and unprejudiced. He then shows that gas, with an incandescent mantle, can be made to yield 60 candles per cubic foot, as in the high-pressure lighting round the old Infirmary. This is the best that gas can do at the present time; but he considers it would not be fair to take it as the standard of comparison. It requires special plant, and the units are far too big for ordinary domestic use, which is what he and his readers were mostly concerned with. Therefore he takes the ordinary inverted mantle burner, and gives it a value of 20 candles per cubic foot of gas burnt. There are claims as high as 30 and 35 candles per cubic foot; but, to be on safe ground, the lower figure is taken. He says it is a figure that can be maintained against all objections.

Passing on to the subject of mantles, the writer gives a few words of warning, and emphasizes the importance of avoiding the cheap articles which are offered for sale, inasmuch as a good mantle cannot be made at the prices charged—1½d. or 2d. With regard to burners, he says the Welsbach "C" still stands as the type of the upright class, and remarks that it has been improved upon possibly only by the Welsbach-Kern. But he adds that inverted burners have become the fashion; and he says that, unlike many fashions, their adaptability and efficiency justify their popularity. There are many excellent burners of

the inverted type available, and also many inferior ones. A good burner is worth the few extra pence paid for it. It lasts longer, and it gives satisfaction during its life. As types of inverted burners, the Nico, the Bray, and the Bland are mentioned as embracing the essentials of a good burner of this kind—viz., easy and accurate adjustment of the gas and air supply, protection of the fittings from heat, and adaptability to existing fittings.

The writer next makes an interesting comparison of the cost of gas and electricity in Manchester. We give this portion of the article in full.

It has been assumed that our burner gives an efficiency of 20 candles per cubic foot of gas consumed per hour. Hence, for (say) ten burners, each consuming 3 cubic feet of gas per hour, and burning for 2500 hours in the year, our lighting bill works out thus: 3 × 10 × 2500 = 75,000 cubic feet of gas, which at 2s. 6d. per 1000 = £9 7s. 6d.; candle power, 30 × 20 = 600 candles. Against this one must put the best electric incandescent lamp—viz., the new metallic filament lamp. It will not be seriously disputed that the best the metallic filament lamp can do is a candle per 1½ watts of energy. Hence we get this little bill: 600 candles × 1½ watts = 900 watts; 900 watts × 2500 hours = 2250 Board of Trade units; and £9 7s. 6d. divided by 2250 = 1d. per unit. In Manchester the charge is 3⅞d. per unit! Hence, with Manchester prices for gas and electricity respectively—viz., 2s. 3d. per 1000 for gas and 3⅞d. per unit for electricity—the corresponding bills would be: Gas, £8 8s. 9d.; electricity, £35 3s. 1d. In this calculation, no account has been taken of renewals of gas-burners and mantles, or of electric lamps. But these cannot be ignored. The liberal assumption will be made that each mantle has to be renewed three times in the year, and that three new gas-burners are needed every year. Then: 30 mantles at 4½d. = 11s. 3d.; and 3 burners at 3s. = 9s.—total, 20s. 3d. The electric lamps will probably require renewal also three times a year. But, to be liberal once more, allowance will be made for only two renewals. Metallic filament lamps may be had of various candle powers. It will be assumed that 60-candle power lamps are used, and therefore that the same number will be required as of gas-burners. Then: 10 × 2 = 20, at (say) 4s. = £4. The total yearly bills therefore become—

	£	s.	d.
Gas	£8	8	9
Renewals	1	0	3
Total	£9	9	0
Electricity	£35	3	1
Renewals	4	0	0
Total	£39	3	1

In other words, electric lighting in Manchester is at least four times the cost of gas lighting. These are not fancy prices on either side. They are readily susceptible of proof.

After some remarks on the modern incandescent burner arranged for lighting from a distance, the writer passes on to the subject of street lighting, and cites figures for some Lancashire towns five years ago and now, to dispel the illusion that gas has been losing ground so far as public lighting is concerned. He then refers to what has occurred within the last few years in the cities of London and Westminster, and gives figures to show that in the latter case the prices in the competitive tenders lately submitted were throughout vastly in favour of gas. They ranged from 21 to 44 per cent. He adds: "This was what was expected by every gas lighting engineer; but perhaps it is the first time that the truth as to relative costs has been impressed so forcibly on the public mind." Before leaving the subject of street lighting, the writer offers a few remarks on the automatic control of lamps, to controvert the statement that electricity would have a great advantage over gas in the matter of lighting and extinguishing.

The next subjects taken up are the use of gas for cooking and heating; but its economy for the former purpose is now, the writer says, so generally recognized that little need be said on the point. Five years ago, there were about 1,800,000 gas-cookers in use; now there are at least 2,600,000. The late Mr. Thomas Fletcher is freely quoted on this subject, and also on the allied one of the use of gas for heating purposes. To show the economical position of the gas-fire, the writer gives an extract from the Glasgow report, published in the first number of the "JOURNAL" for the present year, from which he says it must be accepted that, for the continuous heating of rooms, gas at 2s. per 1000 cubic feet is *per se* more expensive than coal at 10½d. per cwt.; but where the gas-fire proves its superiority is in intermittent heating in drawing-rooms, bed-rooms, and apartments only occasionally used. The writer concludes his article with a quotation from the late Sir B. W. Richardson to show the necessity for maintaining an equable temperature in a bed-room; and points to the gas-fire as a specially valuable means of attaining this end. In testimony of this, he mentions the fact that hundreds of medical specialists now regularly recommend gas-fires to their patients.

LEIGH-ON-SEA GAS-WORKS EXTENSIONS.

Local Government Board Inquiry.

Last Tuesday, Mr. F. H. TULLOCH, one of the Inspectors of the Local Government Board, held an inquiry into an application by the Leigh-on-Sea Urban District Council for power to borrow £6919 for the purposes of their gas-works. It was dealt with in two parts.

The CLERK (Mr. W. Carlyle Croasdell) explained that £2442 of the amount applied for had been spent on works carried out, and it had been met by an overdraft on the Treasurer.

Mr. N. ARNOLD (a member of the Council) opposed the application. He said the gas-works were purchased for £10,064 some twelve years ago, on a loan which was to be paid back in fifty years. Up to Sept. 31, 1909, the Council had borrowed £25,064 under the Act, and had only paid back £2696. The additional £15,000 which was borrowed after the purchase of the works was the limit allowed by the Act. With the exception of £936, which was borrowed for forty years, and £1000 borrowed for thirty years, the whole of the £15,000 was borrowed for fifty years. He wished to make a special point of this, as a great deal of plant paid for out of the loan for fifty years had only a lifetime of

two or three years; while other parts of it lasted for ten, twenty, or thirty years. He added that the Council had borrowed as much as they could; they had paid for as much as they could under the Act. Then, having become stuck for the balance, they had to go to the Local Government Board for it.

The INSPECTOR assured Mr. Arnold that he would inquire into the amounts allowed for superseded works, and place his report before the Board.

Mr. ARNOLD said there was very little of the old works left at the present time, and at the end of September, 1908, they had hardly started their new ones. He considered that half the expenditure should be written down as a replacement, and that all outlay on machinery and fittings for the new retort-house should be so termed.

The INSPECTOR understood that £2000 would be paid back to the reserve from the loan.

Mr. ARNOLD said it would be paid back with borrowed money. He then wished to submit as evidence some figures which had been laid before the Council regarding the statement of accounts.

The CLERK protested, as the figures were supplied to the councillors for their private use, and had never been before the Council. He afterwards, however, withdrew his objection.

Mr. ARNOLD next complained of the way in which the Treasurer's balances were made out; alleging that the figures were misleading owing to the credit and debit being given separately. He also said that if the Council borrowed a part of the sum and took the remainder from revenue, there would be a saving in the interest. It was the policy of some of the members of the Council to borrow as much as possible, and use to relieve the rates the revenue derived from the works with the borrowed money.

The CLERK remarked that the statement that all the moneys under the Act were borrowed for fifty years was not accurate.

At the close of the inquiry, the Inspector visited the gas-works.

THE SMOKE ABATEMENT CAMPAIGN.

Exhibition to be Held in Manchester Next Autumn.

With a view to educating the public on the question, the Manchester Smoke Abatement Society are arranging to hold a large exhibition next autumn in the City Exhibition Hall, Liverpool Road. It will be on the lines of the one recently held in Glasgow. Mr. James Kendall, Hon. Secretary to the Manchester Smoke Abatement Society, who is a member of the City Council, says that they have already received many promises of support from leading gentlemen in the city and in the county. He desires it to be clearly understood that in this campaign there is no intention of harassing trade. Indeed, he and his colleagues believe that the abolition of smoke—for smoke is a great waste—would be highly beneficial to the community. Further, he is of opinion that the smoke nuisance arises not so much from the tall mill chimneys as from the many thousands of small household smoke outlets gathered together over a comparatively limited area. He is a great believer in the substitution of gas-fires for coal-fires; and, with Alderman Gibson, the Chairman of the Gas Committee, he would like to see greater facilities offered to the public to use the former. Mr. Kendall says that both the commercial man and the householder want educating concerning the absolute needlessness there is for Manchester's black canopy, and the Society believe that much can be done by the exhibition they are going to hold. He adds: "It has been calculated that the money cost of fog and smoke to our large towns works out at about £1 per head a year. But more important than mere financial considerations are the effects of smoke upon the health of the community. Light is the enemy of disease; but, on the other hand, illness, and even death, is caused by soot passing into the breathing tubes. Bronchitis is thereby caused, and lung diseases and consumption are sometimes set up."

CORONATION ILLUMINATIONS.

Warning and Suggestions for Electrical Installations by the Chief Officer of the London Fire Brigade.

The Fire Brigade Committee of the London County Council desiring that certain views and suggestions of the Chief Officer of the London Fire Brigade in connection with the Coronation illuminations by electricity should become widely known, we have pleasure in assisting to give them circulation by reproducing a report on the subject appearing in the *agenda* of the County Council for to-day's meeting. It reads:

We have considered the question of the precautions that should be adopted for minimizing the possible risk of fire from the arrangements that may be made for the street illuminations on the occasion of His Majesty's Coronation in June, 1911. On the occasion of the Coronation of King Edward VII. in 1902, the Chief Officer of the Fire Brigade drew attention to the considerable risk of fire that might attend the arrangements for the street illuminations; and by our direction a circular-letter was sent to all the electric supply authorities in London drawing attention to this risk, and suggesting that special care should be taken with the illuminations. Having regard to the rapid development and extension of electric lighting during the past ten years, it is probable that the illuminations next year will be on a very much larger scale than on the previous occasion; and, judging from the inquiries already made of the Council, it appears that electric lighting will be extensively used for the purpose. While the Council, however, has no power to make any regulations in the matter, we think it would be advisable to take some action similar to that taken in 1902; and the Chief Officer of the Fire Brigade has with this object drawn up the following suggested list of precautions, based

on the experience obtained in connection with the electrical arrangements at theatres and music halls, exhibitions, &c. :—

(1) All installations should be inspected, tested, and approved by the local supply authority before connection is made ; and any installation that has not a satisfactory insulation between poles, and between either pole and earth, should not be connected.

(2) All circuits and sub-circuits should be provided with properly proportioned fuses to each pole ; and sub-circuits should be limited to a maximum of (say) 2 Kw. each, and should be arranged with due regard to current density in the conductors.

(3) No bare conductors should be used ; all conductors within reach of the public should be specially protected by suitable conduits ; and all metal conduits or coverings should be efficiently "earthed."

(4) All switches, fuses, terminals, and connectors should be protected from effects of weather and from possibility of mechanical injury.

(5) Festoons, garlands, &c., containing lamps should be provided with means of support independent of, and insulated from, the conductors, and should be secured in such a manner as to minimize risk of injury from wind.

(6) All shades and decorations of combustible materials in proximity to lamps should be rendered non-inflammable by a process which will withstand the action of rain for several days ; and no shades or decorations of celluloid or similar substance should be used.

(7) The installations should be connected, where practicable, at the main intake, or at the main distribution boards, so as to avoid the possible overloading of the house wiring.

We think that a copy of this list should be forwarded to all the local authorities and companies supplying electricity in London, and also to newspapers which deal specially with electrical matters. We venture to express the belief that the supply authorities and the Press would welcome such action, and would co-operate with the Council in the matter. We suggest that action should be taken at this early stage, as we think that the giving of long notice will be to the advantage of all concerned, and will further tend to lessen the risk if the Council's suggestions become widely known.

It is not proposed that the Council should take any responsibility in the matter, since, apart from the question of the Council having no direct jurisdiction, detailed inspections by the Council would be necessary, and this would be impracticable, having regard to the fact that the installations would be fitted only a few days before the date of use. But a system of inspection such as could be organized by each supply authority for its own district, and in its own interest, would be of great advantage in reducing the fire risks, which, in crowded resorts and thoroughfares, might otherwise be serious.

The Committee concludes by recommending : "That the attention of the local authorities and companies supplying electricity in London be drawn to the advisableness of taking steps to minimize the risk of fire that may attend the arrangements for street illuminations on the occasion of His Majesty's Coronation in June, 1911 ; that such authorities and companies be supplied with a list of precautions drawn up by the Chief Officer of the Fire Brigade ; and that the newspapers which deal specially with electrical matters be informed of the action taken."

EXPENDITURE ON ELECTRICITY AT HECKMONDWIKE.

Severe Comments by a Local Government Board Inspector.

An inquiry was held at Heckmondwike last Wednesday, by Mr. H. R. Hooper, M.Inst.C.E., respecting an application by the Urban District Council to the Local Government Board for authority to borrow £24,159 for electricity purposes. The inquiry aroused considerable interest, on account of the fact that £20,000 beyond the amount sanctioned has been spent on the electricity undertaking.

Complaint was made by Mr. Hooper that the Board had had to wait four years to be supplied with particulars of the amount spent on capital account ; and when they had the figures, these did not correspond with the published statement in the Board of Trade returns. Further, the questions he had put to the Council's representatives had failed to satisfy him as to which were the correct figures. They could not begin inquiring about granting borrowing powers if no one could tell them the amount spent. In December, 1904, the expenditure in excess of the sum sanctioned had reached £10,000 ; and the reasons given for not applying earlier for an inquiry for further borrowing powers called for some comment. It was stated, continued Mr. Hooper, that neither the Council nor the Committee knew that in 1906 the Local Government Board wrote for certain information which was not supplied. It was not denied that the letter was received, and somebody must have been responsible for not acquainting the Council with its contents. He would say no more on this point. Another reason given was the dearness of money during 1905-6. The Council, regardless of statutory authority, had preferred to pay a bank $3\frac{1}{2}$ per cent. on debit balances rather than have an inquiry and go into the open market ; and they had consequently created a suspense account of £20,000. Some of the expenditure for which borrowing powers were now sought was in respect of outlay for which only short periods could be granted ; and the time having elapsed, they must be paid out of revenue.

On behalf of the Council, it was stated that the discrepancies pointed out were owing to sums having been transferred from one account to another. It was also explained there was a surplus of about £6000 to provide a sinking fund in respect of unsanctioned expenditure.

The Inspector put a number of questions to ascertain the dates when the various items of expenditure making up the £20,000 overspent were incurred. He complained that the answers were not definite enough to give him the information he desired ; and he ultimately adjourned the inquiry *sine die*.

PORTSMOUTH WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Thursday, at the Company's Offices, Commercial Road, Portsmouth—Mr. W. Grant, J.P., in the chair.

The accounts for the six months ended Sept. 30 last showed that the revenue amounted to £38,413, and the expenditure to £14,828; leaving £23,585 to go to profit and loss account. The balance available for distribution was £27,313 8s. 7d.; and in their report the Directors recommended the payment of the full statutory dividends. They also stated that the engines, boilers, reservoirs, and works were reported by the Engineer (Mr. Herbert Ashley, M.Inst.C.E.) to be in good working order. Reference was made to the action brought against the Company in March last, by a consumer, in the Portsmouth County Court, to recover an amount he had expended in repairing, in compliance with the Company's notice, the communication-pipe between his house and the Company's main. The decision was then given in favour of the consumer; but the Company appealed, and the case was heard by Justices Phillimore and Avory in the King's Bench Divisional Court. The result was that their Lordships allowed the appeal, and reversed the decision of the Court below.

The Chairman, in moving the adoption of the report, congratulated the shareholders on the satisfactory result of the half-year's working; the water-rentals having risen very considerably—by no less than £1526 compared with a year ago. This was the largest increase that had taken place during the past five years; but rates and taxes had increased by £214, which was a grievance connected with all companies. As regarded the lawsuit referred to in the report, which was an appeal against the County Court Judge's decision that the Company were responsible for outside repairs, it was unfortunate, though the appeal had been in their favour, that they had had to fight an issue which applied to all water companies. The taxation of costs was not yet completed; but they would not be immoderate, considering the grest issues at stake, and the importance of the decision. The whole of the outlay for the filtration works—upwards of £70,000—had been paid, with the exception of the retention money.

The Deputy-Chairman (Lieut.-Col. Charles Lanyon Owen, J.P.) seconded the motion; and it was carried unanimously.

The usual complimentary votes brought the meeting to a close.

SOUTH HANTS WATER-WORKS PURCHASE QUESTION.

We learn that the proposal of the Southampton Corporation to purchase the South Hants Water Company's undertaking, to which reference was made last week (p. 590), is not being received with that equanimity which the Corporation were apt to expect. Though doubtless water matters in the added areas required adjustment, the opinion is being freely expressed that before they embarked in proceedings involving probably half-a-million of money, overtures should have been made to the Company with the view of an arrangement being made that would more than probably be very much to the benefit of the ratepayers, while at the same time safeguarding the interests of the shareholders. At a recent meeting of the New Forest District Council, a letter from the Town Clerk of Southampton in reference to the scheme of the Corporation was read; also a communication from the Solicitors to the Water Company, placing before the Council the views of the Company on the question of the proposed purchase of their undertaking. In the course of the discussion which followed the reading of the letters, the Vice-Chairman made some pertinent remarks, stating that the Company had hitherto served the Council very well, and the probabilities were that if the Southampton Corporation bought up the undertaking, and there was any deficiency in the water supply, Southampton would be benefited at the expense of the outlying districts. He thought they should do what they could to stand by the Company; and he considered they would be better off under them than under the Corporation. At the present time, the Company are engaged extending their mains from Totton to Marshwood, and thence to Hythe.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There has been much fog in the West of Scotland this week, particularly on Monday and Tuesday. Attendant upon it there has, of course, been a considerable augmentation in gas consumption. At this season of the year in Glasgow, the daily consumption is about 28 million cubic feet; and it is announced that on Monday it rose to 34,043,000 cubic feet, and that on Tuesday it was 33,164,000 cubic feet.

Reporting to the Town Council on Tuesday, Mr. W. Wilson, the Gas Engineer at Falkirk, stated that the quantity of gas made during October amounted to 18,754,000 cubic feet—an increase of 489,000 cubic feet over October of last year. Since May 15 there has been a net increase in the output of gas equal to 7·81 per cent. The average yield per ton of coal carbonized has been 9250 cubic feet. During October, nine new consumers were obtained, and 53 cookers fixed.

On Tuesday, there was an outbreak of fire in the Milton House Works at Abbeyhill, Edinburgh, belonging to Messrs. James Milne and Son, Limited. The fire was discovered about eight o'clock in the morning, in the tinsmith's shop—a two-storey building, 150 feet in length and 60 feet in breadth, constructed of brick, with wood and iron rafters. In the space of two hours the building was reduced to a ruin. A great deal of valuable machinery and a large number of gas-meters were destroyed. The origin of the fire has not been discovered. The loss was considerable; but it is covered by insurance.

On Monday, in the Dalkeith Police Court, Mr. R. W. Cowie, the

Manager of the Dalkeith Gas Company, was charged with having, on Nov. 2, in Bonnyrigg Road, Eskbank, opened a drain and displaced the pavement of the road without the written consent of the Dalkeith Town Council. A plea to the relevancy of the charge was stated by Mr. Cowie's Law Agent, but was repelled by the Magistrate—Bailie Alison. The case then went to trial. In his evidence, the Burgh Surveyor said that Mr. Cowie opened up the tar macadam surface of the road, which had been laid for only a few days, and that permission to do so had not been granted. Mr. Cowie, in evidence, said there was an arrangement, before he went to Dalkeith, under which written permission was not required, and that he was told by the Burgh Surveyor that the arrangement could still continue. This was to the effect that so long as he told the Burgh Surveyor when he wanted to open a street, that was all that was necessary; and if he raised the pavement or causeway, it was to be restored by the burgh servants at the expense of the Gas Company. On this occasion, he informed the Burgh Surveyor that he was to lay the pipe as soon as he had instructions to do so. Bailie Alison, in disposing of the case, said that facilities must be granted to the Gas Company in cases of emergency, and he did not think that the town had ever refused them; but it appeared to him that the defence had failed to prove that a verbal assent had been given. There might have been a slight misunderstanding; but care should be taken that no such misunderstandings should arise. He imposed a fine of 2s. A case on appeal was asked for.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 670.]

LIVERPOOL, *Nov.* 26.

Sulphate of Ammonia.

During the past week, the depression in the market generally has become more noticeable. This has no doubt been caused by the fact of all November requirements having been covered, and dealers refraining from purchasing against their commitments for next month. The larger production at this time of the year is now making itself felt; and the new orders coming on the market have in themselves not been sufficient to sustain values. The closing quotations for prompt delivery are £12 12s. 6d. per ton f.o.b. Hull, £12 13s. 9d. per ton f.o.b. Liverpool, and £12 15s. per ton f.o.b. Leith. In the forward position, makers maintain a conservative attitude, and no further first-hand transactions have transpired; but it is reported that sales have been made by middlemen for delivery next year at practically spot prices.

Nitrate of Soda.

The market for this article continues dull and uninteresting at 9s. $4\frac{1}{2}$d. and 9s. $7\frac{1}{2}$d. per cwt. for ordinary and refined qualities respectively, on spot.

LONDON, *Nov.* 28.

Tar Products.

The markets for tar products have remained fairly firm during the past week. In pitch, there has been a fair amount of inquiry, but it has had no effect on the market either way. The majority of buyers state that they can purchase at under the equivalent of prices being quoted on this side. In creosote, a few transactions have been made, but have had no effect on the market. A little improvement is reported in the blast-furnace product, and slightly better prices have been paid. Benzols are quiet, and buyers will not pay the high prices being asked on this side. Heavy naphtha is fairly firm; and solvents are not of very great interest. There is practically nothing fresh to report in the market for crude carbolic acid.

The average values during the week were: Tar, 17s. to 20s. 9d. *ex* works. Pitch, London, 34s. to 34s. 6d.; east coast, 32s. 6d. to 33s. 6d; west coast, Clyde ports, 33s. to 34s. Manchester, 32s. to 33s., Liverpool, 32s. 6d. to 33s. 6d. Benzol, 90 per cent., casks included, London, 8d. to $8\frac{1}{2}$d.; North, $7\frac{1}{2}$d. to $7\frac{3}{4}$d.; 50-90 per cent., casks included, London, 8d. to $8\frac{1}{2}$d.; North, $7\frac{3}{4}$d. to 8d. Toluol, casks included, London, 9d. to $9\frac{1}{2}$d.; North, 9d. Crude naphtha, in bulk, London, $3\frac{3}{4}$d. to $4\frac{1}{4}$d.; North, $3\frac{1}{8}$d. to $3\frac{1}{4}$d.; solvent naphtha, casks included, London, $11\frac{1}{2}$d. to 1s.; North, $10\frac{1}{2}$d. to 11d.; heavy naphtha, casks included, London, $11\frac{3}{4}$d. to 1s.; North, 11d. to 1s. Creosote, in bulk, London, $2\frac{3}{8}$d. to $2\frac{1}{2}$d.; North, $1\frac{7}{8}$d. to $2\frac{1}{8}$d. Heavy oils, in bulk, $2\frac{3}{4}$d. to $2\frac{7}{8}$d. Carbolic acid, 60 per cent., casks included, east coast, 1s. $1\frac{1}{2}$d.; west coast, 1s. 1d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, $1\frac{1}{2}$d. to $1\frac{3}{4}$d. per unit, packages included and delivered.

Sulphate of Ammonia.

At the commencement the market showed signs of weakening; but towards the close considerable inquiry came along, which has had the effect of steadying the market; and better prices have been paid than those offering at the beginning of the week. The Beckton Gas-Works report that they are fully sold. Outside London makes are quoted at £12 7s. 6d. In Hull, the price is £12 17s. 6d.; Liverpool, £12 17s. 6d.; Leith, £12 17s. 6d. to £12 18s. 9d.; and Middlesbrough, £12 17s. 6d. to £12 18s. 9d.

Accident at the Lausanne Gas-Works.—Owing to the breaking of an electric lamp in the valve-room near the syphons of one of the gas-holders at the old works at Ouchy of the Lausanne Municipality on Monday last week, a serious explosion took place, by which six men were more or less seriously burnt. Three of them had to be removed to the hospital, where they are making favourable progress. The Manager of the Works, Mr. James Räber, from whom we recently received the particulars of the new gas-works at Malley which appear elsewhere, unfortunately sustained injuries, which we trust will not long incapacitate him for the discharge of his duties.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a better demand in the coal trade; but the scarcity of steamers and the high rates of freight lessen the shipments of most kinds of fuel. In steam coals, there is a fair demand. Best Northumbrians are from 9s. 3d. to 9s. 6d. per ton f.o.b., second-class steams are about 8s. 3d. to 8s. 6d., and steam smalls from 5s. to 6s. 6d. Tenders have been sent in for the large contracts for the Swedish State Railways for next season at higher prices than these. In the gas coal trade, the demand is now about at its fullest; but the deliveries are interfered with from the cause referred to above. Durham gas coals vary in price. The usual classes are from 8s. 3d. to 9s. 1½d. per ton f.o.b., according to the quality; while for "Wear" specials, up to 10s. 3d. and even 10s. 6d. per ton is quoted. Deliveries on the long contracts would absorb much of the current output, but there are negotiations for forward supplies. It is also reported that there have been sales of second-class gas coals at Genoa at 14s. 9d. per ton, delivered there. Some smaller lots are also in treaty; and a contract for the Aalborg Gas-Works at 13s. per ton, delivered, is believed to have been entered into. Coke is rather quiet. Gas coke is steady, though the make is large, at about 14s. to 14s. 3d. per ton f.o.b.

Scotch Coal Trade.

There has been a little more activity in the coal market; but the improved demand has been mostly due to increased household consumption, consequent upon cold weather. Ell for shipment is in good request; but splint is not. The prices now quoted are: Ell, 9s. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The shipments for the week amounted to 312,586 tons—an increase of 25,210 tons upon the previous week, and of 16,486 tons upon the corresponding week of last year. For the year to date, the total shipments have been 14,348,686 tons—an increase upon the corresponding period of 693,758 tons.

"Toby, M.P.," on the Passing of the Gas-Burner Bills.

It is not often that our humorous contemporary "Punch" has anything to say about gas; but in the current issue its representative in Parliament—"Toby," the old and well-tried Member for Barkshire (in other words, Mr. H. W. Lucy)—refers in his "Essence of Parliament" to the rather surprising circumstances attending the passing of the three Gas-Burner Bills, which, as readers are aware, was almost the first business done on the re-assembling of Parliament after the recess. The following are "Toby's" remarks: "The Conference had broken up, admitting failure. There had been going and coming between Downing Street and Sandringham. What did it portend? Immediate dissolution, or further parleying with Peers over Veto Resolutions? Members crowded to Westminster to hear the promised answer to the portentous question. All the world listened at the door. And what do you suppose was the business the House straighway took in hand, and proceeded to deal with in deliberate, prosaic fashion, as if the political crisis everyone was talking about had its local habitation in the planet Saturn? Why, it was consideration of the Gas Companies Standard Burner (No. 1) Bill—a measure which seems to have escaped the ruthless hands of the Lords, and reached the Commons intact. Anyhow, there it lay upon the Table, with intimation that it had come on from the other House. What it was all about only nine members, including the Chairman of Ways and Means, had the slightest idea. Of these, eight filled five folios of the Orders of the Day with notices of motion referring to it. Thus it came to pass that, while the thronged House curbed its impatience, the Gas Companies Standard Burner (No. 1) Bill was understood to be dimly threading its way to the Statute-Book."

Heavy Gas Consumption in Manchester.—During the fog which enveloped Manchester at the beginning of last week, the daily consumption of gas was about 7 million cubic feet above the average. It is estimated that the extra expense to the shopkeepers and citizens in the way of illumination for the two days, consequent on the fog, totalled about £1300.

Explosion at the Stalybridge Gas-Works.—Two men employed at the Stalybridge Gas-Works had a narrow escape from serious injury by an explosion which took place in the purifier-house last Tuesday morning. The men were about to empty one of the boxes, the gas having been turned off, when they were startled by a loud report and a flash of light. An examination showed that the box, which measured 20 feet by 30 feet, had burst, the cause not being apparent. The force of the explosion had been directed downwards and outwards; and, as a result, the riveted plates were blown out. The damage, which is covered by insurance, was confined to the purifying-box.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Messrs. A. & W. Richards offered, in accordance with instructions of the Directors, a further issue of capital of the Pinner Gas Company, Limited, under their Orders of 1901 and 1910. It consisted of 800 "B" shares, ranking for a standard dividend of 7 per cent., subject to the sliding-scale—the dividend on existing similar shares being, however, at the rate of £8 15s. per cent. They were all sold at from £8 15s. to £9 2s. 6d. each. On the same occasion, they sold, by order of executors, 200 new ordinary £10 shares in the Southend Water Company, ranking for a standard dividend of 5 per cent. per annum, but carrying 4½ per cent. They fetched from £10 to £10 2s. 6d. per share. At the Royal Hotel, Slough, the same day, Messrs. Buckland and Sons offered for sale ten "B" shares of £10 each in the Slough Water Company, ranking for dividend up to 7 per cent. per annum. After keen competition, five of the shares were sold at £20 5s. each, and the remaining five at £20 each. At the auction-rooms of Messrs. Llewellyn Puttock and Blake, Gosport, on Thursday, a few parcels of stock of the Gosport Gas Company were offered for sale. Some 4 per cent. perpetual debenture stock, put up in £10 lots, sold at par; and some consolidated ordinary stock fetched from £12 2s. 6d. to £12 5s. per £10 lot. The total amount realized by the sale was £3430 5s.

Christmas Holidays at the Manchester Gas-Works.—At a conference of the Chairmen of the Committees of the Manchester City Council last Wednesday, it was decided that the workmen in the various departments should have two days' holiday at Christmastide—the Bank Holiday and the following one. Those men who are unable to have the holiday will be paid double time. The decision affects about 20,000 workmen.

Gas Exhibition at Sale.—The Stretford Gas Company have arranged a supplementary exhibition of up-to-date gas cookers, fires, and apparatus at Sale, which is within their area of supply. About the end of last month, as recorded in the "JOURNAL" at the time, a marquee in which a gas exhibition was being held at Sale was wrecked during a gale which swept over the district; and it was decided to hold another exhibition at a later date—a wooden building being specially constructed for the purpose. The exhibition is now open; and besides the Stretford Gas Company the following firms have stands: Messrs. Fletcher, Russell, and Co., Limited; the Davis Gas-Stove Company, Limited; the Parkinson Stove Company, Limited; Messrs. Wilsons and Mathiesons, Limited; Messrs. John Wright and Co.; and Messrs. Makinson, Rowen, and Co.

Saltash Water Supply.—Alderman R. Miller, the New Mayor of Saltash, in his speech acknowledging his election, remarked that during the past year the water-main had been brought across the Royal Albert Railway Bridge. The Water Committee of the Corporation deserved the thanks of everyone in the town for their work in this matter, which gave them a better assurance of a supply than when the main ran under the bed of the river. Some people thought that the Corporation had done wrong in arranging with the Plymouth Corporation for a supply of water, and that they ought to have obtained an independent supply. This was not his opinion. It might have cost them from £20,000 to £40,000 to provide water-works of their own; and the result would have been a water-rate of 1s. 6d. or 1s. 9d. in the pound, and other rates of 8s. or more. As it was, they had a good and constant supply without being unduly burdened.

The Imperial Lamp Works (Br.), Limited, have opened showrooms at No. 15, Farringdon Avenue, E.C., where they have on view the various patterns of high and low pressure gas-lamps on the well-known Pintsch system, which the Company supply.

Under the title of Bens Gas, a Company has been registered with a capital of £500, in £1 shares, to take over the business of a manufacturer of petrol gas-producing plant carried on by Mr. L. E. Currey, at Corn Exchange Buildings, East Street, Chichester.

Mr. Joseph Rudd has retired from the partnership he had with Mr. C. J. Sutton, trading as the Pilot Gas-Mantle Company, at 19, Nelson Square, Bolton. Mr. Sutton is to continue the business on his own account under the same style and title, and at the same address.

The accounts of the South-West Suburban Water Company for the half year ended Sept. 30 show a surplus of £13,519. A dividend at the rate of 6½ per cent. per annum is proposed on the ordinary shares; adding £100 to the contingency fund, and carrying forward £5577.

APPLICATIONS FOR LETTERS PATENT.

26,444.—RAIMONDI, A., "Rendering joints of pipes water, steam, gas, or air tight." Nov. 14.

26,461.—JONES, A., and LUPANE, J., "Removing deposits of carbon or other obstruction in and from the gas-holes of burners." Nov. 15.

26,477.—CRAWSHAW, N. S., "Gas regulators." Nov. 15.

26,506.—HIPWELL, D. E., "Valves and traps." Nov. 15.

26,508.—RICHMOND GAS STOVE AND METER COMPANY, LIMITED, RANSOME, J. A., and DIXON, L., "Gas-burners." Nov. 15.

26,509.—DRISCOLL, J., and CRAWLEY, C., "Delivering or controlling fluids." Nov. 15.

26,540.—CLOUDSLEY, J. L., "Continuously-operated carbonizing retorts." Nov. 15.

26,544.—LENTZ, H., "Operating valve plugs." Nov. 15.

26,602.—BERRY, J., and HITCHEN, H., "Water taps or valves." Nov. 16.

26,611.—COLBRAN, J. B., "Inverted incandescent gas-burners." Nov. 16.

26,656.—CANNON, D. W., "Inverted incandescent gas-burners." Nov. 16.

26,673.—LANGE, K., and MENGERS, O., "Regulating nozzles for bunsen burners." Nov. 16.

26,715.—SUTTON, C. J., "Globe holders for use in connection with gas-burners." Nov. 17.

26,719.—SINCLAIR, J., "Valves." Nov. 17.

26,727.—BATES, W. E., "Stop valve for water-mains or the like." Nov. 17.

26,754.—BIHELLER, S., "Lamp shades." Nov. 17.

26,764.—BERRYMAN, W., and REDGRAVE, A., "Flexible metallic tubing." Nov. 17.

26,772.—PATERSON, R. O., and TWYCROSS, L. E., "Preparation of charges of limed coal for distillation in gas-retorts." Nov. 17.

26,803.—SEYD, F. O., "Apparatus for advertising purposes for use with coal gas." Nov. 18.

26,847.—KING, J., JUN., BURNETT, J. R., and the RICHMOND GAS STOVE AND METER COMPANY, LIMITED, "Furnaces." Nov. 18.

26,877-78.—EVANS, W. E., "Treatment of water." A communication from Carl Neff and August Brandes. Nov. 19.

26,893.—SMITH, A. E. H. & C. H., "Water-heaters or geysers." Nov. 19.

26,920.—HAMER, W., "Incandescent gas-burners." Nov. 19.

26,942.—HIGGINS, C. S., "Coin-freed delivery mechanism." Nov. 19.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Nov. 26. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	21/-	18/6—21/-	19/—21/3	18/6—20/6	18/6—20/6	—
Pitch	,,	35/-	32/—32/6	32/6	32/-	32/-	32/-
Benzol, 90%	per gallon	8¾d.	7½d.—8d.	8d.	7¼d.—7½d.	7½d.—8d.	8d.
Benzol, 50-90%	,,	9¼d.	8¼d.—8½d.	9d.	8d.—8¼d.	8d.—8¼d.	—
Toluol, 90%	,,	10d.	9d.	10d.	10d.	10d.	10d.
Crude naphtha, 30%	,,	—	3¼d.—3½d.	3½d.	3¼d.	3¼d.	—
Light oil, 50%	,,	—	3¼d.	3½d.—3¾d.	3d.	3d.	—
Solvent naphtha, 90-160	,,	—	10½d.	10d.	10½d.—11d.	1/—1/0½	11d.
Heavy naphtha, 90-190	,,	—	11d.	11d.	11½d.—1/-	11¾d.—1/-	11d.
Creosote in bulk	,,	2½d.—2¾d.	2d.—2¼d.	2d.	2d.—2⅛d.	2d.—2⅛d.	2d.
Heavy oils	,,	3d.—3¼d.	2½d.	2¼d.	2¾d.	2¾d.—3d.	3d.
Carbolic Acid, 60's	,,	1/1	1/—1/1	1/1	1/0½—1/1	1/0½—1/1	1/1
Naphthalene, crude drained salts	per ton	—	40/—42/6	40/—42/6	47/6	47/6—50/-	—
Naphthalene, pressed	,,	—	60/-	63/-	60/-	66/-	—
,, whizzed	,,	80/-	—	—	70/—72/6	70/—75/-	65/-
Anthracene	per unit	2d.	1⅛d.	1¼d.	1¼d.	1¼d.	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 629.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord.	83—86	-4½	5 16 3
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6½—6¾	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	248—251	+1	4 19 7
330,000	,,	,,	9½	Do. New	186—188	+1	5 1 1
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
220,000	Stk.	Aug 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	158—161	..	4 19 5
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk.	106—109	+1	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	..	3 14 1
800 000	Stk.	June 10	4½	Continental Union, Ltd.	88—93	..	4 6 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103—105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¼—24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4¾	Gas light and Coke 4 p.c. Ord.	105—106	..	4 8 0
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103—105	..	3 16 2
4 531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112—114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	184—186*	..	4 16 9
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 15 4
561,000	Stk.	,,	10	Liverpool United A	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	163—165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4¾—5	+⅛	6 0 0
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¼—12¾	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138—140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd.	6¼—6¾	..	5 18 6
31,800	53	Aug. 31	13	Portsea Island A.	131—133	.	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼—7¾	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5¼—5¾	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅝	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122—124	+1	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	109—111	..	4 10 1
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 0
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	113—115	..	4 6 11
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c.	140—142	..	4 15 1
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	74—76	..	3 18 11

Prices marked * are "Ex div." † Next dividend will be at this rate.

It was stated at the recent annual meeting of the Ashton-under-Lyne Joint Water-Works Committee that up to the present a sum of £72,000 had been paid on the Chew Valley undertaking—this representing the amount of the certificates that had been put in upon the measurements.

We learn that it is the intention of the Block Light Company, Limited, of Manchester, to open for the next lighting season a branch in the Farringdon Road for the sale of their lamp. Among gas companies by whom the lamp has been used are the Cardiff, Dublin, and Northampton Companies.

The Water Committee of the Leeds Corporation have adopted a resolution in favour of the quarterly collection of the water charges. They have already decided to collect the gas-rate quarterly; so that a uniform system will come into operation, which it is thought will be convenient alike to the Corporation and the ratepayers.

Judging from a copy of the "Hythe Reporter" which has lately reached us, the attention of the residents in that town is being specially directed to the local Gas Company. A leading article is devoted to them; the notice of their intention to apply for a Provisional Order for additional capital and further powers, to which reference is made in our "Parliamentary Intelligence," is fully reproduced; and, in a prominent advertisement, the advantages of gas are set forth, and the public are invited to visit the Company's show-rooms, where these are demonstrated by a collection of the latest appliances.

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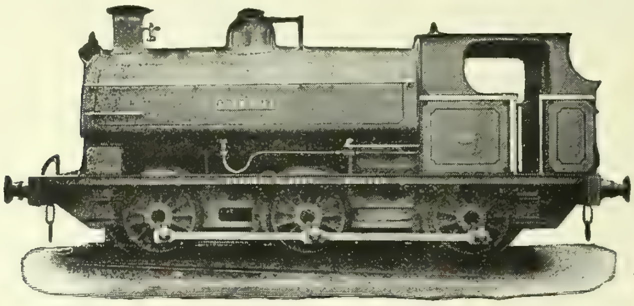

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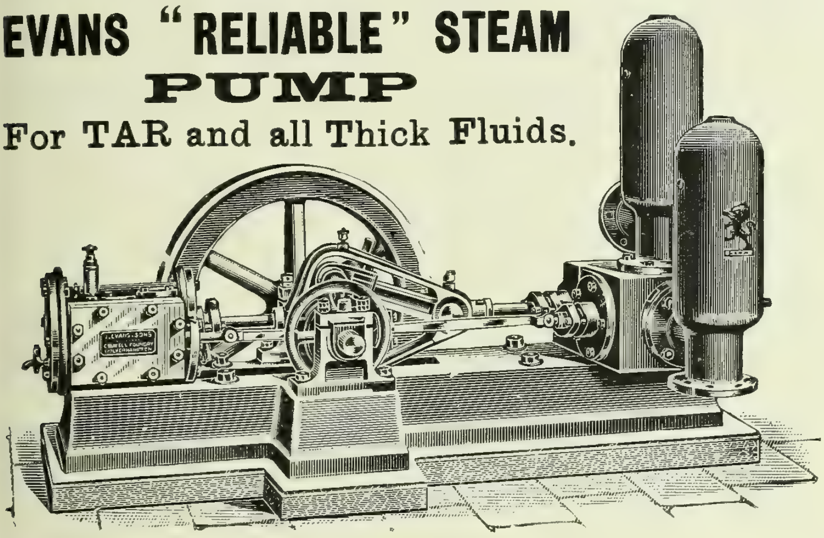

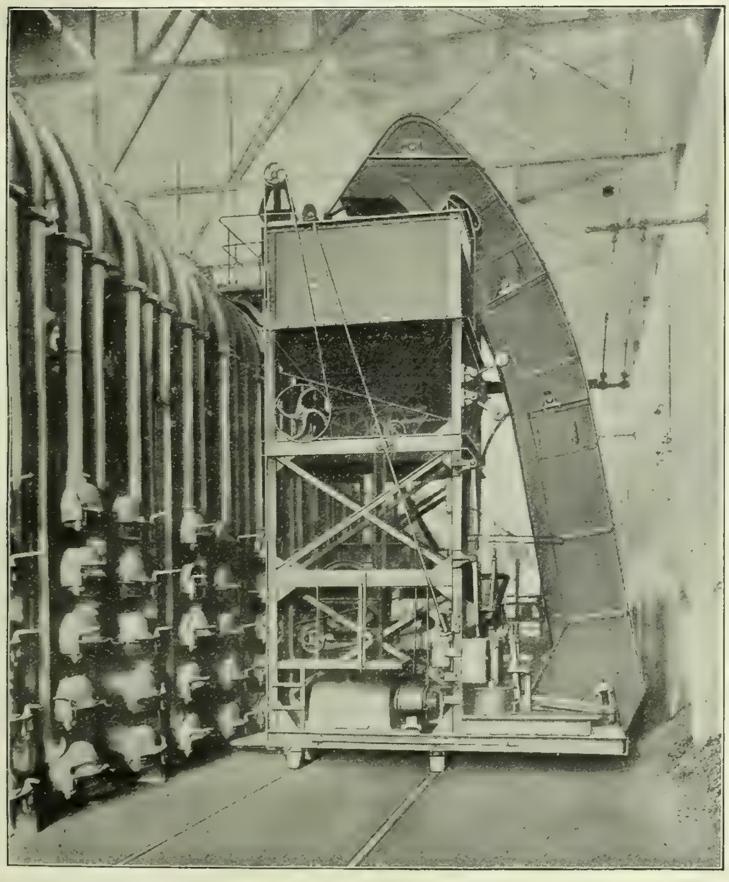

"D.B." PROJECTOR WITH ELEVATOR.

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THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXII. No. 2482.] LONDON, DECEMBER 6, 1910. [62ND YEAR. PRICE 6d.

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2482.——TUESDAY, DECEMBER 6, 1910.

EDITORIAL NOTES—GAS, &c.

Thirty Years Ago.

It has been said on more than one occasion in these columns that an acquaintance with the long-past history of the technical and commercial affairs of the gas industry enables one the better to understand and appreciate the vast changes in thought, opinions, and practices that have passed over and through the industry, and assists in bracing one's optimism regarding the prospect as surveyed from the standpoint of current time. A few days since, turning over the pages of the first volume of the "JOURNAL" for 1881 in search of a matter altogether disconnected from carbonizing, the eye alighted on, and was arrested by, this sentence in an editorial article, dealing with the proceedings at a meeting of the South Metropolitan Gas Company, published on March 1 in the year named: "Mr. E. Horner sharply criticized the "working results of gas made per ton of coal carbonized." Reading on, it was learned that—

> The proprietors declined to take fire even at Mr. Horner's startling statistics of the many thousands of pounds which he suggested were wasted every year in consequence of Mr. Livesey's deliberate choice of a medium, instead of a high, yield of gas from the coal carbonized. . . . Mr. Livesey was not able to flash such dazzling considerations before his hearers as had been brought forward by Mr. Horner; but although his argument was necessarily somewhat technical, it clearly showed to the mind of the most inexperienced person present at the time, that that gentleman's assumption that the extra yield of gas which he so much admired could be obtained without extra expense was a fallacy.

Those final words have a peculiar interest about them with the accounts of the Company facing us for the past two or three years, in which the extra quantity of gas produced per ton of coal, with the consequent saving in coal and in manufacturing expenses, has made a remarkable difference in the financial aspects of the periods to which they refer. But looking at the position then from the point of view of the present, it must not be imagined that the Mr. George Livesey of that time was not just as much a progressive in technical and commercial affairs as the Sir George who led with such spirit and dogged determination in the subsequent years in the cause of the progress and the stability of the gas industry. That it was considered to be a fallacy that an extra yield of gas could be obtained without extra expense thirty years ago, was due partly to the reigning circumstances and restrictions, and partly to the position of the knowledge of the time; and Mr. Livesey was then quite right in maintaining that, in the case of his Company, the extra cost of a different kind of coal that would have been necessitated to maintain the 16-candle gas standard with a higher yield per ton would have meant the sacrifice monetarily of all the advantage of the additional quantity of gas that there would have been for sale per ton of coal. Mr. Horner was making comparison at the time with the working of the Gaslight and Coke Company, who were supplying partly cannel gas in Westminster, and were using some of the expensive material for enriching the ordinary supply, with the result that they were making 500 cubic feet of gas per ton more than the South Metropolitan Company, but were paying a large average price per ton for coal used. Taking this extra make of 500 cubic feet per ton, Mr. Horner calculated that, on the production of the latter Company, it represented 10,000 tons of coal in a half year, and that, taking together the cost of coals and that of carbonizing this quantity, it would mean £8000 to £9000 in the six months. The argument was plausible enough so long as losses and gains under the conditions of the time were not set one against the other, and a balance struck in order to ascertain on which side right and profit were to be found.

Those were days in which carbonizing questions were much to the fore among gas technicians, just as they are to-day. The adoption of generator and regenerative settings was at the time a polemical subject in our columns; and ideas were then in a somewhat unsettled condition. It was readable intelligence then that generator or regenerative settings were being applied at such and such works; just as it is to-day to learn where vertical retorts are being installed. Before the meeting referred to of the South Metropolitan Company, there appeared in the same volume a reproduction of a drawing of the (at that time) new regenerative settings that Mr. Livesey had designed for the Old Kent Road works. The progressive instinct was always very strong in the then Chief Engineer of the South Metropolitan Company. But, regarding the question of higher makes, those were the days of luminosity by combustion without the use of the ancillary mantle; and we find him then saying: "I have gone very "carefully into the question of a large make of gas per ton "of coal; and I am prepared to state that, when you have "to supply 16-candle gas, by increasing the make per ton "of coal beyond about 9800 cubic feet, you impoverish the "gas, and have to use more cannel; and every ton of cannel "the Company use is a decided loss." That reflects the position of knowledge at the time. Advance had not then been made to a comprehension of the benefits of heavier charges, with less free space in the retorts, and longer duration of carbonization. There was a rooted belief in a good free space above the charges in the retorts. Knowledge has altered opinions, and has so changed conditions that the theories and the practices of thirty years ago are not the theories and practices of to-day. What were the facts of thirty years ago, however, were not such stubborn things that they refused to fall, and to be replaced by others set up by fresh knowledge and experience.

With the establishment of the mantle, new views drove the old ones from the mind of the chief at Old Kent Road; and right to life's end new ideas superseded former ones in conformity with changes of condition that were introduced with advancing time. *Tempori parendum.* To no man does the industry owe so much as to Sir George Livesey for initiative work, and for leading in the fight to reduce those restrictions that would, had they continued to survive, have crippled seriously the benefits derivable from current knowledge. It is interesting to look back in this matter, and to remember these things—more especially when an accidental circumstance reminds of views held in the deep past by one who occupied the prominence of Sir George in both the technical and commercial history of the gas industry, and who lived fighting so strenuously for its liberties in the service of the public. But the views as to make per ton in relation to illuminating power held sway in practice until 1901. The 9800 cubic feet make of 1881 was the make within a few feet per ton until 1901, when the fight for a reduced standard of illuminating power brought about the institution of the 14-candle standard south of the Thames, in place of the 16-candle one. The following year the make per ton was up to 10,434 cubic feet. The next year, it averaged 10,715 cubic feet, in the proximity of which figure it remained until 1906. Then in the year, 1907, the average production was 11,138 cubic feet; 1908, 11,386 cubic feet; 1909, 11,499 cubic feet; and the first half of this year, 11,820 cubic feet —2000 cubic feet beyond the figure above which thirty years ago Mr. Livesey declined to go with 16-candle gas on account of the impoverishment of the gas through conditions of carbonizing knowledge and practice at the time. Only at the last half-yearly meeting of the proprietors of the Company, the successor of Sir George (Mr. Charles Carpenter), in his address from the chair, mentioned that the quantity of gas sold per ton of coal carbonized had been increased to the substantial figure of 11,543 cubic feet; whereas ten years ago the amount was only 9300 cubic feet. Mr. Horner, who had considerable knowledge of gas affairs in his day, thought that 10,200 cubic feet per ton was a high make. Had he been alive now, what would he have said to 11,800 cubic feet?

This peep into the past, in regard to carbonization and gas make, shows not only how vastly views and practices and results have changed, but it also illustrates how, in the case

of the gas industry, there has been a hampering of progress by restriction. Statutory and arbitrary have been largely synonymous terms in respect of the restriction under which the gas industry has laboured in the past; but things are getting into a little more orderly condition now. And during the years that restriction has been lessened, the internal working of the gas industry has been on a plane of economy never reached before. From the point of achievement, there will be no turning back.

The Confirmation of Carbonizing Theory.

The lecture that Dr. Harold G. Colman delivered at the Manchester University last Saturday afternoon on coal carbonization for gas production will stand on record as not the least in value of the series that has tempted so many gas men (young and otherwise) to abandon recreation for study on one Saturday afternoon each month so far this winter session—a point which Mr. Dugald Clerk a few days since personally told us struck and greatly pleased him, as a sign of the times in the gas industry, on the occasion of his lecture at the beginning of last month. That by the way. Dr. Colman's subject was a big one; and had he ventured to embrace the whole by a mere outline in a single lecture, it would have been an unprofitable exercise. Capable as he is of dealing with the mechanical and economical aspects of the question, he did well, therefore, in confining himself to its chemical side, in which he is, as one of the really few masters, so much at home. To any student of such a subject, it is an enjoyable treat to be led from theory to theory by the master hand until brought to the stage where it is shown that modern systems and practices give as full effect and practical embodiment to those theories as, within the limits of our knowledge, is possible. At the same time, we have to confess that the information is very imperfect as to what occurs—and what occurs is wonderful—inside a gas-making retort, though many among us have often, in the desire for fuller information, taken the long-since tendered advice of Mr. Thomas Newbigging to project ourselves in thought into a retort to ascertain what is going on there. Imperfect knowledge notwithstanding, that the theories as presented in the lecture are well founded is borne out by the results of the modern practices that incorporate accepted principles of design and method. That is what Dr. Colman, stage by stage, illustrated to the students of carbonization; and all gas engineers young and old must continue in this category while knowledge is incomplete.

It is always, whatever the work in hand, well to have an ideal at which to aim. In the process of making gas, we are afraid that, in the main, the only ideal that numbers of gas engineers and managers have any reverence for is the standard illuminating power of their gas. Were it not for the legislative propping up of illuminating power as the standard quality of gas supply, the ideal to work to in carbonization would be, in the interests of the public and the industry itself, the one (succinctly stated by Dr. Colman) of obtaining the maximum proportion of heat units at low cost in the form of combustible gas, with the proviso that the gas should only contain a limited quantity of inert gas, and that, as far as practicable, it should be of uniform composition and calorific power. That is the ideal; and if we were at liberty in this country to adopt it *per se*, there would not only be relief to the responsible gas maker, not only would the quality forming the base of the standard comply with the major use of gas to-day, but there would be a broadening out of the opportunities of the gas maker in the economical purchase of coals through the abandonment of the present necessary consideration as to their sperm value. At the present time, this consideration has to be retained prominently in view. But there is gratification in the knowledge that, in the horizontal retort, heavier and longer duration charges (though the weight carbonizing capacity per day is somewhat reduced) give a higher yield in combustible gas of B.Th.U.'s. than was formerly the case; and the same applies to the vertical retort systems.

This is highly satisfactory, as though the retention of the illuminating power standard is a material hindrance to the most effective work in the production of carbonizing results, it shows that, the drawback notwithstanding, the gas industry is not debarred from realizing a large proportion of the manifold advantages presented by the practices approved by the highest carbonizing competence of the times—carbonizing in vertical retorts, or in horizontal retorts with a small free space at top. The advantages, putting them generally, are: A larger make of gas, with a greater calorific yield in gas per ton of coal, improved coke, thinner tar containing less free carbon, reduced amount of carbon bisulphide, and less naphthalene, without mention of working economies which formed no part of the lecture. The free space with high temperatures in the old method of working with horizontal retorts has much to answer for in depreciating the results of working. Experience has taught us—and this experience only came with the vertical retort—that the desirable method of carbonization for gas making is one by which (to quote Dr. Colman's own words) "the coal "itself can be heated to a high temperature, without simul- "taneously causing a too great heating of the volatile pro- "ducts." The vertical retorts and heavier charges in horizontal ones produce this condition by eliminating entirely in the one, and nearly so in the other, the free space; and this elimination is the essential escort of high temperature carbonization.

Considerations such as these led to the statement of an interesting hypothesis by Dr. Colman, as to the travel of the gas from the charge in a vertical retort—say, an intermittently charged one. He suggests that, as carbonization proceeds, there is a pasty wall formed between the outer vertical carbonized portion and the inner uncarbonized core, which prevents the gas from the latter passing through to the hot coke, and the remaining gases in the coke passing into the core of partially carbonized coal. Therefore, part of the gas ascends through the coke, and part of it through the uncarbonized core. There would be some difficulty in quantitatively determining the proportions travelling through the two passages; but Dr. Colman ventures to suggest that probably half goes one way, and half the other. On *à priori* considerations, we would submit that he is giving too much to the coke. The greatest evolution of gas from any given part of a charge of coal is at the commencement of its carbonization. We start with a completely uncarbonized charge; and the first large evolution goes on continuously from the outer edge to the inside. Accepting Dr. Colman's hypothesis, there is the pasty division wall that prevents this gas finding any other escape than through the path of least resistance, and that path is the uncarbonized core. The outer carbonized portion of the charge is but a gradually increasing quantity, and surely there cannot be sufficient gas left in it, after the formation of the pasty seal, to account for half the entire production of gas having to take its passage through the incandescent coke. But whatever is said on this point must be more or less mere deduction from a consideration of the known actions occurring in carbonization; and therefore we will adopt Dr. Colman's caution, and refrain from setting up our suggestion as being any more worthy of acceptance than his.

It was a really good lecture—a lecture cohering stage by stage from theory to practice and results; and every word that was said in praise at the close was richly deserved.

The Repentance of Liverpool.

Corporation Adopt "Metropolitan" No. 2 Burner for Fazakerley.

We cannot refrain from making a point of the latest phase of the attitude of the Liverpool Corporation towards the "Metropolitan" No. 2 standard argand gas-burner, with the history of the acrimonious and expensive opposition to the Standard Burner Bills so fresh in mind. From the early stages, the Corporation took the lead in organizing hostility; from the same quarter no opportunity was lost at any stage in trying to destroy the measures and causing their detention in progress; and at the penultimate stage there were attempts being made to produce a wreck, whe[n] various differences between the Gas Company and the Co[r]poration were composed. The result was the latter with drew from further participation in the strife that they ha[d] been so largely instrumental in stirring up; and the oppos[i]tion collapsed like a house built of a pack of cards. Th[e] *dénouement* is before us. The "London Gazette" publishe[d] last Tuesday contained a notice by the Liverpool Corpora[-] tion of their intention to apply to the Local Government Boa[rd] next session for an Order to empower them to adopt t[he] "Metropolitan" argand burner No. 2, or any other burn[er] which the Local Government Board or the Board of Tra[de] may approve under the provisions of the Order, as a sta[n]dard burner in substitution for the burner now in use for t[he] official testing of the illuminating power of gas supplied [by] the Corporation in the parish and township of Fazakerle[y]. The announcement is brimful of interest; but we do ho[pe] for the peace of mind of the Corporation that the Lo[cal] Government Board will not now read the evidence that w[e]

submitted last session in the name of the Liverpool Corporation as to the wicked and mischievous effects upon gas consumers of adopting the burner which it is desired to apply to the Corporation's own gas supply.

But we will not irritate old sores. The Corporation are doing the right thing; and no doubt under good advice. Mr. Isaac Carr is the Consulting Engineer of the Corporation in connection with their new gas-works for the supply of the Fazakerley district; and he designed and put them in possession of a works on as economical lines as any of which we know, considering site conditions and the fact that much of the plant is of an order that will enable the capacity of the works to be considerably enlarged at a very cheap rate. If it is on his advice that the Corporation are now, after all that has transpired, adopting as a test-burner the "Metropolitan" No. 2, the wisdom of the recommendation will not be questioned by any professional man in the industry. At the present time, the gas at Fazakerley is of illuminating power, and tested by the flat-flame burner, precisely as in the case of the gas supplied by the Liverpool Gas Company. It may be that a desire to keep things uniform in these respects throughout the city's administrative area is the reason for the proposal before us. Uniformity of gas testing is one of the points in the case for the universal application of the "Metropolitan" No. 2 burner. The present action of the Liverpool Corporation is certainly the most enlightened they have taken in connection with gas testing during the past twelve months.

The Electrical Art of Falsehood.

THE campaign of falsehood and calumny against gas continues in the advertisements of the electricity supply industry; and the case for the inauguration of the activities of the Gas Publicity Committee strengthens and gets more urgent each passing day. Of course, the great extent of public experience in the use of gas gives the lie direct to the false statements of those writers of advertisement literature who are paid by electrical money for their dishonesty. But public experience is not sufficient to counteract the electrical mendacity circulated in the way of advertisements in the public press. Gas undertakings, it is true, are spreading their business in both cooking and heating at a remarkably healthy rate. But it is the duty of the industry as a whole to, for protection, destroy by any means that is fair and open every check that is attempted on the part of the competitors, and not sit by supinely while the campaign proceeds, or leave the task of meeting it to the enterprise of individual concerns.

Take a single page of the "Pall Mall Gazette" for Nov. 30. Two of the central columns were occupied by advertisement articles, one headed "The Advance of Artificial Heating," and the other one "Up-to-Date Cooking by Electricity." Among the statements in the article dealing with gas heating is one which asserts that "of the amount of gas "purchased, only 18 per cent. actually heats; the re- "maining 82 per cent. disappears in fumes and carbon." Practically the same statement appears in the article on cooking; and in both instances it is maliciously defamatory. Then there is a quotation from the annual report of the Chief Inspector of Factories as to the percentage of carbonic acid found in workrooms said to be due to—not to the number of human beings congregated in ill-ventilated rooms, but to badly ventilated gas-stoves, or to gas-jets lighted for the purpose of raising the temperature of the rooms. This is a matter that was dealt with in our columns at the time of its publication. Further we read that "elec- "tricity in the bath-room is a rare acquisition; being far "better than fumes of gas or other heating." The points as to the small proportion of the heat of gas that is usefully employed and as to the contamination of the atmosphere are answerable by the reports on the gas-heating tests scientifically carried out at the Leeds University; and the columns of the "Pall Mall Gazette" are no doubt just as open to the Gas Publicity Committee for the circulation of the contradiction on the same terms as to the Electricity Publicity Committee for the dissemination of the slanderous statements. In the advertisement-article on cooking, "considera- "tion" is given to the "enormous advantage electricity as "a cooker has over gas;" and among the misleading statements are these: "There being no fumes, all the food re- "mains pure; and the cook is not subjected to the unpleasant "and poisonous gas associated with gas-stoves and coal "fires. . . . As the jets are necessarily placed at the bottom "of the gas-oven, and the heat ascends, all the food placed "within for cooking must necessarily become contaminated "with carbon." It would be interesting if the electrical people would favour us with more definite information on this point, in place of the vague and foolish statement. On the very same page of our evening contemporary there is an advertisement which declares that "Osram Lamps make "Electricity Cheaper than Gas."

Work for the Gas Publicity Committee presses in administering the antidote to the poisonous misrepresentations of (we take it these advertisements emanate from them) the Electricity Publicity Committee; and, bearing upon the advertisement articles to which attention is called, there are points as to the heating capacity of electricity and other matters on which information may be published in the cause of the propagation of useful knowledge among the electrically unenlightened section of the public. But if the slanderous work that is proceeding from the other side wants to be supplemented in order to stimulate the gas industry to prompt activity in these matters, perhaps it will be supplied by the information that, at a joint conference of London Electric Supply Authorities on Thursday last, it was decided to subscribe a substantial amount to the funds of the Electricity Publicity Committee, on a revenue basis, for the purpose of the development of a still more vigorous advertising programme. On the same occasion, a resolution was passed expressing appreciation of the work of the Committee; so that it is clear the electric supply authorities approve of a policy of circulating maliciously defamatory, untrue, and misleading statements concerning gas.

Gas Provisional Orders.

THE report of the Board of Trade on the Gas Provisional Orders of the past session is, as usual, of somewhat commonplace order; but its chief value lies in the confirmation of the current trend of gas legislation in all quarters. It is gratifying to find that so many non-statutory undertakings take advantage of the Gas and Water Works Facilities Act, 1870, to obtain parliamentary authorization; and the same thing will be happening in the next session. In the past session, of fifteen gas companies making application for powers, no less than nine were in respect of non-statutory concerns. Two of the Orders were withdrawn—Sudbury and Dunblane. Among the special clauses appearing in the Orders were an allowance of 4d. extra upon the price of gas in an extension of area obtained by the Swansea Gas Company; while in the Dinnington Order the price of gas for public lighting was limited to 3s. 6d.—the standard price, with sliding-scale, being 4s. The fixing of a maximum price for gas used for public lighting, or provision that gas so consumed shall be at no higher rate than the lowest price charged to any consumer for lighting purposes, is still occasionally seen—the old clause providing for the equivalent of the lowest charge without specifying purpose being one which, in these days of reduced charges for power and industrial purposes, and in some cases for heating, there is a greater desire to amend than to perpetuate or to adopt. Such a clause is out of sympathy with gas trading of the times. In all the Orders, but one, in which illuminating power is dealt with, 14-candle gas is prescribed, tested by the No. 2 burner—the exception being in the case of Sheffield, an arrangement having been arrived at there for a standard of 15 candles with the No. 2 burner. The former standard was 16½ candles. Another noticeable point is that in the Burnham and the Highbridge Orders, clauses are inserted relieving the undertakers from any obligation to supply gas to users of suction-gas plant, if and so long as, in the opinion of the undertakers, the giving of such a supply would interfere with, or jeopardize, the supply to other consumers.

Royal Assent.

In the House of Lords yesterday week, the Standard Burner Bills received the Royal Assent—and they deserved it. We do not recall any other privately promoted measures affecting the gas industry that have continuously taken a full year to pass from notice to Royal Assent, or the full life of a Parliament to reach their final stage; nor do we remember a privately promoted Gas Bill that has received such rancorous opposition on the part of local authorities as these from the beginning almost to the end, and towards the end vexatious tactics causing postponement. Through it all, the measures have come with flying colours. The crowning point of Royal Assent was therefore (as already remarked) richly deserved.

Representation in Parliament.

The main topic of interest at the moment for the country is the General Election; but, irrespective of politics, in these columns our only interest is in the members who have association with the gas industry. With his intimate knowledge, as a professionally trained gas engineer and as Chairman of the Ipswich Gas Company and Deputy-Chairman of the Tottenham Gas Company, Sir D. Ford Goddard is, to the industry, a useful member in the House. He did excellent work in debate in connection with the opposition to the Standard Burner Bills last session. Notwithstanding that he has been ill, and unable to participate as he would liked to have done in the fight, he has again been returned for Ipswich, in the Liberal interest, at the head of the poll; his majority being 484—practically the same as at the beginning of the year. We heartily congratulate Mr. Reginald J. N. Neville on his conspicuous success for the Unionist party at Wigan. He is a Director of the Brentford Gas Company, and has taken a large part at the Parliamentary Bar and in the Law Courts in work connected with the gas industry. We may confidently look for his support, should occasion require, in the House itself. As a gas administrator, he ardently espouses the causes of cheap gas and a progressive policy; and (as may be seen from the proceedings at the meeting of the Gaslight and Coke Company in February, 1909) he has strong sympathy with gas employees. He has made previous plucky fights, though unsuccessful, to gain a seat for the Unionist party. This time he has wrested the seat at Wigan from the Labour party by a majority of 563 votes; last January, meeting the same Labour candidate, he lost by 510. Mr. H. Pike Pease has regained Darlington for the Unionists, which seat he lost last January to his Radical opponent by only 29 votes. This time he has been returned by a majority of 406 votes, which is better than the majority he secured at the 1906 election (288). Mr. Will Thorne, Socialist and Secretary of the Gas Workers' Union, has been re-elected by the huge majority of 4688, about 200 less than eleven months ago, and 550, or thereabouts, less than in 1906. Mr. W. H. Cowan, a Director of Messrs. Parkinson and W. & B. Cowan, who at the last election secured the representation of East Aberdeenshire in the Liberal interest with a majority of 2638, is again contesting that seat; and Mr. A. P. Main, of Messrs. R. & A. Main, Limited, is once more seeking the support of the voters in the Tradeston Division of Glasgow in the Unionist interest. His opponent at the last election had a majority of only 193.

The Output of Coal.

Even in the present time of political strife, it is not to be imagined that so important a Blue-Book as that which deals with the annual output of coal in the United Kingdom would altogether escape public attention. Statistics relating to this vast mineral wealth of the country are assured of a due amount of study, both for their own sake and for that of the many useful deductions that can be drawn from them. With the latter task, we will not now busy ourselves; but a few of the outstanding features of the statistics for the year 1909 (some figures from which were reproduced in last week's issue, while others are being given to-day) may be noted. The period referred to is, of course, long past, and we are now almost at the close of another year; but the compilation of figures for Government returns is, as everyone knows, always a matter of time. In 1901, the output of coal in the United Kingdom was 219 million tons; and there was a yearly increase until 1907, when the record figure of nearly 268 million tons was reached. The following twelve months, however, witnessed a reduction to 261½ million tons. The present return shows that in 1909 the total output was upwards of 263¾ million tons which was an increase of some 2¼ million tons when compared with the preceding year. While, however, the output must thus be deemed to have been a satisfactory one, the colliery owners would probably have been far better pleased if the value at the pit had advanced in a corresponding degree. But this it did not do. On the contrary, the value of the 263¾ million tons is stated to have been £106,274,900, which, in spite of 2¼ million tons greater output, was a decrease of no less than £10,323,948 on the value of the output the preceding year. The drop in price was a considerable one; the average value at the pit's mouth being 8s. 0·7d. per ton in 1909, as compared with 8s. 11d. in 1908. In connection with this matter, it may perhaps be pointed out that, though the price of 8s. 0·7d. per ton in 1909 showed a substantial falling off when placed side by side with the 8s. 11d. of 1908, the average price at the pit as recently as 1906 was a good deal lower still, at 7s. 3½d. per ton. What became of all this coal that was raised last year? The quantity exported, exclusive of coke and manufactured fuel, and of coal shipped for the use of steamers engaged in foreign trade, was over 63 million tons, which was an increase of more than half-a-million tons on the exports the year before. Adding the 3¼ million tons exported in the form of coke and manufactured fuel, and the 19¾ million tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 86 million tons. Thus the amount of coal remaining for home consumption was 177¾ million tons, which represented 3·949 tons per head of the population—an amount which has been exceeded, and then only by a little, on but six occasions during the thirty-seven years over which the statistics extend. The lower price of coal last year did not, of course, apply merely to that consumed in this country; for we received about £4,500,000 less in respect of the exports than was the case in 1908, in spite of the fact that, as already stated, some half-a-million tons more coal was sent out of the country. It is set forth in the Blue-Book that during the past thirty-seven years (1873 to 1909) the value of the coal raised amounted to £2,467,976,000, or 82¾ per cent. of the total value of the minerals raised over this period in the United Kingdom. Of the output of 6,856,407,000 tons of coal which is represented by this sum, nearly 23 per cent. has been shipped abroad as exports in the form of coal, coke, and manufactured fuel, and as fuel used for steamers engaged in foreign trade.

Some Rating Statistics.

Our "Miscellaneous News" columns to-day bear testimony to the fact that we have received from Mr. James Carter, Borough Treasurer of Preston, a copy of his return for 1910-11 of the rates levied in certain towns, and various matters in connection therewith. This statistical compilation is one which we have often before noticed in our pages. In fact, it is stated that the present is the twenty-sixth annual statement of the kind that has been issued. But it has not always been of the same extent as at present. From time to time additions to the number of places included have been made, until now ninety-four towns and Metropolitan boroughs are dealt with—this, by the way, being the same number as last year. Both large and small places are included, with the idea of making the return as representative as possible; and the information furnished, in addition to the amount of the rates, includes the charges for gas, water, and electricity, and the profits and losses on municipal undertakings by which the rates in the particular towns referred to have been reduced or increased. And not merely in size, but in character also the towns selected vary. Some are known as trading and manufacturing centres, while others are seaside resorts and general residential districts. Looking down the list, it appears that the cases in which the rates levied for 1910-11 are less than those raised the previous year are very nearly equal in number to those in which the amount is higher. Dealing with the latest return, there are twelve places where the amount in the pound levied for rates is shown to be 9s. or over. This number compares with thirteen a year ago, and seven for the year before that. Norwich heads the list with 10s. 3d. in the pound; but as is generally the case the two "Hams" are well in the running—East Ham with 9s. 10d. and West Ham with 9s. 9d. This is an increase of 4d. for the year in the case of Norwich, and of 7d. in that of West Ham. There is, however, a falling off of 1d. in the amount levied in East Ham. The number of instances in which the rates amount to 8s. or more in the pound is 33 on the present occasion, as against 36 and 24 for the two immediately preceding years. The only places included in the list in which the rates are 5s. or less in the pound are Bournemouth (5s.) and Oxford (4s. 3d.). The latter place benefited to the extent of 7¾d. in the pound from "reproductive" undertakings; but Bournemouth experienced losses which increased the rates by 1d. In 17 of the places dealt with by Mr. Carter the price of gas is 2s. or under per 1000 cubic feet for domestic lighting purposes, as compared with 16 last year—the new comer being Oldham. Widnes occupies, as usual, the first place in regard to cheapness. For domestic lighting supply of electricity, two places in the list charge 6d. or more per B.T.U.; while in Lincoln the average charge is 2½d., in Ashton-under-Lyne it is 3d., in Wolverhampton the average is also 3d., and in West Ham there is a flat-rate of 3

Ten of the towns (as against twelve last year) relieve the rates to the extent of 1s. or more in the pound in consequence of the "rents of property and profits transferred from gas, water, markets, &c.;" but there is also a list—which includes 42 out of the 94 towns—of places in which deficiencies on municipal undertakings led to the rates being increased—in four cases by upwards of 1s. in the pound.

The Globe and the Light.

In technical circles into which the question of illumination wholly or partly intrudes, the subject of dioptrics is constantly being lifted to the surface; and it is never dropped again without something good being said as to Holophane globes, and deservedly, as if a globe ever had scientific consideration applied to its design above all others, this is the one. The principles are sound; the effects precisely those desired. But commercially the Holophane globe was before its time. There was not the extensive use for it in its early years that there is to-day. The metallic filament lamp has meant its commercial salvation on account of what Mr. W. M. Mordey, erstwhile the President of the Institution of Electrical Engineers, has described as the "whip-lash" on the eyes of that particular form of electric lamp. It is recognized by electrical engineers, physiologists, oculists, opticians, and others concerned that the glare of the concentrated intensity of metallic filaments is very harmful to the human eye; and the Holophane globe is just the thing to break down the glare, and render the light comfortable. Much has of late been written on the subject. Among others, the engineering contributor of the "Daily Telegraph" has had a turn at it. His view is that "the globes are simply indispensable for metallic filament lamps," for the purpose of diffusing light, so that the eye should never be dazzled even when looking towards the lamp. But, of course, these globes mean much extra expense, though, on the other hand, they do not absorb the light in the manner and to the extent of other globes. They are, however, less expensive than lighting by means of reflected light from lamps hidden along the cornice, as in the case of the lecture hall of the Institution of Electrical Engineers; this system having been, it will be remembered, adopted there solely in order that the eyes of members might not at their meetings be offended by the lamps, of the glare of which they say nothing to the public.

Liability for Damage to Street-Lamps.

Early this year, the Works Committee of the Stepney Borough Council called the attention of the Council to a communication received from the Town Clerk of Kensington to the effect that the Council of that borough were unable to recover a large proportion of the money expended on repairing damaged street-lamps, owing to the fact that they could not look to the owner of any vehicle causing the damage for the cost of repairing it, but only to the driver—he being the person responsible within the meaning of section 207 of the Metropolis Management Act, 1855. The Stepney Council resolved to support a request addressed by the Kensington Council to the London County Council that this authority would insert a clause in one of their General Powers Bills having for its object the amendment of the Act. The matter having been brought under the notice of the County Council, a resolution was passed by them sanctioning the promotion of legislation in the direction indicated; and it has been carried into effect in the Various Powers Bill of which the Council have given notice, some features of which were indicated in the "Journal" last week. The Council ask for the amendment of the Act named so as to provide that, in any case in which a vehicle causes damage to the property of the Council or any local authority in any street, the owner of such vehicle or the employer of the driver thereof shall be liable for any damage caused by it, "in addition to, or in place of, the driver."

The Latest Gas Undertakings Returns.—The returns relating to the authorized gas undertakings in the United Kingdom for the year ended Dec. 31, 1909, in the case of the Companies, and March 31 last for the Local Authorities, were issued yesterday. The principal totals will be found in another part of the "Journal;" and other statistics will be given next week, when opportunity will be taken for dealing with them in their entirety. Meanwhile, it may be mentioned that in the period named no less than £132,123,284 was employed, out of £154,500,093 authorized, in the supply of gas, of which nearly 177,687 million cubic feet were sold to 6,164,066 consumers and for use in 712,903 public lamps.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 739.)

The Stock Exchange had a bright and cheerful time last week on the whole, with perhaps the single exception of the American Market, which moved in response to special influences. The beneficent factors were the cheapening of money and sanguine expectations from the Unionist point of view regarding the elections. Business was not as brisk as it might have been; the settlement of the long account engaging much attention. The reopening on Monday partook of the cheerfulness which had marked the close of the previous week. Government stocks were quite firm, Rails active and rising, the Foreign Market showed strength, but Americans were weak. Tuesday was inactive; and some realization set prices back from their recent rise. But Government issues were firm, and Consols rose $\frac{1}{4}$. On Wednesday, fresh business was scarce; but the general tendency was excellent. Consols gained $\frac{3}{8}$, and several other of the choicest class advanced. Rails improved; and Foreigners were stronger. On Thursday, more activity and continued cheerfulness were apparent. Consols rose, and not even the weather could depress Rails. Friday relapsed into quietude; but the good tone was maintained spite of Friday realizations. Consols rose $\frac{1}{4}$, and the leading departments were stronger generally. On Saturday, the general buoyancy was slightly checked by a tendency to reaction after the liberal advances of the week; but movements were not considerable. The Money Market was easy; and on Thursday the Bank of England rate was reduced to $4\frac{1}{2}$ per cent. from the 5 per cent. rate which had lasted six weeks. Business in the Gas Market was a good deal quieter, owing, in some measure probably, to a shortness of stock. Changes in quotation therefore were exceedingly few in number; but they were all in the upward direction. In Gaslight and Coke issues, the ordinary was less dealt in than of late, but was very firm. One transaction was marked at $105\frac{3}{8}$, but the final price was $106\frac{1}{4}$—a rise of $\frac{3}{4}$. The secured issues were fairly active. The maximum changed hands at from 87 to $88\frac{1}{2}$, the preference at from $103\frac{3}{4}$ to $104\frac{1}{2}$, and the debenture at $80\frac{3}{4}$ and $81\frac{1}{2}$. South Metropolitan was little touched; and the old figures of $121\frac{1}{2}$ and $122\frac{1}{2}$ were unchanged. The debenture was dealt in at $81\frac{3}{8}$ and $81\frac{1}{2}$. Nothing at all was done in Commercials. Among the Suburban and Provincial group, Alliance and Dublin marked 97, British $44\frac{1}{4}$ free and $44\frac{5}{8}$, Bournemouth "B" $16\frac{1}{2}$, Brighton and Hove ordinary 159 to $160\frac{1}{2}$, Brentford new 189, and South Suburban $120\frac{1}{2}$. In the Continental companies, Imperial was stronger, and was done at from 185 special to $186\frac{1}{2}$ (a rise of 1), ditto debenture realized 95, European fully-paid $23\frac{3}{4}$ and 24, ditto part-paid $17\frac{7}{8}$. Among the undertakings of the remoter world, Cape Town preference changed hands at $4\frac{15}{16}$, Primitiva at from $7\frac{1}{4}$ to $7\frac{7}{16}$, and ditto preference at from $5\frac{3}{16}$ to $5\frac{5}{16}$.

ELECTRICITY SUPPLY MEMORANDA.

The Marylebone Réchauffé—That Comforting Term "Load-Factor"—Gas-Lamps Electrically Tested—Reconnoitring (?)—Conditions of Holborn Trials - Belief and Gibes—Want of Commercial Qualification—Hastings Workhouse Lighting.

Before the members of the Institution of Electrical Engineers, Mr. Haydn Harrison has been dilating upon the subject of "Street Lighting by Modern Electric Lamps;" and as is the way of most electricians, he has, in the most prominent part of his paper, made comparison with—not the modern, but early forms of incandescent gas-burner. Never on any occasion, within our recollection, has Mr. Harrison been guilty of transgressing the electrical rule never to say a good word for gas lighting; and, so far as we can trace, his tests of gas-lamps singularly enough never, or rarely, give the same results as those of equally reliable gas photometrists who we believe to be as honest as Mr. Harrison would himself claim to be. In this case, the paper was constructed in the same old partisan style. He told once more the story of street lighting in Marylebone with the "modern" metallic filament, and with anti-modern forms of incandescent gas-burner. There was nothing new in it; and it was because of that, that the story suited Mr. Harrison, and pleased his hearers. It is not very enchanting to electricians to hear what might have been in Marylebone if the lighting had been up for fair competition to-day; and it is not pleasant to them to remember that the inverted mantle has succeeded this year in retaining the street lighting in so many boroughs of London for a further contract period, notwithstanding the example of Marylebone, and has effected a brilliant show in the streets of Westminster. If Mr. Harrison—or rather some impartial illuminating engineer—had attempted to compare the "modern" metallic filament in Marylebone with the modern inverted gas-burner, he might have shown that Marylebone is not under the present change representative of the most economical and efficient means of street lighting. We may recommend to his notice a little exercise of our own in this connection, as published in the "Journal" for Sept. 13 last (p. 706).

But croaks the "Electrician," as it has croaked so often before, "there is good reason to think that prices given by the gas companies two years ago were on more commercial lines that those recently adopted in Westminster." If our contemporary studies

the prices quoted for low-pressure inverteds (and they now represent the bulk of the lighting in boroughs where the new contracts have been lately settled), it will find that the quotations in the several different districts for equal candle-power lamps run on similar lines; and does it really think it possible that a large trading concern like the Gaslight and Coke Company would take up the lighting of thousands upon thousands of street lamps in the manner done this year with a loss upon each? The extent of the business transactions entered into in this direction is a sufficient answer to the absurdity. The writer of the sentence quoted at the opening of this paragraph ought, possessing such sparkling business perception, to have no difficulty in securing a position with the Gaslight and Coke Company for the special purpose of keeping the commercial part of their business from deviating from correct lines and principles. Of course, it will have been noticed by our contemporary how gas prices are dropping in London through the greater manufacturing economies that have been discovered in change of methods; and it will be within its knowledge that the inverted gas-burner is more economical in consumption and upkeep than the vertical form of burner. But our contemporary goes on: "It cannot be said that the electric energy for street lighting is supplied at an unremunerative figure." How could anyone say such a thing! "The price charged is quite satisfactory," it proceeds to remark, "having regard to the load factor of the public lighting." To electricians there is as much comfort in the term "load-factor" as the old lady found hearing the "blessed word Mesopotamia." But while the electricians find the much-abused "load-factor" a refuge and help in the time of trouble, they cruelly deny the right of the gas industry to have any load-factor, or to even harbour any thought of such a thing. What is regarded as commercial in the matter of price for electricity supply is uncommercial in gas supply. "Heads I win, tails you lose," and "What is sauce for the goose is not sauce for the gander" are apt classical apothegms.

One point more on this occasion in reference to Mr. Harrison's paper on "modern" electric lamps, in which paper he, as already remarked, mixes up a good deal about gas-lamps, some of which are not "modern." He quotes again those much-cited figures of Professor J. T. Morris published two-and-a-half years ago regarding the variations he found, under conditions that are not clearly defined, in the illuminating power of the Keith inverted gas-lamp, which variations he attributed to differences in quality and pressure of gas. Mr. Harrison states that his own tests corroborate Professor Morris's findings; and he asserts that he has found a nominal 1500-candle power Keith lamp which showed between 720 and 780 candle power. Strange that this test should be absolutely uniform with one that was published by Professor Morris! Perhaps Mr. Harrison will tell us where this lamp was tested, when, and the pressure of the gas. The information will be in his possession as he knows that the consumption of this particular lamp was 23 cubic feet per hour; and we should like to be informed where a test can now be made of the same lamp. It will be remembered that—this was some two-and-a-half years ago—Professor Morris did not say there was any difficulty in getting the full nominal illuminating power of the lamps, under fairly constant conditions; and it would hardly be Mr. Harrison who would make the acknowledgment. As a matter of fact, ordinary pressure and calorific conditions in London have undergone considerable change with the incoming of the inverted lamp, the big extension in the use of gas heating, and penal testing for calorific power in the 100 square miles of the Gaslight Company's area. Used under their intended conditions, it must be that there are no gas-lamps that are subject to more uniform pressures than these high-pressure inverted gas-lamps. Whatever pressure they require can be delivered to them at will through the high-pressure mains; and the official calorific power tests at the London County Council testing-places dotted all over London vouch for an approximate uniformity in this regard—differences in the returns being insufficient to cause any material change in the illuminating power of a high-pressure lamp, worked at such pressures as are these Keith inverteds under ordinary circumstances.

If any value attached to Mr. Harrison's assertions as to only being able to secure 50 per cent. of the nominal illuminating power of these lamps in his tests, then the penal conditions attaching to the Westminster contract would place the Gaslight and Coke Company in a very serious position. But let any electrician who can or who will recognize truth when it is met with walk in Pall Mall and Regent Street, or in Fleet Street any evening, and say whether the lamps there are returning a duty 50 per cent. below their nominal designation. These lamps throw back the electrical absurdities in the teeth of those who make them. Against Mr. Harrison may be quoted the independent test made by Mr. J. F. Simmance of the illuminating power of one of the Aldwych trial lamps last August (see "JOURNAL," Aug. 9, p. 400), when he found the illuminating power of the lamp at 50° angle 3712 candles and at 20° 4288 candles, under pressure conditions there prevailing, for a three-burner gas-lamp. Mr. Simmance quotes the conditions of the test that were within his knowledge as a photometrist. The comparatively small difference between the candle-powers at the two angles is very striking; but the higher figure is at 20° from the horizontal. Mr. Harrison seems to have a preference for quoting for metallic filament lamps the candle power at angles of 10° and 20° from the horizontal, and the measurements give nearly double the value to the 10° rays as to the 20° ones. This is a large difference between two such close angles. On one occasion before, we remember Mr. Harrison talking of making a selection in his tests of the important rays. The idea is good. But for the 50° and 20° angles, Mr. Harrison will no doubt be delighted with the results found by Mr. Simmance, whose competence and knowledge as a photometrist is universally acknowledged, as was also his honesty until the latter-day illuminating saints descended into our midst, and began to study in their own pretty ways matters photometrical. But is it not time that Mr. Harrison and other electricians appreciated that that little ruse of theirs, of quoting Marylebone lighting past and present—old gas conditions with new electrical ones—is getting well understood by local authorities unattached to electricity undertakings, who are interested in learning what are the concrete facts regarding the new inverted gas-burners which are doing so well in London boroughs?

Touching that Gower Street trial lighting which is to offer the Holborn Borough Council some guidance in the matter of their street-lighting contract, the electricians will not be able to complain of any want of knowledge in their effort to win the prize. Sundry single and duplex inverted gas-burnered lamps had made their appearance in Gower Street early last week; and a band of young gentlemen were found making tests at various angles with the instrument placed a certain distance from the ground, and at different taped distances from the lamp-posts. The diligent operators were not recognized. Therefore the question naturally crosses the mind, were they from the Borough Council Office, or were they from the electrical camp reconnoitring to ascertain the candle-power of the lamps of their competitors? The electricians cannot complain that want of information killed their chances of success. They have before them the tender of the Gaslight and Coke Company.

The specification of the conditions on which the Gower Street trials are to be carried out has been issued by the Borough Surveyor of Holborn; and there does not seem to be a single point in them that commends itself to the electrical (would-be) dictators as represented by "Meteor" of the "Electrical Times." Nothing is right; and nothing would please but conditions defined entirely by electrical fancy to meet the special needs of the metallic filament lamp. Incidentally, "Meteor" makes out that the metallic filament lamp is a most awkward thing to which to apply reflectors to get light into the photometer at the Westminster angles—in short, the whole specification is thoroughly bad, vague, and arbitrary in the judgment (the qualified and expert judgment) of "Meteor." This is all the fearful, ire-raising specification amounts to: Each lamp is to give a maximum candle power of 300 candles, when measured by a Trotter photometer at the ground level. The reflectors are to be flat or slightly convex, and are to be placed horizontal. The candle power will be arrived at by taking the average of two sets of readings in any position with regard to the light under test—one set at an angle of 20°, and a second set at an angle of 50° to the horizontal. The tests are to be taken so that they are not interfered with by glazing-bars, and in reasonably clear weather—*i.e.*, not during rain, mist, or fog. Not less than three, and not more than six readings, at regular intervals of not less than 30 or more than 60 seconds, are to be made at each angle; and the average will be termed the illuminating power at that angle.

One of the little fads of the "Electrical Review" is to attack all who venture to talk of short-circuits and fusion of electric wires when there is an outbreak of fire. If there has ever been a single occasion on which that paper has not reared at the one or the other of the statements, then that is the only occasion or which it is believed by the estimable joint editors that electricity has really been the culprit. It has had a little poke at a provincia paper which, in reporting the destruction by fire the other week o the Wellingborough Music Hall, says: "Though it cannot actually be stated as a fact, it is believed the outbreak was due to th fusion of an electric wire." Following the protest regardin Wellingborough, there is another paragraph, which opens in thi effeminate style: "We do not question for a moment that all ga explosions are 'alarming,' for really they do give you a shock you know." Then the paragraph proceeds: "A Glasgow paper however, says that one of these 'alarming' events that occurre in that city last Friday [this would now be a little more than fortnight since] is believed to have been caused through a defec tive electric light fitting . . . melting a gas-supply pipe. Th Daily Press has a remarkable ability for believing some things. Now Mr. W. W. Lackie, the Corporation Electrical Engineer o Glasgow—unlike the "Electrical Review"—has never shown an disposition to minimize danger where he believes danger exists and he does regard this question of the fusing of gas-pipes b electric wires as a serious matter. We remember his repor that, between 1902 and 1908, 61 fires in Glasgow were due to de fective electric wires, several of which set up fusion of gas pipes. There is the case of a public man at Belfast who not lon since was suffocated by gas through the pipe-penetrating capacit of a leaky electric light wire. There was the case recorded i our "Correspondence" columns recently in which an explosio of gas was caused by a leaky electric meter being placed i proximity to a gas-meter. It is quite possible that the Glasgow reporter had more ground for his belief than the "Electrica Review" had for its gibe.

It has been matter for remark on previous occasions that ou electrical contemporaries appear to be very dissatisfied, generall speaking, with the type, or rather the accomplishments, of men a the head of the electricity supply undertakings of the country. repetition of the point cannot bring about a change, then th

fault will not be that of the electrical press. Commenting upon an address delivered by Mr. M. J. Railing, to the Birmingham Local Section of the Institution of Electrical Engineers, the "Electrician" says that "he is strongly convinced that one very important factor contributing to our set-back is that we still try to use both commercial and theoretical men as of old, whilst other countries have developed a type of man who combines the qualities of an engineer and of a commercial man in one. . . . The tendency of electrical engineers in this country to confine themselves to technical questions is, we think, continually being emphasized; one of the most striking instances being in connection with electricity supply. The engineering results of our undertakings compare most favourably with those achieved abroad; but in the method of developing the supply and obtaining consumers, we have something yet to learn." It must be very distasteful to electrical engineers to be constantly pilloried over their commercial disqualifications in the manner to which our electrical contemporaries are addicted. As we have said before, a little practical experience of the commercial difficulties of electrical engineers would make their accusers, if not sadder (that might not be possible), certainly wiser men.

In dealing with the question of the lighting of the Hastings Workhouse last week, there was an error in the figures, which rather spoilt the argument. The corrected figures are in the following passages: "Excluding capital expenditure, the annual charge for electricity is put at £190. Now the Gas Company have shown the rash haste of the Guardians in the matter by offering, if they are still enamoured of electric lighting and really wish to oust gas lighting, that they are prepared, for £160 per annum (subject to necessary agreement), to convert sufficient gas for the supply of the current necessary for the 486 lamps as per the Borough Electrical Engineer's list (see p. 555), though there is no wish, on the part of the Gas Company's technical advisers, to endorse the economical views of this gentleman as to the quantity of light required."

PERSONAL.

Mr. L. J. Hoyles, of Stratford-on-Avon, has been appointed Second Engineer of the Rosario Gas Company, Argentina, South America. Mr. Hoyles was for three years a pupil under Mr. W. G. S. Cranmer, the Manager to the Willenhall Gas Company; and for the last four-and-a-half years he has been Draughtsman and Assistant to Mr. Henry Fowler, the Gas and Chief Mechanical Engineer to the Midland Railway Company, Derby. Mr. Hoyles is a member of the Midland Junior Gas Engineering Association.

Mr. Maurice Graham has just been elected a Fellow of the Royal Geographical Society. He is about to leave England for an extended visit to the Continent; and soon after his return to London (about March next), he intends starting for a tour through South Africa and South America, visiting the principal cities and towns in both countries. On the completion of this second visit, Mr. Graham probably will have had more experience of the conditions of gas supply in parts far away from England than any other present-day engineer; and the knowledge he will gain in this way, coupled with his earlier career as a gas-works contractor, will stand him in good stead when eventually he settles down as a consulting engineer.

OBITUARY.

By the death last Thursday, at the age of 69, of the Right Hon. J. E. Ellis, the Scarborough Gas Company have lost a Director, and the House of Commons one of its most respected members. Mr. Ellis had been suffering from asthma, and, owing to the state of his health, was compelled to decline nomination for the Rushcliffe Division of Nottinghamshire (which he had represented for a quarter-of-a-century) for the present election.

Much regret has been expressed in Lancaster at the death at "The Ridleys," Wennington, of Mr. John Chapman Mount, who only retired from the position of Water Engineer and Borough Surveyor to the Lancaster Corporation two months ago, as was notified in the "Journal" at the time. Deceased served his articles with Mr. Cook, now the Water Engineer to the Fylde Water Board, and succeeded him when he left Lancaster in 1902. The Blea Tarn reservoir was constructed during his time. The deceased was 43 years of age; and he leaves a widow.

The death occurred recently, in his 83rd year, at his home in Brooklyn, of Dr. Henry Wurtz, a distinguished American chemist, who was at one time Editor of the "American Gaslight Journal." Pending the publication of a fuller notice of the deceased, our contemporary says of him he was "one of the old-school chemists, a man of erudition and high scholastic attainments, a contemporary and friend of Professors Hunt, Silliman, Dana, Hitchcock, and that brilliant set who in the early seventies electrified the chemical world with their seemingly iconoclastic outputs." He was Editor of the above-named paper in the interim between the death of Mr. Mills L. Callender and the accession of Major Dresser (1871 to 1875). At the beginning of the Civil War, Dr. Wurtz was Chemical Examiner in the United States Patent Office, as well as Professor of Chemistry in the National Medical College at Washington. He was the author of numerous scientific treatises.

THE LAST GAS EXAMINATIONS.

Report of the City and Guilds of London Institute.

We have received from the Superintendent of the Department of Technology of the City and Guilds of London Institute (Sir Philip Magnus) the report on the work of the department during the past session. We extract from it a few particulars as to the examinations in "Gas Engineering" and "Gas Supply."

First of all, as showing the extent of the work of the department, it may be mentioned that at the recent general examination in technology 24,508 candidates were presented from 418 centres in the United Kingdom; and 14,105 of them passed. By including the candidates from India and the Colonies, and those for the teachers' certificates in manual training and domestic economy, the total number of examinees was 26,878. These figures show an increase on those of any previous year. In order to secure the expert advice of trade societies and professional bodies in the conduct of the department's educational work, the Institute have arranged for the formation of several Advisory Committees, consisting of persons interested in different trades and industries, and possessing a full knowledge of their technical details. The functions of each Committee are to suggest improvement in the Institute's syllabus of instruction, to recommend new examiners for appointment, and generally to advise on any matter connected with the course of instruction or the examinations which may be referred to them. The Council of the Institution of Gas Engineers have consented to act as an Advisory Committee in the subjects of "Gas Engineering" and "Gas Supply." By the aid of these Committees, the Institute are enabled to promote useful relations between trade organizations and the schools in which artisans and others receive their technical instruction.

Coming to the general work of the department, we find that the number of subjects in which examinations were held last session was 75, compared with 73 before; and the number of separate classes was 4329, against 4021—the former figure being the highest on record. The number of students in attendance was 53,227, compared with 48,897. In the subjects of "Gas Engineering" and "Gas Supply," the number of students increased from 652 to 757; but that of the candidates decreased from 626 to 614. The programme for the session 1910-11 was issued in June, and was noticed in the "Journal" at the time.

Turning to the tables which give the results in the separate subjects, the report shows that in the two relating to gas there were 26 centres, with (as already mentioned) 757 students in attendance, compared with 22 and 652 before. The candidates numbered 304 in "Gas Engineering," and 310 in "Gas Supply," compared with 311 and 315 before. In the Honours grade, in the former subject, 43 passed in the first class, 39 in the second class, and 24 failed; while in the Ordinary grade the passes were 67 and 53 respectively, and the failures 78. There were consequently 202 passes and 102 failures, or 33·5 per cent. In the Honours grade in "Gas Supply," 23 candidates passed in the first class, 37 in the second, and 33 failed; while in the Ordinary grade 54 passed in the first class, 81 in the second, and 82 failed. There were thus 195 passes and 115 failures, or 37 per cent.

Of the total number of students in the two subjects, 3 of the 13 who attended classes at the Battersea Polytechnic passed in the Ordinary grade in "Gas Supply." At the Goldsmiths' College, out of 34 students in attendance, 13 were examined and 7 passed in the same subject—6 in the Ordinary and 1 in the Honours grade. From the classes at the Regent Street Polytechnic 40 students out of 54 were examined in "Gas Engineering" and 7 in "Gas Supply." Of the former, 20 passed in the Ordinary and 10 in the Honours grade. Of the 7 candidates examined in "Gas Supply," 2 passed in the Ordinary and 4 in the Honours grade. There were 6 candidates from the Woolwich Polytechnic examined in "Gas Engineering," and 3 passed in the Ordinary grade. From the various schools of the London County Council, out of 125 students in attendance at classes for "Gas Supply," only 20 were examined, and of these 6 passed in the Ordinary and 5 in the Honours grade—one being a prize winner. One candidate was examined at Lithgow (New South Wales) in "Gas Engineering" and another in "Gas Supply;" and they both passed in the Ordinary grade.

Reporting upon the work of the students in "Gas Engineering," the Examiner (Mr. Thomas Glover) says:

A general review of the results gives the impression that the knowledge of many candidates is too general. There is revealed an insufficient knowledge of detail; and in many cases the inability to make good sketches and proportionate drawings prevents candidates from expressing their knowledge in an acceptable manner. This was most evident, strange to say, in the Honours examination. Students would be well advised to take their "Machine Drawing" and "Mechanical Engineering" courses before sitting for the Honours "Gas Engineering" examination, and to accustom themselves to draw and sketch every important piece of apparatus in use on the works where they are employed.

There is distinct evidence that many of the candidates have been well taught; and the acquaintance with modern methods of chemical testing is quite gratifying. The formation of cyanide during the process of carbonization, and its subsequent washing-out from the gas, appears to be imperfectly understood; and the same may be said about the use of heavy charges of small coal and the modern practice of longer periods for carbonization.

It is of importance that candidates should answer the questions set

at the examination in as direct a manner as possible. Several candidates of evident ability obtained comparatively few marks by writing essays on one or two questions. Students employed on small works should take every opportunity of visiting larger works, and enlarge their outlook by diligently reading the Technical Press; and they would also gain in many ways by associating themselves with other students.

Mr. J. H. Brearley, the Examiner in "Gas Supply," reports as follows:

It is again necessary to refer to the great difference in the quality of the papers submitted. There are a large number of papers which show either very inefficient preparation or poor tuition. The scope of the syllabus is so wide that only candidates who work assiduously throughout the winter months can reasonably hope to pass in the first class. There is a gratifying reduction, however, in the number of students who have obtained less than 30 per cent. of the total possible marks. The number of candidates, too, who have attempted six questions or less in the Ordinary grade is smaller this year. The Honours students have shown a greater appreciation of the use of squared paper for plotting illumination curves. Many candidates waste time in writing matter which is not pertinent to the subject of the questions; and there were two or three instances where candidates did not follow the instructions as to answering only one of alternative questions.

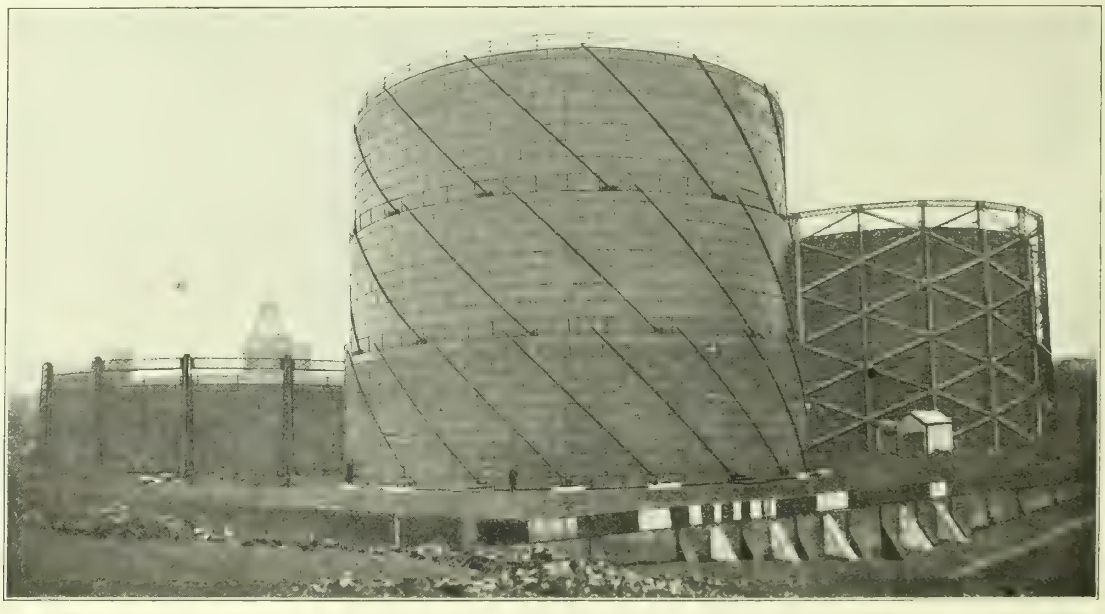
The questions in "Gas Supply," with the answers, were given in the last volume of the "JOURNAL" (pp. 29, 108, 186, 259). The names of the successful candidates in both subjects will be found in Vol. CX., pp. 776, 934, and Vol. CXI., pp. 21, 106, 174; and those of the prize winners in the issue for Aug. 2 (p. 317).

GASHOLDER EXTENSION AT TUNBRIDGE WELLS.

THE increasing demand for gas in the district supplied by the Tunbridge Wells Gas Company has recently made it imperative that the Company should extend the capacity of their gas storage plant. Some of our readers will remember that the works were erected about the year 1878, according to the designs of the late Mr. R. P. Spice, who was at that time the Company's Engineer. They included two single-lift gasholders, 112 feet in diameter by 30 ft. 6 in. high. The holders, as well as most of the apparatus on the works, were constructed by Messrs. S. Cutler and Sons, of Millwall; and, after consultation with this firm, the present Engineer (Mr. Andrew Dougall, M.Inst.C.E.) recommended his Directors to provide the additional storage required by transforming one of these single-lift holders into a three-lift telescopic holder of the following dimensions: Outer lift, 112 ft. by 30 ft. 6 in.; middle lift, 109 ft. 2 in. by 29 ft. 6 in.; inner lift, 106 ft. 5 in. by 30 ft. 2 in. The landing stones, not being long enough to take the three lifts, the middle lift is supported upon brackets attached to the outer lift, and the inner lift on brackets fixed to the middle lift.

On examination, it was found that the original holder could be utilized in the enlargement, as it was in excellent condition; and it was, therefore, determined to use the sides for the outer lift and the crown for the new inner lift. The existing guide-framing constructed for a single-lift holder was not at all suitable for extension; and it was decided to discard this framing altogether and adopt the spiral-guided system.

The work thus designed has been carried out in a most efficient manner by Messrs. Cutler and Sons; and in respect to many of its details, they have introduced special features peculiar to their manner of constructing spiral-guided gasholders. These include their patent arrangement for providing a flush and uninterrupted surface for the spiral rails to bear against. This device avoids the necessity for using narrow strips, with the accompanying necessary continuous lines of rivets, and making use of sheets of the ordinary dimensions corresponding to those in other parts of the holder—in this manner answering most satisfactorily. The guiding wheels also are fitted with Cutler's improved devices for adjustment. The successful working of this guiding apparatus was demonstrated when the holder was first inflated by air, which happened to be at the time of one of the strongest gales of the past season.



The New Spiral-Guided Gasholder at Tunbridge Wells.

The work has been carried out under conditions of exceptional difficulty, inasmuch as the water could not be removed from the tank. The erection of the two new lifts, therefore, together with the alteration of the existing work (including the requisite reduction in the diameter of the crown and the crown-framing), has all been carried out over the water; and this has been successfully accomplished without accident or mischance of any kind whatever—no doubt, largely due to the adequate and complete plant provided by the Contractors, and the skill, resourcefulness, and unremitting attention bestowed upon the work throughout.

On the invitation of the Directors of the Tunbridge Wells Gas Company, a number of representative residents visited the gas-works last Tuesday afternoon to witness the inauguration of the new holder referred to above, and also to inspect the Company's works. The visitors, on their arrival proceeded at once to the new holder, where the Chairman, Mr. W. H. Delves, J.P., amid applause, opened the outlet valve, thus allowing gas to pass out of the holder to the town for the first time. Afterwards three parties were formed for a general inspection of the works—Mr. Andrew Dougall, the Engineer and General Manager, and other officials acting as guides. Starting at the coal-stores, which have a capacity of 3500 tons, they proceeded to the retort-house, where the process of carbonization was fully explained. The plant consists of 240 retorts, capable of dealing with 150 tons of coal per 24 hours. The tar-extractor, naphthalene washer, condensers, scrubbers, and purifiers were then inspected in turn. The engine and exhauster room claimed a good deal of attention—especially the 50 H.P. engine and accumulator, which provide the hydraulic power for working the lifts, cranes, capstan for hauling trucks in and out of the railway siding, &c. The carburetted water-gas plant, which is in two sections, and will produce a million cubic feet of gas per 24 hours, aroused great interest. The sulphate of ammonia apparatus was also inspected. This plant turns out about 200 tons of sulphate of ammonia per annum, fully one-half of which is sold to local farmers. The parties then made their way to the laboratory, where the various chemical and physical tests were explained, for ascertaining the illuminating and calorific values of the gas, its purity, and the commercial value of the bye-products.

At the conclusion of the inspection, the party assembled in the Manager's office, and partook of light refreshments.

The CHAIRMAN, in a few remarks, after welcoming the party, traced the progress of the undertaking, which had, he said, now been brought by the developments of science to such a high state of efficiency. When the works were built in 1878, storage was provided for 580,000 cubic feet of gas; in the year 1889, this was increased to 1,220,000 cubic feet by the erection of a two-lift gasholder; and now the total storage had been brought up to 1,718,000 cubic feet by the construction of the new three-lift holder, which was capable of containing 788,000 feet, and, when fully inflated, reached a height of 85 feet. The Directors were perfectly satisfied with the way in which the Contractors (Messrs. Samuel Cutler and Sons, of Millwall) had performed their work, and complimented them upon the fact that it had all been carried out without any accident. Mr. Delves gave other particulars concerning

the Company—incidentally mentioning that, whereas the price of gas to the consumer was formerly 4s. 2d. per 1000 cubic feet, it was now 2s. 7d. He also said that the Company used 20,000 tons of coal per annum, and paid £12,000 in wages; alluding, in conclusion, to the co-partnership scheme which had been successfully introduced in connection with the employees, so as to encourage thrift.

Mr. Samuel Cutler remarked that it was about forty years ago that the Company first became their customers; and he would like to say that his firm had always received the greatest kindness and courtesy at their hands. The fact that they had now entrusted the present work to them was a great compliment—implying, as it did, that their previous work had been carried out satisfactorily. He thanked Mr. Delves for the appreciation that he had expressed, and he trusted that his firm would build them another similar holder at some future time. He would also like to express his warm obligations to Mr. Dougall for the assistance he had given them in carrying out the work. The conditions under which it had been done were abnormal; but the difficulties had been successfully surmounted, largely owing to his arrangements. Thanks were also due to the workmen for so carefully executing the work. As a souvenir of the occasion, he asked Mr. Delves's acceptance of an album which would contain photographs, &c., of the old and new arrangements.

Mr. Delves having briefly acknowledged the gift,

Mr. W. C. Cripps, on behalf of the visitors, returned thanks for the invitation, and for the opportunity of inspecting this most valuable and interesting undertaking, which, by the way, was almost a child of the Chairman. He remembered when the old gas-works were in the centre of the town, in 1878; and he was sure the citizens were proud of the fact that the Company had always grown and kept pace with the requirements of the town. The work, too, had been carried to a successful issue by local men and local capital. It had given the people an opportunity of investing their money, from which they had received a very fair remuneration. There was another undertaking in the town in which he was officially interested; but despite the fact that contests had naturally taken place between them, the two undertakings had got on well together. This was due, to a large extent, to the tact and good judgment of their Chairman, Mr. Delves. As far as the Gas Company was concerned, he believed it had a great future before it; and there was no reason whatever why it should not continue to be as successful as had hitherto been the case. He trusted, with them, that Mr. Delves and the others actively connected with it might be long spared to conduct its operations in the same admirable way in which they had been managed in the past.

Mr. Delves, in acknowledging the compliment, expressed his pleasure that they had been interested in looking through the works. The manufacture of gas had evolved from a rule-of-thumb method to a very scientific process; and those who had to do with it had to be chemists as well as engineers. He cordially reciprocated Mr. Cripps's remarks, and trusted that both undertakings would continue to live in harmony. He also trusted, with Mr. Cripps, that the Gas Company would continue to prosper; and he saw no reason why this should not be the case, because gas had become more popular than ever. There had, indeed, never been a year yet during the fifty years he had been connected with the Company that it had not made progress.

The company then separated.

RELATIVE EFFECTS OF GAS AND ELECTRIC LIGHT ON THE PURITY OF AIR.

By G. Stanley Cooper, B.Sc.

With the introduction of metallic filament lamps in electric lighting and the high-pressure system in gas lighting, competition between the two industries concerned has enormously increased. Supporters of both sides have advanced numerous arguments on behalf of their own system; and the question has been considered from many standpoints. Not by far the least important of these arguments is one which deals with the relative effects of the two systems of lighting from a health point of view; and in this article, what to the majority of readers will be a new side of the matter is opened up.

The electrician is continually telling us of the enormous advantages of electric light—its cheapness [?], handiness, and cleanliness. With regard to the last-named quality, coal gas is all that is evil. It is dirty and unwholesome; its products of combustion are harmful to human beings, furniture, &c., and render the air of a room foul. This fouling of the air is due to the production of carbon dioxide in large quantities by the burning of coal gas; and this is in itself a sufficient reason (to the electrical advertiser) to cast out gas and use electric light. The great increase in the number of gas-fires in recent years would not have been, were it not for the ignorance of the user.

It was in connection with the chemical side of the question—viz., the purity of air—that the investigation described in this article was undertaken. The results were so striking that the technical aspect was considered also and deemed worthy of publication. The experiments performed were: To find the amount of carbon dioxide present in a well-ventilated room—(A) when lighted by electricity and (B) when lighted by gas. It is essential, of course, to specify that the room should be ventilated scientifically—that is to say, the fresh air should have an inlet near the floor and the bad air an exit near the ceiling. It has also to be borne in mind: (1) That heated air rises; and (2) that carbon dioxide, though much heavier than air at the same temperature, is much lighter than air when there is a sufficient difference of temperature between them. In other words, carbon dioxide produced at a gas-burner is lighter than the surrounding air.

The experiments were performed in a room 14 feet long, 12 feet wide, and 12 feet high (approximately); having one door and two windows. It contained two grate ventilators—one 8 inches from the ground and the other the same distance from the ceiling—on opposite walls of the room. The lights used were a tantalum lamp and an upright incandescent gas-lamp of approximately the same candle power, as registered by a shadow photometer. The gas was obtained from a wall-bracket, so arranged that each light could in turn occupy almost identically the same position. Two operators were in the room the whole time; and as far as possible all conditions were kept equal for the two tests.

The room was closed for three hours in each case, and several bottles of air were then taken and analyzed. The air had been previously tested for carbon dioxide, and the amount noted. The method of estimation employed was the standard Pettenkofer method. The air to be tested was blown into a bottle of known capacity; and a quantity of barium hydrate (of known strength) was then introduced and the bottle immediately closed. It was shaken for some time, and any carbon dioxide present was absorbed by the barium hydrate, and precipitated as barium carbonate. A quantity of the liquid was then withdrawn from the bottle and titrated against standard oxalic acid. Two or three titrations were performed each time; and the mean amount of acid used was noted. From these results was calculated the percentage of carbon dioxide in the air.

The experiments were performed under the same conditions with both lights; and the results were as follows:—

Electric Light.	
Percentage of CO_2 at commencement	= ·064
,, ,, after three hours	= ·218
Net increase per cent.	= ·154
Gas Light.	
Percentage of CO_2 at commencement	= ·071
,, ,, after three hours	= ·203
Net increase per cent.	= ·132

The striking thing about the experiments is that there was actually less carbon dioxide in the room when gas was burning than when electric light was employed. This is perhaps due to the fact that an incandescent flame raises the temperature of the atmosphere around it much more than an electric light does. This being so, a better circulation of air in the room would necessarily follow, and hence the carbon dioxide would be more readily removed through the ventilator.

COAL STATISTICS FOR 1909.

In the last issue (p. 631) there were set forth some particulars in regard to the output and price of coal in the United Kingdom during the year 1909, taken from Part III. of the Home Office Report on Mines and Quarries. To-day, some other statistics in this Blue-Book may be noted.

The quantity of coal exported (exclusive of coke and patent fuel, and of coal shipped by steamers engaged in foreign trade) was 63,076,799 tons, as compared with 62,547,175 tons in the preceding year—an increase of about 500,000 tons. In 1907, the exports were 63,600,947 tons; and in 1906, 55,599,771 tons. The declared value of last year's exports of coal was £35,319,070, and of those of the preceding year £39,546,169. In addition to this, there was in 1909 the equivalent of 1,936,043 tons of coal exported in the shape of 1,161,626 tons of coke, and of 1,310,257 tons in the form of 1,455,842 tons of manufactured fuel. If to this be added the 19,713,907 tons of coal shipped for the use of steamers engaged in foreign trade, there is arrived at a total quantity of coal and coal equivalent shipped of 86,037,006 tons. The declared value of the exports of coke was £836,570, and of manufactured fuel £974,338. The coal equivalents are ascertained by assuming that for every 60 tons of coke exported, 100 tons of coal were consumed in its manufacture. The manufactured fuel exported is computed to contain 90 per cent. of coal; the remaining 10 per cent. consisting mainly of pitch.

Perhaps a moment may be spent in glancing at the list of countries to which this large quantity of coal was exported. Our three biggest customers are as in the preceding twelve months; and they occupied exactly the same relative positions. France took 10,408,010 tons of coal as such, of a value of £5,559,670; Germany, 9,671,992 tons, of a value of £4,548,987; Italy, 9,081,667 tons, of a value of £5,280,915. In the case of France and Italy, these figures would be increased by upwards of 200,000 tons by the inclusion of the coal equivalents taken in the shape of coke and manufactured fuel. The coal, as such, exported to these countries in the three immediately preceding years was as follows: 1908—France, 10,415,430 tons; Germany, 9,646,868 tons; and Italy, 8,742,634 tons. 1907—France, 10,694,136 tons; Germany, 10,107,877 tons; and Italy, 8,317,637 tons. 1906—France, 9,444,528 tons; Italy, 7,810,024 tons; and Germany, 7,629,653 tons. From these figures, it would seem that our exports to the countries named have not varied to any great extent during the past three years. Imports of "coal, culm, and cinders" into the United Kingdom—always of a totally insignificant character—are slightly more in the present statistics than was the case in 1908, though still a good deal below the quantity two years ago. In 1909, the total amount imported was 6318 tons, and the value £8297. For 1908, the tonnage was 3842, and the value £4689; and in 1907, there were 18,834 tons, of a value of £20,845. The Netherlands, with 2696 tons, were last year the largest contributors; the smallest being Hong Kong, with only 20 tons. After

meeting all the requirements from abroad, there remained, of the total output of 263,774,312 tons of coal, 177,737,306 tons for home consumption for all purposes; and reckoning the population of the United Kingdom at 45,005,833, this represented a quantity of 3·949 tons per head—an amount which has only been exceeded (and then by very little) on six occasions since 1873, the date of the first statistics. In 1908, the amount remaining for home consumption per head of the population was 3·956 tons.

Particulars in regard to the making of coke and briquettes, and the number of coking-ovens in use, during the year 1909 show that returns of production of coke were received from 161 colliery owners (comprising 233 separate works), 1436 gas-works, and 14 other owners of coke-ovens (comprising 15 works). The counties of Durham and York furnished 70 per cent. of the total quantity of coke made in coking-ovens; and 69 per cent. of the total number of ovens were being worked in these counties. Of the 248 works (other than gas-works) where coking plant is in use, bye-products were recovered last year at 71; the principal of the bye-products being sulphate of ammonia and tar. Returns as to the manufacture of briquettes were obtained from all firms known to be engaged in the industry; South Wales being by far the largest contributor in this respect. It is remarked in the Blue-Book that very fine slack which would otherwise be of little value commercially is employed in making briquettes. The total quantity of coal used in the manufacture of coke in 1909 is given as 34,514,573 tons; the total amount of coke obtained being 18,867,149 tons (7,370,598 tons from gas-works, and 11,496,551 tons from coke-ovens), of a value of £11,896,913. Of the gas-works output, 6,307,966 tons came from England, 134,068 tons from Wales, 773,526 tons from Scotland, 145,307 tons from Ireland, and 9731 tons from the Isle of Man. Of the 24,182 coke-ovens in use, 17,393 were of the beehive pattern; the second and third in order being: Coppée, 1959; and Simon-Carvés, 1143. Of Otto Hilgenstocks there were 948, of the Semet-Solvay pattern 842. There were produced 1,511,645 tons of briquettes, which were valued (selling price at place of manufacture) at £978,498.

Before leaving the Blue-Book, we may turn for a minute to some of the materials other than coal which are, or have been, embraced in the subject with which the report deals—namely, the mineral output, and exports and imports, of the United Kingdom. A substantial decrease is shown on the present occasion in the output and value of the bog ore taken from open workings in Ireland; the figures being 2676 tons, of a value at the open works of £669, as against 4295 tons, of a value of £1074, in 1908. During the period since 1880 (over which figures are given in the statistics), the greatest output was in the year 1891, when it was 16,075 tons, of a value of £8037. The output of iron ore last year was 14,979,979 tons, valued at £3,689,777. This was 51,046 tons less than in the preceding twelve months. During the year 1909, the Blue-Book tells us, the amount of natural gas obtained at Heathfield was 236,800 cubic feet, of which 81,850 cubic feet were used for lighting the local railway station, and the remaining 154,950 cubic feet were supplied to the East Sussex Gas and Water Company. It may be pointed out that in 1904 the quantity of natural gas obtained at this much-advertised spot in Sussex was 774,800 cubic feet; so that the business does not strike one as being of a growing character. The output of oil shale from mines and quarries in the United Kingdom during 1909 (all of which was from Scotland, with the exception of 40 tons from the county of Stafford) was 2,967,057 tons, of a value of £815,937; the figures for 1908 being 2,892,039 tons, of a value of £795,257. Since 1906, no petroleum has been obtained. Last year the imports of petroleum amounted to 358,102,867 gallons, of a value of £6,121,202, compared with 343,613,048 gallons, value £6,662,811, during the preceding year. The sources of supply were: Russia, 27,824,129 gallons; the United States, 268,532,909 gallons; and other countries, 61,745,829 gallons. Once more we see a falling off in the Russian supply, which, however, is more than counterbalanced by the greater quantity derived from the United States. The imports from Russia in 1904 amounted to 129,599,066 gallons, compared with the 27,824,129 gallons of last year. The value of imports during 1909 is given as: Russia, £535,792; the United States, £4,190,779; other countries, £1,394,631.

THE LATEST GAS UNDERTAKINGS RETURNS.

Official Figures as to Gas Supply.

The returns relating to the gas undertakings of the United Kingdom for the year ended Dec. 31, 1909, in the case of Companies, and March 31, 1910, for the Local Authorities, were issued yesterday—having been ordered for printing on the 15th of November only. The immediately preceding returns were published on the corresponding day last year; the order for printing having been given on the 4th of November. This, as readers are aware, is a great improvement on past years. The number of pages occupied by the returns is the same as before—101 pages for the Companies and 59 for the Local Authorities.

Information is furnished in reference to 794 undertakings this year, compared with 790 before. The new comers among the 501 Companies are Ammanford, Blackwood, Hayfield, Rainford, Tawe Valley, Woolmer, and Fermoy; but the Hailsham, Prestatyn, Wath-upon-Dearne, Western Valleys, and Ystalyfera Companies drop out. Among the 293 Local Authorities, there are two new comers—viz., the Risca Urban District Council and the Tayport Corporation. The total capital authorized (including other purposes than gas supply in certain cases) is given as £154,500,093, of which £132,123,284 has been paid up and borrowed. For the Local Authorities, the capital authorized is £46,474,744, and the amount borrowed £42,002,322. In the case of the Companies, the figures are: Amount authorized, £108,025,349, being £86,156,331 share and £21,869,018 loan capital; amount paid up and borrowed, £90,120,962. The receipts are: Companies, £19,951,779; Local Authorities, £10,398,263—a total of £30,350,042.

The statistics relating to working show that 15,225,320 tons of coal were carbonized; the quantity of gas produced being 193,547,394,000 cubic feet, of which 177,686,943,000 cubic feet were sold. The total make includes 23,625,186,000 cubic feet of water gas and 99,792 cubic feet of acetylene gas. The totals in the preceding returns were: Coals, 15,394,307 tons; gas made, 189,918,737,000 cubic feet; gas sold, 173,957,395,000 cubic feet; water gas made, 21,628,862,000 cubic feet; acetylene gas made, 93,500 cubic feet. At the date to which the latest returns were made up, there were 35,230 miles of mains in use to supply 6,164,066 consumers and 712,903 public lamps. The preceding figures were: Miles of mains, 34,490; gas consumers, 5,916,120; public lamps, 700,696.

Comparing the figures furnished by the present returns with those contained in similar returns for the previous nine years, it will be seen that the Companies show as follows:—

Year.	Share and Premium Capital Paid Up.	Loan Capital Issued.	Receipts.	Expenditure.
1900. . .	£59,638,877	£11,775,642	£17,638,963	£13,864,808
1901. . .	62,775,845	12,201,533	17,955,187	14,537,797
1902. . .	64,299,112	12,829,925	17,205,002	13,167,186
1903. . .	67,417,798	13,451,381	17,756,626	13,214,322
1904. . .	68,953,306	13,775,734	17,828,872	13,397,727
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369
1907. . .	73,152,891	14,645,271	19,567,336	14,884,982
1908. . .	74,328,645	14,944,060	20,013,159	15,475,933
1909. . .	74,952,664	15,168,298	19,951,779	15,097,658

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1900. . .	8,426,853	94,869,749,232	1,945,825	326,813
1901. . .	8,580,365	97,386,618,553	2,048,359	326,209
1902. . .	8,520,004	99,676,048,000	2,197,987	333,308
1903. . .	8,528,823	101,490,084,000	2,385,348	335,363
1904. . .	8,673,343	105,311,980,000	2,588,917	343,908
1905. . .	8,722,145	109,823,682,000	2,813,156	350,113
1906. . .	8,922,781	114,528,923,000	3,023,619	356,070
1907. . .	9,240,280	118,699,705,000	3,230,993	362,986
1908. . .	9,281,738	119,985,109,000	3,399,193	367,950
1909. . .	9,175,532	122,930,431,000*	3,573,796	369,882

* Including 18,345,916,000 cubic feet of water gas. Number of cubic feet sold, 112,331,153,000.

The somewhat similar figures for the Local Authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1900-01 .	£31,509,701	£9,121,418	£7,463,693	£1,353,259	£400,802
1901-02 .	34,045,442	9,300,567	7,630,856	1,467,232	414,001
1902-03 .	35,738,023	9,554,984	7,215,502	1,584,985	793,764
1903-04 .	37,103,279	9,819,685	7,182,008	1,700,405	967,194
1904-05 .	38,512,295	9,546,682	7,052,474	1,738,682	790,450
1905-06 .	39,401,896	9,636,107	7,085,710	1,799,094	798,210
1906-07 .	40,089,167	9,843,243	7,211,987	1,843,122	832,341
1907-08 .	40,712,159	10,500,416	7,839,122	1,882,427	827,454
1908-09 .	41,435,988	10,506,480	7,998,776	1,905,810	659,445
1909-10 .	42,002,322	10,398,263	7,710,985	1,970,241	767,961

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1900-01. .	5,479,435	57,138,062,255	1,767,464	278,343
1901-02. .	5,522,264	59,300,273,086	1,872,633	287,887
1902-03. .	5,589,215	60,902,739,000	1,970,738	294,828
1903-04. .	5,673,013	62,717,759,000	1,945,777	301,308
1904-05. .	5,622,259	63,335,696,000	2,148,260	310,275
1905-06. .	5,758,180	65,081,109,000	2,250,919	315,678
1906-07. .	5,923,476	67,312,153,000	2,339,014	321,910
1907-08. .	6,166,473	69,786,988,000	2,434,183	327,278
1908-09. .	6,112,569	69,933,629,000	2,516,027	332,716
1909-10. .	6,049,788	70,616,963,000*	2,590,270	343,021

* Including 5,279,272,000 cubic feet of water gas and 99,792 cubic feet of acetylene gas. Number of cubic feet consumed, 65,352,790,000.

The returns furnish, as usual, particulars in regard to the nature and quantity of materials other than coal used for the manufacture of gas, and also give the percentages of carburetted water gas mixed with the coal gas sent out for consumption. These statistics will be dealt with next week.

CARBONIZATION.

By Dr. Harold G. Colman.

[A Lecture delivered at the Manchester University last Saturday.]

The subject on which I have been asked to lecture to-day—namely, "Carbonization"—is so wide in extent that it is impossible within the limits of a lecture to consider the matter exhaustively. I therefore propose to confine myself chiefly to its chemical aspects, although it will be admitted that the mechanical and economical aspects are of the utmost importance, and that for a full consideration of this, as of all other technical subjects, each of these sides ought to be given due weight.

Coal Carbonization and the Results.

The term carbonization is employed technically as representing the process involved in the destructive distillation of carbonaceous matter for the production from it of combustible gas, coke, and liquid products. The gas is the primary product aimed at in the gas industry, the remainder being bye-products; while in the coke-oven industry the coke is the primary product required, and the gas a bye-product. The aim of those who are concerned with the manufacture and distribution of a public supply of gas, capable of being employed for the production of light, heat, or power, is to carry out the distillation of coal in such a manner as to obtain from it, at low cost, in the form of combustible gas, the maximum proportion of heat units present in the coal, with the proviso that this gas shall only contain a limited quantity of inert gases, and that, so far as practicable, it shall be of uniform composition and calorific power. The illuminating power of the gas when burnt in open flames, which was formerly the matter of greatest import, is now only of minor concern, owing to the adoption of the incandescent burner and the great development in the use of such gas for purposes of heating, cooking, and power production.

The changes which take place when coal is heated in the absence of air are, as is well known, exceedingly complicated in character, and result in the production of many thousands of different substances—some gaseous, some liquid, and some solid at the ordinary temperature; and both the nature of these substances and their relative amounts vary greatly according to the temperature to which the coal is heated, and to the manner in which the heat is applied. Our knowledge of the nature of the reactions occurring during the process is still very far indeed from complete; and it is only possible as yet to consider these changes in very broad outline from a chemical point of view.

Gas-Making Coals.

Coal consists essentially of carbon, hydrogen, and oxygen; but it always contains, in addition, varying quantities of ash, and smaller amounts of nitrogen and sulphur. For gas-making purposes, bituminous caking coal is employed in the great majority of cases—*i.e.*, a coal yielding a large proportion of gas, and which, on heating, first becomes semi-fused and plastic and coalesces, and then undergoes carbonization, in which case the coke produced is quite different in shape from that of the original coal; such coke commanding a higher price than that obtained from non-caking coal. In the coke industry, where the coke is the primary (and not a bye) product, it is even more important that the coal used should have good caking properties.

The following analysis expresses the elementary composition of a sample of gas coal of good quality:—

Carbon	80·10 per cent.
Hydrogen	4·88 ,,
Oxygen	8·89 ,,
Nitrogen	1·24 ,,
Sulphur	1·16 ,,
Ash	3·73 ,,

Action of Heat on Coal.

In considering the action of heat on coal, it will be convenient to deal first with the carbon and hydrogen only (these being the most important constituents from the gas-making point of view), and to leave the consideration of the fate of the other elements until later. When coal is heated above its decomposition point in closed vessels, it splits up into two portions—(1) a solid non-volatile portion, and (2) a volatile portion, partly liquid and partly gaseous at the ordinary temperature. It is an invariable rule that the volatile portion, as a whole, contains more hydrogen and less carbon than the original coal, and that the reverse is the case with the solid residue. When the temperature employed is the lowest at which decomposition of the coal occurs (about 300°-400° C., or 570°-750° Fahr.), it is found that the volatile portion consists mainly of hydrocarbons which are liquid at the ordinary temperature, and only a small yield of rich gas is obtained, consisting mainly of methane (CH_4), ethane (C_2H_6), and ethylene (C_2H_4), with small quantities of hydrogen. The liquid products consist chiefly of hydrocarbons of the paraffin and ethylene series, and of their derivatives—that is, of organic substances relatively rich in hydrogen.

The residue obtained in such a case still contains a good deal of hydrogen, and burns in the air with production of flame, but not of smoke. Where the chief product required is a residue of this kind containing hydrogen, or where the tar is the product of greatest value, as in the Scotch shale-oil industry, low temperatures such as this may be advantageous; but where gas is the first consideration, the yield of gas, although high in calorific power, is relatively very small in volume, and for such purpose higher temperatures must be employed. It should, however, be said that Professor Armstrong, in his paper read before the British Association this last autumn, advocated low temperature carbonization even from the gas-making point of view; but I am quite unable to agree with him in this respect, particularly from a mechanical and economical standpoint.

What Goes on in the Retort.

When the retort is heated to a greater extent, the coal charged into it only rises in temperature gradually, and first undergoes the above low temperature decomposition. The further action of the heat then brings about new changes, both in the above hydrogen-containing residue and in the volatile matter first produced; and although these changes are taking place simultaneously, it is most convenient to consider them separately. The effect of further heat on the low-temperature coke is to eliminate further quantities of hydrogen, which at a dull, red heat is mostly evolved as methane and free hydrogen. At such a temperature a considerable additional quantity of hydrogen is given off, and the coke becomes harder and denser. But even then the elimination of hydrogen is incomplete, and on raising the temperature to the highest attainable in practice, an additional yield of gas is obtained, still consisting of methane and hydrogen. But as the temperature increases, the amount of methane falls and that of hydrogen rises. It follows, therefore, that the higher the temperature to which the residual coke is finally heated, the greater is the yield of combustible gas.

Let us turn now to the further action of heat on the volatile products first evolved, which, as mentioned above, are of but little use to the gas maker, consisting largely of the vapours of petroleum-like hydrocarbons. When the retort is more highly heated—say, to dull redness—these petroleum-like products undergo further decompositions if they are subjected to the action of the heat before they can escape from the retort, yielding a still more volatile portion, consisting of substances which are gases at the ordinary temperature; the most important of these being hydrogen, methane, ethylene, and benzene. The latter, it is true, is a liquid at the ordinary temperature; but it is so volatile that most of it remains in the gas.

On the other hand, simultaneously with the formation of these gases, the petroleum-like products yield many substances that are less volatile than themselves, consisting of hydrocarbons of the aromatic series, such as benzene, naphthalene, anthracene, and their derivatives, which contain a higher percentage of carbon and a lower percentage of hydrogen than is present in the substances from which they are formed. These are liquids at the ordinary temperature, or, if solid (like naphthalene and anthracene), are soluble in the other liquids and condense together as a moderately fluid tar in the subsequent cooling of the gas. By subjecting the primary volatile products to such a temperature, therefore, the yield of permanent gas is largely increased, and that of the tar diminished, and the latter now consists chiefly of aromatic, instead of fatty, organic derivatives—making the tar of especial value for the coal-tar colour industry.

If, however, the volatile products are subjected to still higher temperatures before escaping from the retort—such as a bright red or white heat—further decompositions takeplace, which, on the whole, are by no means favourable to the production of gas. The tar vapours of the aromatic series undergo further decomposition into still denser hydrocarbons, and a gas consisting mainly of hydrogen; and many of the new hydrocarbons formed are solid even at a red heat, and are quite insoluble in the remaining liquid tar. These are partly deposited on the heated walls as "carbon" or "scurf," and are partly carried away with the hot gas as finely-divided particles, and separate on cooling with the tar, making this much more viscous even when hot. Further, even the gaseous compounds undergo additional decomposition; the benzene undergoing partial conversion into hydrogen and denser hydrocarbons, the ethylene yielding some hydrogen and methane, as well as tarry matter, and even the more stable methane undergoes partial decomposition into its elements hydrogen and carbon.

The Maximum Yield.

The chemical considerations, therefore, lead to the conclusion that while, in order to obtain the maximum yield of gas from coal, it is advisable to subject the latter finally to as high a temperature as possible, so as to drive off the volatile matter as completely as may be, the gases and vapours produced in the distillation should only be subjected to a considerably lower temperature than that to which the coke is eventually heated, as too high a temperature results in the separation of carbon, which would otherwise have remained in the gas—thus depreciating both its calorific and its illuminating power. On the other hand, it is equally evident that these volatile products must not be subjected to too low a temperature; for in that case the hydrocarbons, &c., produced in the early stages of distillation would not be sufficiently decomposed, and would be lost from a gas-making standpoint—being condensed in the tar.

Fate of other Constituents.

Now let us consider the fate of the other constituents of the coal during carbonization—oxygen, nitrogen, and sulphur. The ash, of course, remains in the coke, and need not be further considered here. Oxygen is present in considerable amount in the coal-substance; and the coal as used also always contains either

moisture in the free state or in such a loose state of combination that it is given off at temperatures below 100° C.—the amount varying usually from 1 to 4 per cent. The oxygen in the coal substance is probably evolved in the early stages to a considerable extent as volatile compounds of carbon, hydrogen, and oxygen; and these, on further heating, are largely decomposed, forming steam, carbonic oxide, and carbon dioxide. As the temperature rises, the carbon dioxide tends to combine more and more with the red-hot carbon present, undergoing reduction to carbonic oxide; and the steam tends also to act on the carbon, with production of water gas. The higher the temperature to which the gases are heated, more especially while in contact with the coke, the greater is the amount of carbonic oxide formed, and the higher also the amount of steam converted into water gas. Some of the oxygen is found in the tar as compounds with carbon and hydrogen, such as phenol; but the bulk of it remains as steam, which condenses out on cooling, and, roughly, about one-fourth is found in the gas as oxides of carbon.

The effect on the nitrogen is similar to that on the hydrogen. At very low temperatures some ammonia is given off, and also substances containing carbon, hydrogen, and nitrogen, which condense in the tar; while a large proportion of the nitrogen remains in the residue. At higher, but still moderate, temperatures, much more nitrogen is given off from the coal, and the above volatile products are largely broken up, with the formation of ammonia and some free nitrogen; and at such temperatures the maximum yield of ammonia is obtained. At still higher temperatures, more nitrogen is evolved from the coke; but the ammonia itself is largely decomposed into its elements, nitrogen and hydrogen, and also reacts with the hot carbon, producing hydrocyanic acid; and, in spite of the more complete elimination of the nitrogen from the coke, the yield of ammonia is decreased. Some of the nitrogen is also found in the tar, chiefly in the form of nitrogenous bases, such as pyridine.

The sulphur, too, probably comes off first as compounds with carbon and hydrogen; and these, when more strongly heated, yield sulphuretted hydrogen, which can be removed from the gas without much difficulty. At still higher temperatures, however, the decomposition of these volatile organic sulphur compounds takes place, with formation of larger quantities of carbon bisulphide; this compound being also produced, but probably in much smaller amount, in the gases last driven off from the coke, due to the sulphur still remaining in the latter. The high temperature, especially if allowed to act fully on the volatile products, therefore tends to considerably increase the amount of this impurity, which can only be removed with difficulty.

Both with regard to sulphur and nitrogen, therefore, as well as in the case of the hydrocarbons, it is desirable that the volatile products themselves shall only be heated to a moderate temperature if a maximum yield of the valuable product (ammonia) and a minimum yield of the deleterious impurity (carbon bisulphide) are to be obtained. In the case of the oxygen compounds alone does there appear to be any advantage in subjecting the products to a high temperature, owing to the larger proportion of carbonic oxide and the smaller proportion of carbon dioxide produced, as well as to the larger amount of steam converted into combustible gas. On the whole, the advantages gained in the latter respect are more than counterbalanced by the deleterious action of such high temperatures so far as the hydrocarbons and the nitrogen and sulphur compounds are concerned.

Synthetic Results.

Thus far, the formation of new compounds by decomposition has been mainly considered; and there is no doubt that these changes are the most important. But, in addition, formation of fresh compounds by synthesis from two or more of the products of decomposition also occurs; and a large number of the tar constituents are doubtless produced in this way. So far as the gaseous products are concerned, the formation of carbon monoxide by the action of the dioxide on carbon and the synthesis of water gas within the retort have already been referred to; but, in addition, there is the possibility that methane may also be produced to some extent in the retort, not only by decomposition, but also by synthesis from hydrogen and carbonic oxide in accordance with the equation: $CO + 3H_2 = CH_4 + H_2O$. It is known that this reaction takes place to some extent under certain conditions of temperature in contact with certain substances. For instance, it occurs to a very considerable extent when the above mixture of gases is passed over metallic nickel at 300° C.; but very little investigation has been made of the extent to which such a reaction does, or can be made to, take place in the retort. There is evidence that this synthesis does occur in some degree in the retort; and in view of the fact that methane is the most important of the constituents of the gas, further work on this point is desirable.

From Theory to Practice.

Bearing in mind these theoretical considerations, we may now consider the manner in which the changes take place in the carbonization of coal in the various types of apparatus commonly employed. In the gas industry, except in its very earliest stages and again in recent years, carbonization has almost always been carried out in long, narrow retorts, set horizontally, or at an angle of about 32° to the horizontal, into which the coal is charged all at once in such a manner as to cover fairly evenly the whole of the bottom of the retort, and leave a considerable free space above the coal for the full length of the retort, through which the gas must pass in order to reach the exit pipe or pipes provided at one or both ends. In the main, the nature and the sequence of the chemical changes are identical both in the horizontal and the inclined retort.

The carbonization commences on the outside of the mass—namely, at the bottom and sides—where it is in contact with the heated retort wall, and also at the top, where it is affected by the heat radiated through the free space from the hot crown of the retort. The coal on the outside first becomes pasty and agglomerates, and then undergoes the low temperature decomposition already described; the resultant vapours and rich gas escaping fairly readily into the free space above the coal. Here they are subjected to the further action of heat in two ways—namely, by contact with the heated walls of the retorts, and also by the action of the radiant heat rays which are traversing the free space. The late Mr. William Young pointed out that the action of these two forms of heat is different. In general, the heated surface appears to act fairly equally on all constituents; but the radiant heat has a selective action, and most readily decomposes the molecules which absorb such heat most readily. While this is in itself probably true, recent experience appears to indicate that the extent of the difference is less than Mr. Young believed, and that its influence in practical working is not of very great importance. Whatever is the exact relative effect of the two forms, the net result of their combined action is to raise the temperature of the vapours passing through the free space, and to bring about much change; and the higher the temperature to which the retort walls are heated, the greater is the amount of further decomposition they undergo.

The further action of heat on the pasty mass on the outside of the charge converts this eventually into coke—heat passing simultaneously further into the charge and converting the layer below into the pasty condition, which is assisted by the condensation on these lower layers of some of the tarry matters formed by the decomposition of the hotter layers above; and the extent to which such condensation occurs doubtless has much influence on the physical properties of the resulting coke. This sequence of changes continues until the heat has penetrated to the centre of the mass, and effected its complete carbonization. After the first layer of hot coke has been formed, the gases produced from the interior of the charge, in order to escape from the retort, must not only undergo the ordeal of heat in passing through the free space, but must also pass through the hot layer of coke on the outside of the charge; and the temperature and area of this coke mass constantly increase as time goes on. Further, as carbonization proceeds, the rate at which the gas is evolved decreases, and in consequence its speed through the free space becomes less, and it is exposed to heat there for a greater length of time. From all these causes, the quality of the gas falls off after the first hour, and especially when the carbonization is approaching completion. The percentages of methane, ethylene, benzene, sulphuretted hydrogen, and carbon dioxide steadily diminish as time progresses; that of hydrogen steadily increases; while that of carbonic oxide varies less considerably.

Low Temperatures v. High Temperatures.

Before the introduction of gaseous firing, the retort temperatures obtained in practice did not usually exceed about 900° C., or 1650° Fahr. Under these conditions, the volatile products were not materially overheated, and gas of high illuminating power was produced; while the tar simultaneously formed was fairly fluid, and only contained moderate amounts of the objectionable "free carbon." The quantity of naphthalene formed was also not excessive, and that of "light oils" simultaneously produced was in most cases sufficient to wash the naphthalene out of the gas during condensation to a sufficient extent to prevent its subsequent deposition in the solid state in the mains and services. On the other hand, under these conditions a relatively low yield of gas per ton is obtained, as an appreciable quantity of volatile matter is left in the coke.

When, with the aid of gaseous firing, higher carbonization temperatures were employed, matters were considerably modified, as the volatile matter of the coal was more completely evolved with the production of a greater volume of gas. But, as we have seen it follows inevitably that, in a horizontal or inclined retort havin a large free space above the coal, the volatile products must als be more strongly heated by an increase in the retort tempera ture; and, as a result, we find that, under these conditions, th gases and vapours undergo a more far-reaching decompositio than before, and a reduction in the quality of the gas is brough about. Some of the hydrocarbons formerly present in the ga are now deposited in solid or liquid form, which either remain i the retort as carbon or are condensed with the tar, and are los from a gas-making point of view. Simultaneously other disadvan tageous changes occur, inasmuch as the tar produced is thicke and contains much more "free carbon," thereby increasing th trouble from stopped ascension-pipes and pitched hydraulic main and greatly increasing the practical difficulties of retort-hous working. Further, the action of these high temperatures on th volatile products increases the production of naphthalene an decreases that of light oils, and renders the cooled gas much mor liable to deposit solid naphthalene in the mains and services bot on the works and in the district, causing serious trouble both t supplier and consumer.

In spite of these last-named drawbacks, the use of higher ten peratures has, on the whole, proved favourable; the increase

yield obtained from the more complete elimination of the volatile matter of the coal having more than counterbalanced these disadvantages. But even admitting that in the employment of high carbonization temperatures, the advantages more than balance the disadvantages, the fact remains that there are considerable objections to the process as it stands, and that it is desirable to find a method whereby the coal itself can be heated to a high temperature without simultaneously causing too great heating of the volatile products; and it is largely with a view to this end that modifications of methods of working have been introduced during the past few years.

Advantages of the Smaller Free Space.

From what has been said, it is clear that one of the chief causes of the overheating of the gases and vapours is the existence of a large free space above the coal in the retort. So long as the coke had to be extracted by a rake, worked either by hand or mechanically, a considerable amount of free space was necessary in order to afford room for the introduction of the rake-head above the coke. But the invention of mechanically propelled pushers, which discharge the coke by pushing from one end of the retort, has done away with the necessity of the free space for the removal of the coke, and has made it possible to put in a much larger charge of coal without increasing the difficulties of discharging the latter. In recent years, therefore, by the introduction of such increased charges, the amount of free space has, in many works, been largely reduced in horizontal retorts, so that the gases and vapours are exposed to a smaller amount of retort surface, and, still more important, owing to the volume of the free space being smaller, they pass through it more quickly, and are exposed to the action of the heat for a shorter time. As the practical result, it is found that the coke produced is larger, a thinner tar containing less free carbon is produced (owing to the lessened over-heating), less carbon bisulphide is produced, less trouble from naphthalene ensues, and retort-house working is considerably facilitated. Whether the total heat value of the gas obtained from a ton of coal—*i.e.*, gas per ton × calorific power—is greater than can be obtained with the smaller charges, is a matter on which different opinions prevail at present.

On the other hand, owing to the increased thickness of the charge, a longer period must be allowed for its carbonization if the central core is to be completely carbonized; and beyond a certain weight of charge, varying apparently with different classes of coal, the gas production per retort per twenty-four hours falls off, or can only be maintained by increasing the carbonization temperature above that employed with the smaller charges. Such higher temperatures also increase the heat to which the gases are exposed in the free space. But experience seems to show that the effect of such increase is small when the volume of free space is low; in other words that, in bringing about the decomposition of the volatile products, the time during which the gas is exposed to heat is much more important than is the temperature of the retort walls.

Carbonizing in Retorts on End.

But, while the amount of free space can be greatly reduced in this manner, it is scarcely practicable to get rid of the free space altogether in horizontal retorts. If, however, the retort is placed in a vertical instead of a horizontal position, this is readily effected; as, in the nature of things, the coal when charged in from the top must completely fill the retort. Although a small amount of free space may be left at the top, matters can be so arranged that the retort walls at this point are not heated to any material extent. Hence during the past few years carbonization in vertical retorts has been attempted to a considerable extent, and is now practised in a large number of works.

Two methods of working such vertical retorts are in use. In the first, or the intermittent, method, represented by the Dessau system, due to Dr. Julius Bueb, the old system of carbonization is adhered to in so far that the coal is charged into the retort all at once and is allowed to remain there until completely carbonized, when the coke is discharged by gravity and the retort refilled with fresh coal. To facilitate the discharge of the coke, the retort is tapered, increasing in size from the top to the bottom; and as the charge is thicker at the latter point, a higher temperature is maintained at this part, with a lower temperature in the upper portions, where the thickness of the charge is less. The result of this arrangement is that with high carbonization temperatures a large yield of gas of good calorific power is obtained; the tar formed being very fluid, and only containing a low percentage of free carbon. At the same time the naphthalene produced is less; and the light oil production is such that the naphthalene is sufficiently removed by the ordinary condensation process without requiring any special subsequent treatment, and the amount of sulphur obtained in the objectionable form of carbon bisulphide is greatly diminished. The coke is also harder and denser.

Passage of Gas through Charge in Dessau Verticals.

In spite, therefore, of very high retort temperatures, the objectionable overheating which occurs under these conditions with horizontal retorts with much free space above the coal, is obviated in these vertical retorts. This is due very largely to the abolition of the free space; but, in addition, other conditions come into play. In the horizontal retorts, after a layer of incandescent coke has been formed on the outside of the charge, all gas produced from the unaltered coal in the centre of the charge must find its way out through this incandescent layer, and thus be subjected to considerable heat. In the intermittent vertical retort, the carbonization also takes place from the periphery inwards; and a layer of incandescent coke is in the early stages formed on the outside. Here, however, the gas produced from the still uncarbonized coal at the centre has two possible paths of escape—namely, on the one hand, through the hot-coke layer, and, on the other, through the central core of uncarbonized or partly carbonized coal which extends to the top of the retort; and such of the gas as travels in this manner would avoid the overheating by the hot-coke layer. Dr. Bueb holds the view that the great bulk of the gas travels through the cool central core; but with this hypothesis, I am unable to agree fully.

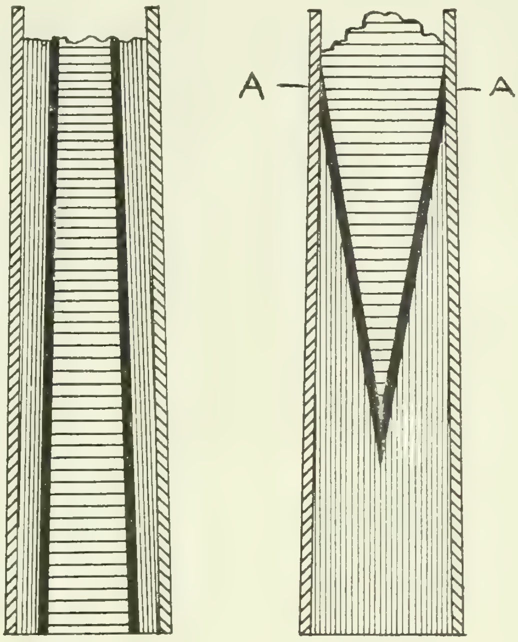


Fig. 1. Fig. 2.

Retort Wall shown by Diagonal Lines.
Coal ,, Horizontal Lines.
Coke ,, Vertical Lines.
Pasty Layer ,, Thick Black Line.

In fig. 1 is represented, by a sectional diagram, the condition of affairs which most likely prevails in such a vertical retort when carbonization is partly completed. The heat, penetrating the coal from the periphery, has converted the outer layers into coke, represented by vertical shading; and this is followed by a layer of coal which has assumed a pasty condition, denoted by a thick black line, where some of the tarry constituents formed by the carbonization of the outer layer have also condensed. Beyond this is the central core of uncarbonized coal, represented by horizontal shading. The pasty layer forms a boundary between the coke on the one hand, and the uncarbonized coal on the other, and, owing to its condition, will only with difficulty permit of the passage of gas through it. It would therefore seem probable that any gas produced at or beyond the outer side of this layer will find its easiest passage through the coke; while the gas formed on its inner side will most readily pass up the central core of uncarbonized coal. The determination of the actual proportions of the gas travelling in each of these directions is very difficult, if not impossible; and at present, without some experimental evidence, any estimate of this can only be a hypothesis. But my own view is that probably half the gas finds its way through the coke. On the other hand, the gas produced on the inner side of the pasty layer is the richest and most susceptible to heat; and it is more important that this portion should not be too unduly heated.

Continuous Systems of Working.

In the continuous vertical retorts, which have been chiefly worked out in this country, and are represented at present by the Woodall-Duckham and Glover-West systems, the object aimed at is not only to abolish the heated free space above the coal, but also to render the carbonization process a continuous one by the addition of mechanical arrangements whereby the coke is withdrawn continuously, or nearly so, from the bottom of the retort—fresh coal being added to the retort at the top to take the place of the coke removed. Here the conditions of carbonization remain fairly constant, and the quality of gas produced is approximately uniform, instead of falling off as the carbonization becomes more complete. The condition of things prevailing in this retort remains therefore always nearly the same, and is represented diagrammatically in fig. 2. Here, also, the heat penetrates the mass of coal from the periphery and travels inwards; but as the charge is constantly moving downwards, the uncarbonized coal takes the form of an inverted cone, as shown by the horizontal shading. In this case, too, we have, between the more or less completely carbonized coke and the unaltered coal, a pasty layer, indicated by a thick black line. The gas produced on the outside of this layer, together with that still evolved from the coke, most likely finds its easiest way through the coke to the point A.

If the pasty layer adheres closely to the retort wall at this point, the gas would have difficulty in escaping to the exit-pipe at the top of the retort; but the constant motion of the mass downwards tends to prevent too close adherence, and allows the gas to pass through. The gas formed on the inside of the pasty layer finds its most ready exit through the uncarbonized coal.

Vertical Retort Heating.

In working such retorts, higher temperatures are usually maintained around the upper portions than around the lower end; whereas the reverse is the case with the Dessau vertical retort. But although the retort walls may be hotter at the top, the temperature within the retort is always lowest there, owing to the cooling action of the cold coal coming in. With these continuous retorts, the temperature of carbonization may be very high, and a complete elimination of the volatile matter of the coal obtained without excessive overheating of the volatile products; and, as in the case of the intermittent vertical retorts, the tar produced is thin with a low content of "free carbon," no naphthalene trouble occurs with the gas after condensation, and the carbon bisulphide production is reduced, while at the same time a high yield of gas of good calorific power is obtained.

Large-Scale Charges.

Lastly, brief consideration must be given to the conditions prevailing when the charge of coal is much larger than is the case when retorts are employed, as in coke-ovens, where coke is the primary product desired, and in the somewhat smaller carbonizing chambers now employed for gas-making purposes in many instances, especially in Germany. In these ovens or chambers, the coal is charged in such a manner that the mass to be carbonized lies in a block, from 14 to 20 inches thick, between two strongly heated vertical walls; the length of the mass being as much as 20 feet, and the depth about 8 feet in the case of coke-ovens. The heat is applied to the charge from the side walls only; and it slowly penetrates from each side to the centre of the mass. The sequence of changes is very similar to that occurring in the intermittent vertical retort; coke forming first on the outside of the mass where it is in contact with the hot walls, a layer of coal in the pasty condition coming next, and finally, the uncarbonized coal in the centre. In both cases, too, there is no highly heated free space above the coal. The most important difference is that, owing to the much greater bulk of the charge, the ratio of heating surface to the weight of charge is much smaller than is the case with retorts, and in consequence the rate of carbonization is much slower.

So far as the coke produced is concerned, the effect of this slower rate is to give a denser and harder coke; but where the coal used is of the same quality and size as employed in retorts (which is usually the case with chambers for gas production) the end results, so far as quality and quantity of gas, tar, and ammonia are concerned, do not, according to the published results, appear to be very materially different from those obtained in vertical retorts. The relative advantages and disadvantages of chambers and retorts lie rather in connection with the capital and working costs and in questions as to the desirability of such large carbonizing units as these chambers for making a uniform quality of gas and adjusting the output to the seasonal variation in the requirements for a public supply of gas; and these points it is not possible to discuss this afternoon.

In the case of coke-ovens, where the gas is mostly a secondary consideration, conditions differ in another respect, as, in addition to the requirement that the coke produced must be hard enough for all metallurgical purposes, it is also desired to utilize in its production the slack obtained in mining the coal, which has a lower commercial value than the larger coal. This slack is now usually washed to remove impurities, and when charged into the ovens lies in a close mass, with very small interstitial spaces between the coal fragments, and is sometimes further specially compressed; and, in addition, it contains 10 per cent. or more of moisture. While the result of these factors is to improve the quality of the coke produced, the gas, as it is formed, has greater difficulty in escaping from the centre of the charge, and the volume produced is usually lower, although of good calorific power, excepting where it is diluted by the drawing in of considerable amounts of furnace gas and air.

GAS CALORIMETRY IN THE UNITED STATES.

The American Gas Institute Report.

At this year's meeting of the American Gas Institute, a report of the "Committee on Calorimetry" was read by Mr. John B. Klumpp, who it will be remembered was the author of a paper on the subject presented to the meeting of the Institution of Gas Engineers last June. The report is as follows.

During the last two years your Committee undertook an investigation of the subject of gas calorimetry, with the view of ascertaining the best commercial methods for obtaining the calorific value of city illuminating gas. With this object in view, they obtained calorimeters of the prevailing makes then in use by the gas companies and other gas industries, and undertook to determine the efficiency and general utility value of these instruments. The reports, submitted by your Committees in 1908 and 1909, described in detail the line of investigation undertaken, and the results obtained; and up to this time we have no further knowledge that would tend to modify our conclusions. These conclusions were, briefly, that calorimeters of the water-heater or Junkers type were best suited for our commercial practice; and, when operated under certain prescribed directions, they should give results that could be accepted as the relative calorific value of any gas.

The object of continuing this Committee was for the purpose of investigating any further development in gas calorimetry, as several instrument makers signified their intention to manufacture gas calorimeters differing in principle and design from those now in use. Therefore, it has been the task of your Committee to keep posted in this line of work—not to recommend or condemn, but to advise members of the Institute as to a type of calorimeter best suited for use in the gas industry.

Unfortunately, several very interesting types of instruments were received as late as the first week in September, but the time has been too short for us to conduct experiments that could be presented in full at this meeting.

Professor S. W. Parr, of the University of Illinois, concluded during the past year some experimental work upon the Junkers calorimeter, and submitted the results of his work to the American Chemical Society. His article on the subject was published in the September number of the "Journal of Industrial and Engineering Chemistry." He claims that the Junkers calorimeter gives results too low by from 1 to 4 per cent., when operated with circulating water of the same temperature as that of the air, which he determined by burning pure hydrogen in the calorimeter. These figures are not in accord with the experiments of Hugo Junkers, or of Dr. Immenkotter, and do not agree with our efficiency tests. Professor Parr claims that the errors are due to atmospheric humidity and radiation; and your Committee are not ready to accept his criticisms without further investigation.

Professor Parr has submitted to us a calorimeter of his own design, depending upon the comparison of the unknown gas to be measured with hydrogen of assumed heating value.* This instrument is a duplex calorimeter—one side burning the city gas, while the other side burns the hydrogen. The ratio of the heating value of the gases is determined; and this factor is used to give the value to the unknown gas being measured.

The American Meter Company have produced a gas calorimeter of the same general design and specifications as the Junkers. This instrument is modified, however, so as to have the thermometers on the same level, and is supplied with a gas meter of its own make and a balance for weighing the circulating water. This instrument, with its accessories, is constructed in accordance with the recommendations of your Committee.

The Junkers Company, of Dessau, Germany, have also modified their calorimeter, producing a later instrument with the water thermometers on the same level. The entire outfit is arranged similarly to the original Junkers, although the interior of the calorimeter proper is slightly altered, and the arrangement of the exterior connections somewhat changed. They have also produced a recording calorimeter, mounted in a cabinet, which maintains an even ratio between the gas and water supplied, and records the difference in temperature of the inlet and outlet water, electrically. This instrument is somewhat elaborate, and requires careful adjustment and supervision. But in the larger works it could be made to give very satisfactory results.

During the month of September we received, for experimental purposes, a Doherty calorimeter, from the Improved Equipment Company, of New York—an instrument of the water-heater type, with gas measured by water displacement, the water at the same time being used for jacketing purposes. This instrument is undergoing tests, the results of which are not as yet completed.

We have received word from several other parties who were about completing calorimeters, or have them in view, pending the granting of patents, or completion of design, and who up to the present time have been unable to submit instruments to us. They include the Rotary Meter Company, and Dr. C. E. Lucke, of Columbia College.

While not engaged in active experimental work this year, owing to the lack of instruments to work with, we have consulted with various members of the Gas Institute for the purpose of receiving information in regard to the practice of others, and have in addition been called in consultation with several State Gas Associations, and the Engineers of State Commissions, and have endeavoured to assist and advise in matters pertaining to the correct reading of calorific value of commercial city gas.

Your Committee have been asked by several members of the Institute for concise directions for operating a gas calorimeter, and they refer to the directions in the Calorimeter Report of the "Proceedings of the Institute" for 1908, which go into considerable detail. The 1909 report gives further specifications, especially to thermometers to be recommended for measuring the temperature of the water, which should be graduated preferably from 60° to 110°, instead of 65° to 115°, as stated.

While not in a position at this time to present the results of our experimental work on new calorimeters, we are endeavouring to obtain unbiassed and correct data on such calorimeters as appear on the market; and if our Committee are continued for another year, we will attempt to collect further information for the Institute.

* The calorimeter here referred to was illustrated and described in the "Journal" for Oct. 18, p. 205. It is the subject of a patent applied for in England by Professor Parr, on Jan. 18 last.—Ed. J.G.L.

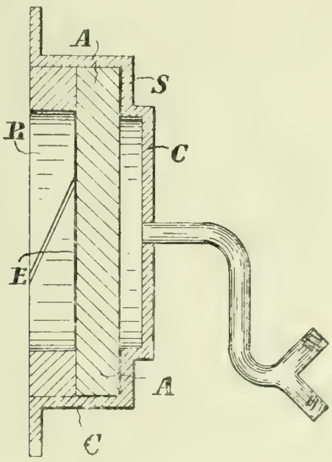
THE COMBUSTION OF GASEOUS FUEL.

The Bone, Wilson, and M'Court Patents.

Last week, specifications were issued by the Patent Office relating to the first two of a series of inventions for which protection was sought by Professor W. A. Bone, of Leeds University, Mr. James W. Wilson (Wilsons and Mathiesons), of Leeds, and Mr. C. D. M'Court, of Balham. The importance of the specifications issued—for patents No. 25,808, Nov. 9, 1909, and No. 29,430, Dec. 16, 1909—justify fuller abstracts than would be allowable in our usual "Register of Patents."

Patent No. 25,808; Nov. 9, 1909.

The first invention referred to relates to apparatus for burning an explosive mixture of two or more gases or vapours which combine together to produce heat—called the "combustible mixture" (such, for instance, as a mixture of coal gas and air, with air in the proportions necessary for complete combustion, or slightly in excess); the objects being to obtain complete combustion and also utilize as much as possible of the heat for any desired purpose. The purposes to which the apparatus may be applied "are numerous, and include gas-fires of various kinds."



The illustration represents a simple form of what may be described as the "fundamental unit" of the apparatus. It consists essentially of a permeable diaphragm A, of sufficiently refractory material, in conjunction with a chamber or casing C. The diaphragm constitutes one wall of the chamber, into which combustible mixture is led through a pipe or pipes. The mixture passes through the diaphragm, and is caused to ignite on the face of the exit E, or in close proximity thereto. For instance, a combustible mixture of coal gas and air in proper proportions and at various pressures (examples of which are afterwards given) may be used for many household and industrial purposes. The supply of gas and air in proper portions is regulated by ordinary means, so that the combustion may take place substantially within the surface layer E of the diaphragm A. The regulation of the supply of the mixture having been adjusted, the face of the diaphragm becomes hot or incandescent, and is maintained in this state by the continued flow of the combustible mixture through the porous diaphragm, and its combustion within its surface layer. The flow can be regulated so that little or no flame appears beyond the surface of the diaphragm while the surface is maintained in a state of glow or incandescence.

With regard to the combustible mixture, the proportions of the combining gases will be substantially the proportions necessary for complete combustion. In general, with coal gas, the patentees prefer to employ a little excess of air. For example, in the case of a coal gas (which theoretically requires about $5\frac{1}{2}$ times its own volume of air for complete combustion) they have obtained good results with about 7 times its own volume of air.

The joint between the diaphragm A and its seating S may be white lead, asbestos paste, or other suitable luting material; and a ring R, or an angle ring, may be used to secure the diaphragm in position. The margin of the diaphragm may be glazed so as to prevent escape of gas through its edges—"no claim being made to this feature except in so far as it affects our particular combination." The diaphragm may be arranged in various ways, depending on the object in view. In some cases more than one diaphragm may be employed. Thus for grilling or toasting purposes, two diaphragms may be arranged opposite one another, and the article to be treated placed between them, so that both sides may be acted on at once. Where plane diaphragms are employed, they may be placed horizontally, vertically, or at any desired angle; and the heated external surface may be either the superior or inferior surface.

In some cases, instead of using plane diaphragms, they employ dome-shaped or cylindrical diaphragms, or diaphragms of other special forms suited to special purposes. It should be noted, however, that where there is, with any particular mixture of gases, a tendency to heat the diaphragm so much as to cause firing-back, the arrangement must be such as to utilize or convey away the heat with sufficient rapidity to prevent such firing-back. For instance, in using water gas there is always a tendency to fire-back; but this may be in a large measure counteracted by employing diaphragms of a closer or less permeable texture, so as to produce a steeper pressure-gradient in the diaphragm—thereby increasing the velocity of flow of the combustible mixture through the diaphragm. Accordingly, it is desirable in any given case to select from a series of diaphragms of different permeabilities the diaphragm which on trial is found to be sufficiently impervious to prevent firing-back under the given conditions. Also the tendency to fire-back may be checked by mixing a larger proportion of inert gas or air with the combustible mixture. Further, where there is risk of firing-back the progressive accumulation of heat in a confined space must be avoided. On the other hand, when using poor gases—as, for example, blast-furnace gas—the production of the glow or incandescence depends on conserving a certain amount of the heat on the surface of the diaphragm.

It should be noted that in the apparatus, though the products of combustion necessarily pass away in a heated condition, and thus carry off some of the heat generated, the arrangement described enables the user, when desired, to reduce the convective heat outflow and to utilize a large proportion of the heat in radiant form by radiation from the surface of the heated diaphragm, which for some applications of the invention is a matter of importance.

The diaphragms may be produced from various materials, either separately or in combination, and may vary considerably in their nature, shape, and construction (examples are hereafter specified). But other constructions in the nature of a diaphragm may be adopted, so long as they enable a mixture of gases or the like on burning to produce within the surface of the medium a combustion with little or no flame.

In the production of the diaphragms, the refractory materials employed are combined so as to give the desired degree of porosity and permeability somewhat in the manner usual in the production of porous refractory blocks. Materials of a nature to burn out and leave pores or interstices may be combined with refractory materials—for example, the patentees have used mixtures of fire-clay with fine seed, bran, and (or) spongy plumbago produced by acting on Ceylon flake plumbago with strong fuming nitric acid and applying heat.

In some cases, two or more diaphragms of differing degrees of permeability or porosity may be combined; such diaphragms being formed into one or superimposed—the more porous diaphragm being that which is on the side of exit of the gaseous mixture. Similarly, granules of refractory material may be spread over a slightly pervious fire-clay diaphragm; the granules forming the side or surface of exit for the combustible mixture.

The degree of porosity will be determined by the quantity of organic material employed. In general, it is preferred to employ fine seed for this purpose, as being a material the individual grains of which are substantially of the same size and shape. The patentees find that rape seed is specially suitable for this purpose. The proportions will vary somewhat with the nature of the clay employed—some clays being by nature when burnt more porous than others; and in every case it is necessary to determine by trial the proper proportions for producing a desired degree of porosity. But the examples given serve to indicate in some measure the nature of the mixtures which are found suitable in practice.

In making diaphragms suitable for working with coal gas and air at a pressure of 6 inches water-gauge, they mix 18 parts by weight of powdered Stourbridge fire-clay in the dry state with 8 parts by weight of English rape seed, and mix therewith sufficient water to render the mixture suitable for moulding. It will be found that the plasticity of the mixture becomes rapidly lost on standing, owing to the absorption of the water by the dry seed. Only sufficient of the mixture should be made to suit immediate requirements; and the diaphragms should be moulded immediately after the mixture is made, and before it has lost its plasticity. To obviate in part the loss of plasticity mentioned, the rape seed may be steeped in water prior to mixing with the clay. The moulded diaphragms are carefully dried, baked, and burned in an oxidizing atmosphere, so as to ensure the complete burning out of the seed. After burning, the surface of the diaphragm which is to form the heated surface is preferably roughened with a rasp, sand blast, or by other means; or both surfaces of the diaphragm may be roughened.

By employing the proportions mentioned, diaphragms have been made which, when $\frac{3}{4}$ inch thick, are able, at a pressure of 6 inches water-gauge, to admit of a flow per square inch of heating surface of 6·4 cubic feet per hour of a gaseous mixture consisting of one volume of gas with six or seven volumes of air.

By employing a mixture consisting of 18 parts by weight of dry, powdered Stourbridge fire-clay with 12 parts by weight of English rape seed, diaphragms have been made which, when $\frac{3}{4}$ inch thick, admit of the same gaseous flow at a pressure of 1 inch water-gauge.

Another method of making porous diaphragms consists in consolidating a mass of granules or fragments of refractory material in such a manner as to leave pores or interstices throughout the mass. For example, burnt fire-clay coarsely ground (and preferably meshed to a uniform size), mized with a powder adapted to act as a cementing material, when highly heated, may be moulded in the form of diaphragm required, and burned. Thus, for working at a pressure of about $\frac{1}{4}$ inch water-gauge, with a mixture of

coal gas and air, the grade of fragments employed is that which passes through a sieve of eight meshes to the linear inch, but will not pass a sieve of sixteen meshes. These fragments are wetted, mixed with one-tenth their weight of finely-ground felspar, and moulded into the form of diaphragm required; slight pressure only being used to give the diaphragm the desired configuration, and burnt at a temperature of 1300° or 1400° C. A series of such diaphragms, made with differing degrees of fineness, can be used to determine which is the best grade to use for any particular gaseous mixture.

The patentees conclude their specification by saying: We are aware that it has been proposed to construct burners in which a mixture of gas and air is passed through a body of porous refractory material in close proximity to a flame, but separated therefrom by a mantle of loose refractory material or by a perforated plate; and they claim: (1) Apparatus for the burning of an explosive mixture of gases arranged so that a regulated flow of the explosive mixture through a porous diaphragm can be maintained in such wise that combustion takes place substantially within the outer surface layer of the diaphragm, which outer surface layer is thereby maintained in a state of incandescence. (2) The combination of a permeable refractory diaphragm with a suitable chamber and means of regulation, so that an explosive mixture of gases may be burned substantially without flame within the surface layer of exit of the diaphragm. (3) In apparatus as claimed in Claim 1 a porous diaphragm made by mixing a plastic refractory substance, such as fire-clay, with a suitable oxidizable material such as rape-seed, moulding to the desired shape, and firing substantially as described. (4) In apparatus as claimed in Claim 1 a porous diaphragm made by crushing and grading a suitable refractory solid material such as burnt fire-clay, and consolidating it into a porous mass. (5) In apparatus as claimed in Claim 1 a porous diaphragm made as in Claim 3 or Claim 4, and having its edges rendered impervious to gases by glazing or its equivalent.

Patent No. 29,430; Dec. 16, 1909.

This invention relates to means for utilizing the accelerating influence of an incandescent solid upon gaseous combustion (such means being a development of patent No. 25,808 *supra*) in such a way as to enable a large proportion of the heat of combustion to be utilized at a high temperature—in a space which is more or less enclosed—in a variety of furnaces applicable to a number of industrial or laboratory operations.

A mixture of combustible gas or vapour—*e.g.*, coal gas—and air or the like in proper proportions is introduced through a suitable passage or passages at a velocity greater than the speed of ignition of the mixture, into a bed of refractory granular material of suitable texture in which it is burnt. Combustion of the mixture takes place in the bed around (on or in) the granules, thus maintaining the bed in a state of incandescence. This bed, part of which thus constitutes the seat of an intense combustion, may be disposed around, or in proximity to, the retort, muffle, chamber, or body to be heated, in such a manner as to produce the desired heat distribution. The bed of refractory material is enclosed or retained in position by an outer shell or walls of refractory material of low heat conductivity; the shell or walls being of sufficient thickness (or suitably lagged, or in some cases provided with stagnant air cavities) to give efficient heat insulation.

A feature of the invention is that it is well adapted for the combustion of a large variety of combustible gases—for example, blast-furnace gas, producer gas, water gas, coke-oven gas, coal gas, petrol air gas, and natural gas—although the temperature attainable in any particular case will naturally depend upon the calorific value of the gas employed. The invention lends itself to a variety of applications—for example, it may be employed in the construction of tube furnaces, muffle or retort furnaces, crucible furnaces, sagger furnaces, furnaces adapted to annealing operations, and for the heating of chambers and bodies in general.

In fig. 1 is shown a laboratory furnace for producing high temperatures. The furnace body is constructed of a sufficiently refractory material—such as fire-clay, calcined magnesite, or bauxite—and provided at the bottom with a hole to receive an iron pipe D for the supply of gaseous mixture. The end of the pipe terminates sufficiently far from the bed of granular material to prevent the pipe becoming unduly heated. On the branches of the pipe are two valves F for the regulation of the air and gas

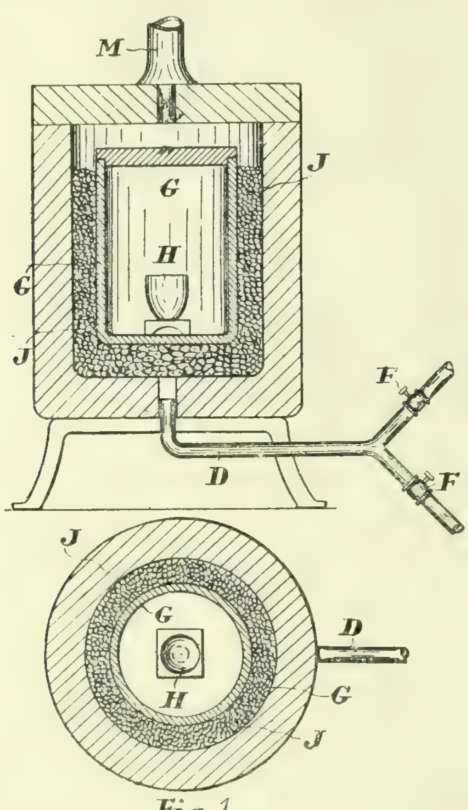


Fig. 1.

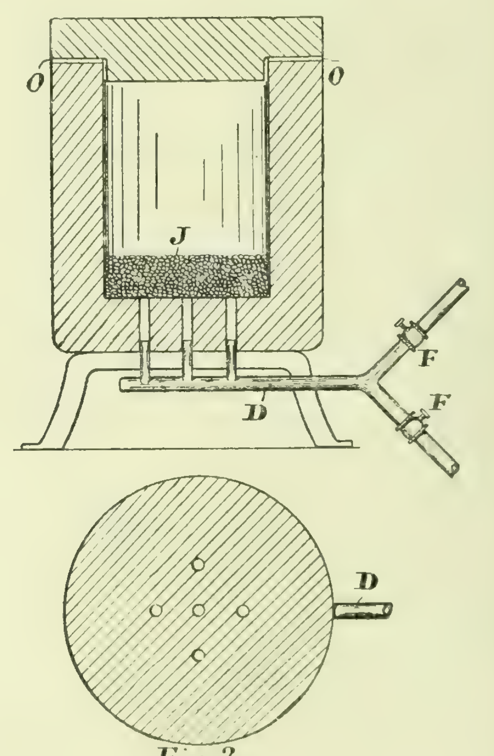


Fig. 2.

respectively. G is a cylinder of a very refractory material—such as bauxite—adapted to receive a crucible H or other article to be heated. J is the refractory granular material, which, provided the furnace body and vessel G are sufficiently free from ferric oxide and the like (as hereafter explained), may consist of carborundum crushed and meshed to such a size—for example, as will pass a sieve of two meshes to the linear inch, but will not pass a sieve of four meshes. A few larger fragments may be disposed in the neighbourhood of the hole below. The furnace is provided with a cover through a hole in which the products of combustion escape to a chimney M. The pressure of air and gas required will depend on the temperature desired and on the relative dimensions of the parts. In practice, when using coal gas it is convenient to employ a pressure of from 1 lb. to 2 lbs. per square inch.

Fig. 2 represents a similar construction of furnace adapted to the heating of crucibles, melting of metals, and other metallurgical operations. The furnace body is provided with a removable cover resting on projections O, between which the products of combustion escape. J is a bed of granular refractory material, to which the gaseous mixture is supplied through the holes connected with the pipes below, which themselves are connected with the gaseous mixture main D, to which gas and air are supplied and controlled by the valves F.

This description will suffice, it is said, to make clear the principle involved in the invention, and the way in which it may be generally applied in furnace construction. The patentees then indicate certain conditions which must be fulfilled in applying the invention in the above and other cases, as well as modifications of construction which may be found useful or desirable in special cases.

The granular material must be of a nature sufficiently refractory to stand the temperature produced by the combustion of the gaseous mixture, which, as stated, will depend largely on the nature of the gas employed. For example, where blast-furnace gas, producer gas, or other gas of low heating power is employed, a large variety of refractory materials may be used—for example,

calcined fire-clay, ganister, or the like. But where the highest temperatures are produced—as, for example, by the use of coal gas or oxy-hydrogen gas sufficiently diluted with nitrogen—special pains must be taken in providing a refractory material of a sufficiently refractory nature. For example, carborundum may be employed as the granular material, provided it is not in contact with any material or body containing ferric oxide or other oxide which at high temperatures will react chemically with the carborundum. Or very pure calcined magnesite may be employed, in which case the body or bodies in contact with the material must be of a basic nature. The size of granular material employed will be determined by the size of the chamber or body to be heated. Thus, for heating small crucibles or muffles, they have used granular material crushed to such a size as will pass a sieve of four meshes to the linear inch, but will not pass a sieve of eight meshes. On the other hand, in constructing a furnace for the heating of large saggers, they have used granular material the individual fragments of which are 1 or 2 inches in diameter.

It may be found advisable in certain cases, or for some purposes, to admit the air into the mass of granular or porous material in two or more portions, in order to allow the combustion of the inflammable gas or vapour to proceed in suitably regulated stages so as to produce a more regular or suitable distribution of the heat; or, conversely, the inflammable gas may be similarly introduced. Also, in the construction of large furnaces, or for the heating of long retorts or tubes, two or more beds of the granular material, each with its own separate supply of the mixture of combustible gas or vapour and air, and with or without separate exits for the combustible products, may be employed, or, in cases where the bed of granular material is extensive, two or more separate supplies of the combustible mixture of gas or vapour and air may be introduced at different points, or at different levels, so as to ensure a proper distribution of the heat.

In general, the method of starting-up a furnace and initially raising the bed of granular material to the state of incandescence required for the combustion of the gaseous fuel according to this invention will consist in first turning on the combustible gas and causing it to ignite by applying a flame to it as it issues from the bed of granular material. Immediately afterwards the supply of air is gradually turned on until the flame strikes-back, and combustion takes place in the granular bed—thereby raising it, or the lower layers of it, to the required state of incandescence. The proportions of gas and air are then adjusted so as to produce the desired conditions. In certain cases, where the furnace construction admits, a stoppered lighting hole or holes in proximity to the point or points where the gaseous mixture enters the bed may be provided.

It will be seen that the invention differs from their previous one in some important particulars. The object now being to produce high temperature in a confined space, combustion takes place in the mass of refractory material, which does not in this case serve to prevent firing-back. Hence the arrangement of a chamber of considerable size through which the combustible mixture passes on its way to combustion, must be replaced by a passage or passages of such length and sectional area in relation to the gaseous flow that firing-back is prevented. Owing to the conduction backward of the heat of combustion by the walls of the passage or passages, the narrowing of the passages must extend backwards to a point at which the temperature of the walls is lower than the temperature required to ignite the particular mixture used.

The essential features of the present forms of apparatus to obtain higher temperatures and concentrate the heat in a space which is more or less enclosed, may be enumerated as follows: (1) An outer shell or body composed of refractory material and being a bad conductor of heat. (2) An inner bed or layer composed of refractory material having interstices, into which bed the combustible mixture is introduced, and in which it burns. (3) An internal chamber in which the heat is required to be utilized, and which may or may not be surrounded by an internal shell of refractory material. (4) A passage (or passages) through which the combustible mixture passes, of such length and cross section in relation to the gaseous flow that the ignition of the combustible mixture shall not travel backwards in the passage.

Scottish Junior Gas Association (Eastern District).—We learn from the Hon. Secretary (Mr. W. Geddes, of Granton) that the second visit of the members of the Eastern District Division of the Scottish Junior Gas Association will take place next Saturday afternoon, when they will be afforded an opportunity of inspecting the fire-brick works of Messrs. James Dougall and Sons at Bonnybridge. At the conclusion of the visit, Mr. E. M. Stewart will read a paper on "Fire-Bricks."

Entertainment to Stafford Corporation Employees.—Last Tuesday, Mr. Hubert Pooley, who will shortly be leaving Stafford to take up his new duties at Leicester, entertained the members of the staff and employees at dinner at the Swan Hotel. There were upwards of a hundred present; among the company being the Chairman of the Gas Committee (Alderman C. H. Wright). Mr. W. M. Valon, Mr. Pooley's successor, was unable to attend. The toast of the evening, "The Health of Mr. Pooley," was proposed by Mr. S. Caulfield, who took an opportunity of sincerely thanking the host for his generous hospitality. He said Mr. Pooley had been at Stafford ten years, during which time he had enjoyed the esteem of everyone who knew him. A programme of music was an enjoyable feature of a very pleasant evening.

GAS AND ELECTRICITY FOR STREET LIGHTING.

A Comparison of Costs and Effects.

At the last Meeting of the Institution of Electrical Engineers, a paper, on "Street Lighting by Modern Electric Lamps," was read by Mr. Haydn T. Harrison, in which he made some interesting comparisons of the cost of gas and electric lighting. The following are extracts from the paper.

In the very early days of electric lighting, the streets which, owing to their importance, required increased illumination, were changed from gas to high candle-power lamps, such as arc lamps. But, unfortunately for electrical engineers, these streets were comparatively few in number compared to the thousands of miles of less important streets and roads which were, and are, lighted by incandescent gas-lamps. Moreover, the high candle-power arc lamps which electrical engineers had at their disposal for competitive purposes, gave their maximum candle power at an angle requiring that they should be placed at a considerable height and at a short distance apart when required to obtain an even illumination, which resulted in a high cost per mile of lighting. The improvements connected with electric lamps which have taken place within the last two years have placed electrical engineers in a very different position, not only as regards large units of light—arc lamps being now available which give their maximum candle power in the direction most suitable for street lighting—but also with small units; incandescent lamps, such as tungsten lamps, being available, which give four times the candle power of the carbon lamps for the same consumption of energy. It was the advent of these efficient small units of light that gave electrical engineers an opportunity of competing favourably with gas for side-street lighting, as they can be installed without a heavy outlay in capital; and as most of the streets are sufficiently well illuminated by small light units, a large and valuable load results.

In nearly every town and city of this country, gas, being the illuminant available at the time when the streets were built, was naturally chosen for the purpose; and electrical engineers have found that, in order to displace it, they must be in a position to supply lamps of about the same candle power either at an equal or a lower cost, as it is often not considered advisable to go to the expense of "scrapping" existing posts and lanterns. I propose, therefore, to lay before you the figures relating to the Borough of Marylebone, where the incandescent gas-lamps have lately been replaced by electric (tungsten) lamps. In this case, the procedure was as follows: The Electricity Supply Department of the Council were advised by their Consulting Engineer to ascertain exactly the illumination given by the existing gas-lamps; and an outside testing authority intimately connected with the gas industry was instructed to test at random 100 street gas-lamps in the district. The results showed an average for the single 4½ cubic feet gas-mantles of 50-candle power and 76·6-candle power for the double mantles. Mr. Arthur Wright having discussed the matter with me, I tested for my own satisfaction and found that with the single mantles I obtained an average of 45-candle power, and with the double 76-candle power. It was decided that the single lamps should be replaced by two 115-volt 35-watt Osram lamps in series, and the double lamps by two 55-watt lamps. It was estimated that the capital cost of converting 1964 lanterns and connecting them to existing distributors would be £8000. But, owing to the excellent systems adopted by the Mains Engineer of the Council and his assistants, the work has been done for £5788, or an average of less than £3 per post; and when it is borne in mind that the work was carried through in three months, at an average of nearly 200 posts a week, without in any way interfering with the continuity of supply to a single customer, great credit is due to the organization of the department.

The excellent results obtained have led to the Council deciding to convert the remaining 1385 lanterns in the district; but owing to these not being adjacent to existing distributors, new ducts and mains were necessary. As these would, of course, eventually have to be laid for private lighting and power supply, it is difficult to allot the right amount of capital charges to the public lighting. But even if the whole of it were allotted to public lighting based on a 25-year loan, and the cost of the electric fittings be repaid in three years, £1640 would still be available for electric supply if the existing gas-rate were still charged for lighting. This is equivalent to 0·9d. per unit for the first three years, and 1·17d. per unit thereafter. The 1964 lamps when lighted by gas cost the Council for gas, lighting, extinguishing, cleaning, and maintenance, £8818 per annum. The gas contractors, when asked for a revised tender, reduced their price considerably, but were unable to compete with the tenders of the Electricity Department, which amounted to £7350 per annum, made up as follows:—

			Per Post.
A.—Electrical energy at 1·42d. per unit .	£3950	=	£2 0 0
B.—Lighting, extinguishing, cleaning, painting, &c.	1570	=	0 16 0
C.—Lamp renewals.	1230	=	0 12 6
D.—Repayment of cost of electric fittings in three years	600	=	0 6 6
Total	£7350	=	£3 15 0

It must be remembered that 1964 street lanterns included in this charge contain lamps of various candle power. In dividing

them, the proportionate cost of each per annum would be approximately as follows, taking energy at 1·42d. per unit:—

	70-Watt.	110-Watt.	160-Watt.
A . . .	28s. 6d.	45s. od.	64s. od.
B . . .	16 0	16 0	16 0
C . . .	12 0	12 0	15 0
D . . .	6 6	6 6	6 6
Total .	63s. od.	79s. 6d.	101s. 6d.

The figure charged (1·42d.) was not arrived at with any idea of the cost to the Electricity Department, but in order to repay the cost of the services at an early date. If the charge per unit had been 1d., which is more consistent with the costs of generating, the sum of £3950 per annum would be reduced to £2780, which allows £1170 per annum for repayment of cost of services, &c., the cost of the repayment of the electric fittings being already allowed. This will easily wipe off the cost of the services in five years. Therefore, if a ten-year or a fifteen-year loan had been arranged, the price could have been reduced to 1d. per unit, which would work out as follows:—

	70-Watt.	110-Watt.	170-Watt.
A.—Electrical energy at 1d. per unit. .	24s. od.	38s. od.	56s. 6d.
B, C, and D, as before .	34 6	34 6	37 6
Total	58s. 6d.	72s. 6d.	94s. od.

Note.—Charges B and C have since been reduced; thus an actual higher rate is being obtained for current.

The illumination of the streets of Marylebone has been improved by the conversion. The tests on the gas-lamps mentioned previously are compared with tests on the electric lamps. In total candle power, these figures are very striking: The 1964 gas-lamps gave a total of 109,000-candle power; and 1964 electric lamps give a total of 146,000-candle power at 20° and 193,883-candle power at 10°. As regards the illumination, this was, of course, increased directly in proportion to the increase of candle power as the position, height, &c., of the lamps remained the same.

The number of posts to the mile varies with the importance of the thoroughfare or street, and also the width of the roadway. The above results take these two factors into consideration, and are calculated from actual candle-power measurements in the street. In the important thoroughfares, there are an average of 76 posts to the mile, and in the less important streets 65 posts; so that at 1·42d. per unit the cost per annum works out at: Main thoroughfares, £384 per mile; side streets, £204 per mile. Or if electrical energy be taken at 1d. per unit, the cost would be £356 and £190 per mile respectively.

Before leaving the subject of the Marylebone lighting, it is necessary to consider a third type of thoroughfare—viz., Oxford Street. At the time Oxford Street was changed from gas to electricity, the most efficient lamp available for the purpose was the converging carbon flame arc lamp. This was therefore used; the globes being of the opalescent type recommended by the makers. Where favourable, two such lamps were erected on centre poles at distances of nearly 200 feet. This resulted in a minimum horizontal illumination of 0·11 candle-foot. Thus it will be seen that the cost of this type of lamp works out at nearly £20 per annum. The results are roughly as follows: Minimum horizontal illumination, 0·11 candle-foot; cost per annum per mile, £800.

Since that time, the arc-lamp makers have turned their attention to altering the distribution of light from flame lamps in order to make them more suitable for street lighting. For instance, in the case of arc lighting, it is difficult to arrange for the arcs, when erected on posts, to be higher than 25 feet from the ground; and the distance between them is rarely less than 150 feet, and is sometimes as much as 300 feet. Therefore the light rays which reach the point of minimum illumination are those which emanate at 10° to 17° from the horizontal. Some tests which I have lately conducted in Oxford Street, Oxford Circus, and Regent Street proved these rays to be of the following candle power: 10-ampere Union flame arc lamp, opalescent globe, 10° to 15°, 1100 to 1200; 10-ampere Union flame arc lamp, dioptric and opalescent globe, 10° to 15°, 1750 to 1800; 12-ampere Union flame arc lamp, dioptric and clear globe, 10° to 15°, 3700 to 4400.

While discussing highly illuminated streets and the use of high candle-power units of light, the relative results obtained by the use of high-pressure gas-lamps is of interest. Therefore I will refer to the tests made by Mr. J. T. Morris at the East London College,* from which he draws the conclusion that the candle power of a high-pressure gas-lamp varies 50 per cent., depending on the quality and pressure of the gas. His figures show that from 30 to 34 candles per cubic foot of gas consumed per hour is a very average result, when working at a pressure of 4 inches of mercury. As my own tests tend to corroborate this, I will take as an example a nominal 1500-candle Keith lamp, which gave on test between 720 and 780 candle power with a consumption of 23 cubic feet per hour. This, when compared with a flame arc lamp giving 5-candle power per watt at 1d. per unit, would have to be supplied with gas at 7d. per 1000 cubic feet in order to produce the same light for an equal cost; and thus it is obvious that even high-pressure gas-lamps do not compare favourably in cost with those high candle-power electric arc lamps which embody the improvements of the last few years.

* A lecture by Mr. Morris, on "Daylight Illumination," was noticed in the "JOURNAL" for the 21st of June last (p. 864).

Among other examples of the great improvement possible with modern electric lamps, I would like to mention Harrogate, where the Engineer (Mr. Wilkinson) has replaced the arc lamps by four 100-candle power tungsten lamps, arranged on spreading arms at a considerable height; the result being excellent both as regards illumination and appearance. It is interesting to note that at Harrogate the lamps are used without globes, but are provided with prismatic reflectors. This leads up to the question of reflectors generally. It is important that the reflectors should be designed with the object of reducing the effect of "glare"—in other words, of counteracting the high intrinsic brilliancy of the light source. With arc lamps, opalescent globes are very generally used to get over the effect of glare; but the greatest care is necessary in selecting these, as the loss of light is very often a serious matter.

Some very interesting work has lately been carried out in the City of Westminster in connection with street lighting by gas; and as at the time of writing the lighting of Victoria Street has been completed, the writer has had an opportunity of measuring the illumination and judging the effect of what may be taken as the most modern form of gas lighting. It is not proposed to enter upon any criticism of the Local Authority's action in accepting the tender of the Gas Company, but only to compare the results now obtained with those which existed in the past, and those which could have been obtained by other units of light which were tendered for by the Gas Company. Before going into these figures, it is necessary to examine that part of the specification relating to candle power under which the Electric Light and Gas Companies tendered. This is somewhat unique, reading as follows: "The candle power shall be arrived at by taking the average of two sets of readings in any position with regard to the light under test—one set at an angle of 20°, and a second set at an angle of 50° to the horizontal." It will be noted that there is no statement that the 20° ray shall bear any definite ratio to the 50° ray. Mr. Jacques Abady, referring to this in his paper on the subject read before the Institution of Gas Engineers, said: "Of course, it might be possible for an enterprising individual to make a lamp giving 180 candles at 50° and none elsewhere; and this would be a 90-candle lamp. But a lamp such as this would not comply with the general specification of the Westminster testing clause; and the example is cited simply as a *reductio ad absurdum*." Be this as it may, surely a clause stating what ratio the one ray should bear to the other was necessary, as any individual might have taken advantage of this clause, and tendered for converging flame arc lamps with clear glass globes, or direct-current open-type arc lamps, which at 50° give from three to five times more candle power than is obtained at 20°. The use of such lamps as these would naturally have resulted in a very low minimum illumination. As it is, the high-pressure gas-lamps installed give about 1·5 times more candle power on the 20° ray than on the 50° ray. This is, of course, a ratio in the right direction, but not sufficiently so to prevent the illumination adjacent to the post being 20 times that of the minimum illumination, whereas with the small gas units displaced it was only 16 times as great; and if the height of the small units had been that of the present units, it would only have been twice as great, which would have come under the head of even illumination.

The units of light according to the specification were to be 90, 180, 300, 1800, and 3000 candle power, for which the accepted Gas Company's tender works out at £2 16s. 6d., £4 10s., £6 10s., £15 10s., and £22 per annum respectively. Of these, the 1800-candle unit fixed 20 feet high was selected for Victoria Street. This street is approximately 3600 feet long, and 25 such units have been erected in place of 50 upright double incandescent gas-mantles placed 12 feet from the ground, with the result that the minimum illumination is increased to 0·15-candle power.

The author next passed on to deal with the cost of public lighting by electricity, which he said depends on three factors: (1) Cost of electrical energy; (2) cost of lamp maintenance; and (3) capital charges and their repayment. Considering the first item from a consumer's point of view, he adopted the standing charges per kilowatt of demand given by Messrs. Handcock and Dykes in their paper read before the Institution in November last year —viz., £17. This for a 60-watt lamp would work out at 20s. per lamp per annum. Taking the running charges at 0·4d., and the hours of burning at 4000 per annum, he arrived at 96d.; making a total charge of 28s. per lamp per annum, or at the rate of 1·4d. per unit. Treating the street-lamps as an ordinary customer, he thought a remunerative price would be 1d. per unit for large undertakings and 1·5d. for small ones, inclusive, as in the case of consumers, of the cost of service to the ordinary distributors, but not of fittings, &c., which would come under the same heading as the consumers' wiring and fittings, which are part of the installation. With regard to lamp renewals, taking total candle-power units from 50 up to 500, the cost with tungsten lamps would range from 2·4d. down to 1·2d. per candle power per annum, with naked lights, and from 1s. 3d. down to 0·6d. in special lanterns. Lighting and extinguishing would range from 4d. down to 0·4d. per candle power; and the cost of carbons, &c., taking the units at from 300 up to 4000 candle power, from 3·6d. down to 0·15d. Adding together all the figures arrived at, the author gave the following table showing the cost per candle power per annum,

exclusive of capital charges, and taking 1d. per unit as the price of current in pence:—

	Candle Power of Light Unit.	Total Cost per Candle Power per Annum with Naked Lamp.	Cost per Candle Power per Annum in Special Lantern.
A.	50 tungsten	10·50	7·0
	100 ,,	8·20	5·0
	200 ,,	7·00	4·3
	300 ,,	6·66	4·1
	400 ,,	6·50	3·8
	500 ,,	6·40	3·5
B.	—300 open arc	10·20	—
C.	1000 flame arc	3·65	—
	3000 flame arc (dioptric and clear outer)	1·32	—
D.	—2000 to 4000 regenerative flame	1·0 to 0·8	—

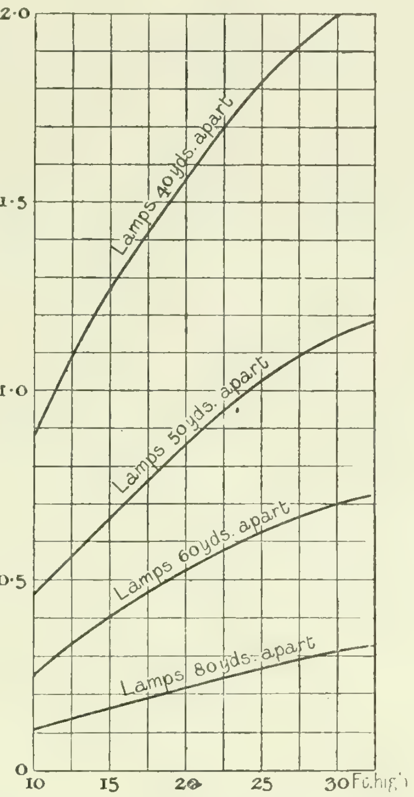
Having obtained an approximate table of costs per candle power per annum for various units of light, the author said it would be easy to ascertain which were the best to use under different circumstances. In order to assist in coming to a decision, he gave the following table showing the total candle power needful to produce a minimum of horizontal illumination of 0·1 candle-foot with lamps spaced at various distances and at heights of 20 feet and 12 feet respectively.

Space between Lamps.	Candle Power of Lamps.		Total Candle Power per Mile.	
	12 Feet High.	20 Feet High.	12 Feet High.	20 Feet High.
Yards.				
100	..	8800	..	156,000
90	..	6300	..	125,000
80	7300	4539	160,000	100,000
70	4800	3060	121,000	76,600
60	3140	1950	92,000	57,000
50	1820	1186	63,500	41,600
40	950	620	41,500	27,300
30	400	300	23,300	17,600

The author directed attention to two important factors which he said were noticeable in the above table—viz., the large reduction in the total candle power necessary to produce the same minimum degree of illumination with small units of light placed close together, and the effect of the height of the lamps on horizontal illumination. He pointed out that when lamps are spaced at 30 yards, only one-ninth of the total candle power gives the same result as when they are placed 100 yards apart. Therefore, from the table of costs per candle power, it would be seen that unless a lamp giving a very high candle power at low cost were used, the closer spacing would be the cheaper alternative. Converging flame lamps (unless provided with dioptric globes), when erected at 70 yards, would give illumination, at the same cost, equal to small units of light placed between 40 and 50 yards apart, provided, of course, the small units of light were fixed at the same height.

Referring to the height of lamps, the author said: Based on horizontal illumination, and obviously in order to obtain even illumination, they should be placed as high as possible. For instance, if the lamps in Baker Street had been 20 feet high, the minimum horizontal illumination on the ground would have been 0·11 instead of 0·08-candle power, or an increase of nearly 50 per cent. But I doubt whether the Lighting Committee or the public would agree that the illumination of the street had been improved 50 per cent., and I am certain that there would be no hesitation in their choice between increasing the height of the lamps 8 feet or the candle power 50 per cent., provided the increased candle power cost no more. This, to my mind, demonstrates clearly one of the objections to horizontal illumination as the gauge of street lighting, for the increase in the height of the lamps would not in any way increase the illumination of pedestrians and vehicles or other vertical objects; and it is certainly misleading owing to the introduction of the cosine factor. [See diagram.] On the other hand, the specifying of minimum horizontal illumination does encourage raising the height of the lamps; but, as I have mentioned in previous writings, the factor of direct illumination covers this point when the maximum and minimum are stated. That the difference between the maximum and minimum illumination at any point of a street should be as small as possible is so important that it is gratifying to note the comparatively low candle power when measured near the vertical of the tungsten and modern arc lamps, especially when the former are in correctly designed lanterns. For example, maximum illumination with the inclined carbon flame lamps is as high as 10 candle-feet in Oxford Street, with a minimum of 0·11 candle-foot, or a diversity factor of 90. In Baker Street, the maximum illumination on the ground is 0·5 candle-foot with a minimum of 0·08 candle-foot—a diversity factor of only 6. Again, in Regent Street, where "Excello" lamps having dioptric globes are in use, the maximum illumination does not exceed 3 candle-feet; the minimum being 0·23 candle-foot, or a diversity factor of 13.

The importance of correct characteristic light distribution is clearly brought out in the following curve, where the candle power at various down-



CURVE showing variation in horizontal illumination due to various heights of lamps. This curve is calculated on the basis that the lamps are giving equal candle-power at all hemispherical angles. It demonstrates clearly the effect of the cosine factor if horizontal illumination is used for comparison purposes.

ward angles necessary to produce even illumination is compared with that given at those angles by tungsten lamps with a suitable reflector, such as the Marylebone type, which it will be noticed closely approaches the correct curve, a vertical low-pressure gas-mantle which gives about the same curve as a tungsten lamp without a reflector, and a low-pressure inverted gas-mantle.

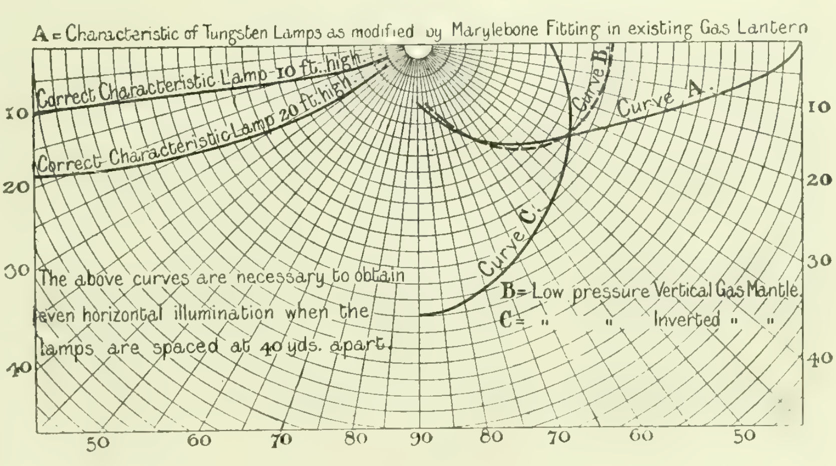
The effect of using correctly distributed light is not only more even illumination, but also reduced cost of lighting for a given minimum, as shown by the following comparisons:—

Position.	Minimum Illumination.	Diversity Factor.	Cost per Mile per Annum.
Baker Street (electric)	0·08	6	£356
Regent Street (electric)	0·23	13	660
Victoria Street (high-pressure gas)	0·15	20	540

NOTE.—The tender for the Regent Street type of lighting was subsequently reduced to £425 per mile per annum.

The above figures direct attention to the considerable variation in the diversity factor of illumination. The importance of this factor cannot be overrated. Mr. A. J. Sweet, in his paper read before the Franklin Institute of Philadelphia,* states that a ratio of maximum to minimum (illumination) of 4 to 1 is permissible; and he points out that the present factor more frequently falls between 100 to 1, or even 500 to 1. For example, in Oxford Street, using flame arc lamps, it is 99 to 1; whereas in Regent Street, where the same type of lamp was employed, but with a dioptric globe, this was reduced to 13 to 1. In Victoria Street—the latest example of gas lighting—it is 20 to 1; whereas in the important streets of Marylebone it is 6 to 1. In both Regent Street and Marylebone, this great advance was brought about by the correct use of globes and reflectors specially designed for the purpose. It is the possibility of one using such globes and reflectors with

* See "JOURNAL," Vol. CX., pp. 437, 502.



electric lamps which gives them great advantage over gas, where the dissipation of the great heat necessary for the efficient use of mantles makes the employment of efficient globes and reflectors a practical impossibility. For instance, in Victoria Street the light rays from the high-pressure gas-lamps which reach the point of minimum illumination are only 1·5 times the power of those adjacent to the lamp-post. In the case of the tungsten lamps in Marylebone, they are six times the power; hence the more even illumination. It is interesting to note that if the latter lamps had been placed a few feet higher, and spaced at (say) 100 posts to the mile, the illumination would have been even throughout the street, with a diversity factor of unity. At first sight, this would appear to increase the cost considerably; but this is not so, as the candle power of the lamps could be reduced to one-fifth without reducing the illumination.

I must apologize if I have too often repeated examples and figures proving that the multiplicity of small light units results is more efficient street lighting. But the fact that measurements and figures invariably lead to this conclusion proves that it is well worthy of the consideration of those who have to deal with street-lighting problems. I am aware that the average man who is asked to compare brilliant and powerful lamps with the less brilliant but increased number of light sources will generally vote in favour of the powerful light, regardless of the result; but the fact that the Marylebone lighting has given satisfaction to all concerned does prove that in the long run even illumination is appreciated.

The eyesight of the present generation is suffering from the indiscriminate use of large glaring light units unsuitably placed. Therefore it is important that those who are called upon to illuminate streets, where the minimum illumination cannot exceed 0·1 of a candle-foot, should not be tempted to accentuate this low figure by producing a few patches of bright light. It is noticeable that in the past the small light units derived from gas have been more economical for outdoor lighting than those produced by electricity. The reverse is now the case. Therefore electrical engineers should be able to compete favourably, considering that the light they are able to supply is constant, reliable, capable of correct distribution, and easily manipulated, which must result in its adoption for exterior lighting in the same way as it has been so generally adopted for interior lighting.

There is one other feature which I should like to take this opportunity of bringing to your notice—*viz.*, the rating of light units. It is the custom to mark incandescent electric lamps with the mean horizontal candle power; and they are known by this figure. But if by the use of suitable reflectors or globes it is often more than doubled over the angles where the light is required, that unit becomes of twice the value. In completing this paper, difficulty of this sort has arisen; and when calculating the cost per candle power the writer has in most cases given figures based upon the horizontal candle power of the naked tungsten lamp, whereas (where they have been erected in suitable lanterns or globes) this cost per candle power-hour is reduced to one-half or one-third. This must be carefully borne in mind when using the tables referred to.

In conclusion, the author said he should like to take the opportunity of warning engineers that good illumination, though the prime object in street lighting, is not the only feature to be considered. Careful thought must be given to obtaining as even illumination as possible; and if high intrinsic brilliancy were avoided, the result would be in every way satisfactory, not only to the lighting authorities, but also to the general public.

Discussion.

Mr. Frank Bailey said it was the duty of all lighting companies and authorities to call the attention of municipalities to the meagreness and the very unsatisfactory nature of most of our public lighting. At present they seemed satisfied to have very little more than was the case many years ago, when the conditions of street traffic were entirely different from what they are to-day. The difficulty was that those in charge of this sort of work knew very little about it. An electrical engineer could do very much more for street lighting if he were only allowed to try. This had been his position in the City of London during recent years; for he had had to beg to be allowed to demonstrate what his Company [the City of London Electric Lighting Company] could do with modern appliances. In his opinion, the standard of illumination should not be less than that given by the new electric arc lamps suspended across the roadway in Cheapside. It should be possible in every thoroughfare to be able to see from end to end. He did not think the author's price of 1d. per unit for street lighting was one that could be quarrelled with. Certainly it was one with which it was worth while to push the use of metallic filament lamps in streets of minor importance. In main thoroughfares, however, the lighting could only be carried out properly by means of flame arc lamps of large candle power placed high up. He put Cheapside forward as an example of what should be done in main thoroughfares; and there were plenty of them in London which justified an expenditure of £800 per mile, which was not an excessive sum for what was absolutely required for the protection of life and property.

Mr. C. P. Sparks said the electrical industry was, comparatively speaking, new in the public lighting business; and he thought the Institution of Electrical Engineers could do a great deal of good by appointing a Committee to draw up a standard specification for street lighting which, while it might not be adopted in all cases, could be taken as a guide, and serve as an authoritative basis. The industry had been very much handicapped hitherto by the fact that there had been only large units of light; but the advent of the metal filament lamp had proved a great advantage. Until recently, all the pioneer street lighting had been in the hands of the gas companies; but (to a large extent due to Mr. Harrison, who had devoted himself specially to the question of street lighting in recent years) a change was coming over the scene. In looking at what had been done in the past in public electric lighting—and it was mostly in those places where the municipality owned the electricity works—one could not help noticing the poor comparison between the old open type of arc lamp which still very often existed, and modern gas lighting; and at the rates at which many of the old contracts had been taken, there was ample margin to allow of discarding the old fittings and putting in modern flame arc lamps. With regard to Mr. Harrison's figure of 1d. per unit, in view of the prices now being quoted by the gas companies, he regarded this as on the high side; and he felt quite sure that unless electricity supply undertakings were prepared to offer energy at a lower rate than was indicated in the paper, there was not much chance of the electrical industry wresting the bulk of the public lighting from the gas companies.

Mr. A. H. Seabrook referred to the statement in the early part of the paper that, as the results of tests in Marylebone, the average for the single 4¼ cubic feet gas-mantles was 45 to 50 candle power, and about 76-candle power for the double ones. If they compared these figures, taken from mantles in actual commercial use, with those given as the correct ones by the gas companies, the result would be very striking. If a few more people would do this, there would not be the absurd disbelief in electricity for lighting, heating, and cooking that existed at the present time. He disagreed with Mr. Sparks as to 1d. per unit being on the high side. In Marylebone, the Council were at this price saving £3000 per annum compared with the old gas figures; and it seemed ridiculous to go below it. They had to fix their price according to what the light would fetch, and also bearing in mind the prices charged by their competitors; and a saving to the extent he had mentioned seemed good enough to give to the rates. Dioptric globes appeared to him to cause a considerable and unpleasant glare, an example of which was to be seen in Regent Street. He would have liked more information about side-walk lamp-columns, as compared with centre lamps for arc lighting. He had come to the conclusion that where a street was wide enough for centre columns, this was the best position in which to put the arc lamps, or any others of high candle power. Arc lamps on the footpaths wasted an enormous amount of light on the buildings, which did not require it; and if a street could be lighted by centrally-supported lamps, it seemed to him to be the best way out of the difficulty.

Mr. W. A. Vignoles thought it was questionable whether Mr. Harrison's view that the minimum horizontal was the best standard of illumination. In walking between two lamps, they did not want to look at anything in the horizontal so much as in the vertical direction. When the change from gas to electricity was made in Grimsby, it was a question whether they should retain the existing posts. It was finally decided not to take them over, for the reason that it meant fixing fuses either at the top of the posts or else digging a pit in the ground in which to place them. They therefore purchased new posts, and put in a new fitting. At the same time, from the point of view of getting a brilliant effect in a street, there was nothing better than a gas-lantern. They could design scientific fittings to take their electric lamps; but, when all was said and done, an electric lamp hung inside a gas-lantern, with four panes of glass round it and a white reflector at the top, was very hard to beat.

Mr. L. Gaster, referring to the subject of a standard specification for street lighting, said that about a year ago the Verband Deutscher Elektrotechniker appointed a Committee to draw up a specification for indoor and for outdoor lighting. This was to include illumination at certain heights, the mean and maximum illumination for the various classes of streets, and so on. His point was that, until they settled what was wanted, they could do nothing. At present, when people wished to know anything about street lighting, they had to go to the Continent. He had heard it stated that London seemed to be the laboratory of the world in public lighting; and this was brought about because every borough engineer desired to do something better than his neighbour. A committee having upon it representatives of all those interested in street lighting was certainly badly wanted in this country.

Mr. C. M. Shaw differed from Mr. Vignoles as to the advisability of using the existing gas-lanterns when introducing electric lighting. He also thought that lower prices than those now charged for electric lighting in streets would have to be introduced if they were to make any progress in getting gas out. The author had mentioned £204 per mile for lighting side streets; but he (Mr. Shaw) only got £120 in Worcester, and was satisfied.

Professor J. T. Morris suggested that an improvement in street lighting would be effected if the lamps were screened down to from 10° to 15° below the horizontal. He thought it was an open question as to whether the sources of light in a street should be actually visible.

Mr. K. Edgcumbe thought it would be doubtful whether the Institution of Electrical Engineers could appoint a Committee to draw up a standard specification without inviting representatives of the gas engineers and also architects.

Mr. H. Boot said he had made some tests which showed that street lighting could be undertaken at very little more than ½d. per unit.

Mr. Harrison, in reply, said he was not at all in favour of centre lighting, because, while it was good for the pavements, it was not good for the drivers of vehicles, who were mounted rather high, and who must, at some moments, have the lights in their line of vision. The question of a standard specification was a difficult one, because the gas people could not be ignored altogether; and it was doubtful whether any specification would be generally adopted unless it was mutually agreed upon. Probably some independent institution, like the Institution of Civil Engineers, would have to take the matter in hand. It would have to be a society to which surveyors belonged, as they were the gentlemen who had the street lighting under their control. Unfortunately, very few surveyors had made a study of illumination. He agreed that his price for electrical energy was high; but electrical engineers did not seem disposed to do what the gas companies did—viz., do the thing cheaply for the sake of the advertisement. Municipal electrical engineers would be told that they were giving the current away if they did this.

THE PRESENT STATUS OF GAS LIGHTING.

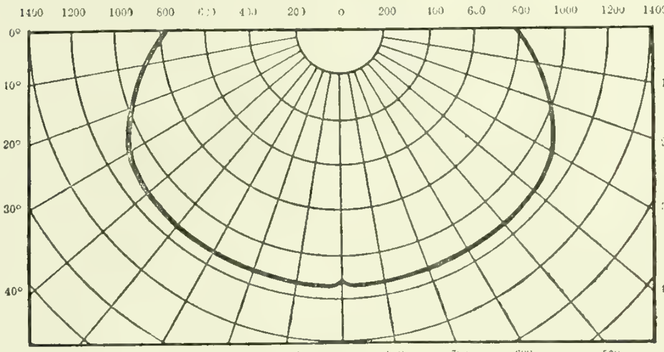
Some Expert Experiences.

On the occasion that Mr. F. W. Goodenough read before the Illuminating Engineering Society, his paper on "Recent Progress in, and the Present Status of, Gas Lighting" (*ante*, p. 468), it was announced that some contributions had been received from correspondents, and would be published in the official journal of the Society. This has now been done; and from the communications the following extracts are made—these being of interest on account of the testimony afforded, from such widely separated quarters as London, Paris, and Berlin, as to the marked progress in efficiency that has been scored by inverted incandescent gas-lamps, both high and low pressure.

M. Lauriol (Chief Engineer of the Lighting Department of the City of Paris), in the course of his communication, remarks that, when comparing ordinary upright incandescent burners, it is only necessary to measure the horizontal intensity, as the form of the intensity curve will be the same for different burners; but a measurement in one direction only is not sufficient, as the value in different directions may vary as much as 10 per cent. from the average value. Measurement in four directions at right angles is suggested as satisfactory. A comparison of upright and inverted burners for street lighting should be on the basis of the mean lower hemispherical intensity. In the case of interior lighting, the question as to the best basis of comparison is more difficult to settle. In some cases the hemispherical, and in others the spherical, intensity would be the most satisfactory, according to the quantity of light that may be reflected from the ceiling and walls. In general, the mean spherical intensity is to be preferred. The following figures give the results of some recent tests on efficiency attainable with Paris gas (tested according to the method of Dumas and Regnault for the candle power of flame-burners), and also tested in the laboratory for calorific power, giving practically 4800 calories per cubic metre (steam not condensed). The figures are given in international candles, and are the average values for 400 hours' working; the efficiency being actually about 10 per cent. lower at the end of 400 hours. Ordinary burners, with ordinary pressure of 50 mm. (2 inches) of water: Small burner (mean horizontal intensity), consuming 50 litres (1¾ cubic feet) per hour, 1·25 litres per candle-hour (23 candles per cubic foot). Medium burner (mean horizontal intensity) consuming 80 litres (2·8 cubic feet) per hour, 0·95 litre per candle-hour (30 candles per cubic foot). Large burner (mean horizontal intensity) consuming 150 litres (5¼ cubic feet) per hour, 1·30 litres per candle-hour (22 candles per cubic foot). Thus the medium burner gives the highest efficiency. Inverted gas-burners (mean hemispherical intensity): Pressure, 50 mm. (2 inches); burner of 80 litres (2·8 cubic feet) per hour; consumption, 1·38 litres per candle-hour (21 candles per cubic foot). Pressure, 1400 mm. (55 inches); burner of 300-2500 litres per hour (10½-87 cubic feet); consumption, 0·67 litre per candle-hour (43 candles per cubic foot). Dealing with other points, he says that, with ordinary pressure (50 mm. or 2 inches) good mantles last 400 hours, with a decrease of 20 per cent. from the initial efficiency. This applies only to laboratory experience. The intrinsic brilliancy of any lamp is too high for direct light to be allowed to enter the eye direct; and screening, either with diffusing globes or else with thick opaque paper or thin metal shades, is desirable in the case of indoor lighting. For street lighting, diffusing globes are at present used with electric arcs, but not for gas-lamps, however powerful they may be. But it is not certain what the future practice in this respect may be. In the case of an incandescent burner, the higher the pressure at the nozzle of the burner, the higher the efficiency, provided that the burner has been designed for this pressure. In practice, it is therefore desirable to maintain the pressure at the burner constant, and keep this pressure as near as possible to the high limit. Now, a gas-governor cannot raise the pressure above the value of the supply; it can only reduce the pressure in the burner to a certain limit, p, for which the burner is designed. Consequently, when the pressure in the pipes is less than p, the governor cannot achieve its purpose. Therefore it is desirable to maintain in the pipes a somewhat higher pressure than this value p, and also to design both governor and burners for use on the highest pressure that can actually be attained in the pipes during lighting hours. In Paris, the contract entered into with the Gas Company specifies that the pressure at any point in the street network must not be less than 40 mm. (1·6 inches) of water. In practice, it is always maintained at a somewhat higher value; and the burners and governors in use are designed for a pressure of 50 mm. (2 inches).

Mr. George Keith (London) points out that it is naturally not possible to give the maximum efficiency in candle power per cubic foot of gas consumed per hour, unless it is known what kind of gas is to be used, as the results vary considerably according to the quality. In my experience, however, he continues, one can obtain on the average 60 candles per cubic foot; and in some cases, where extra good coal gas is obtainable, we have obtained results as high as 73 candles per cubic foot. As an illustration of the dependence of the results on the quality of gas, it may be said that, using our system with oil gas, and that only in small units, we have obtained as high a result as 120 candles per cubic foot of gas consumed. The pressure we employ is ordinarily 54 inches of water (or 2 lbs. per square inch); but we occasionally go higher than this if necessary. In my opinion, the most accurate method of expressing the lighting value of a lamp is unquestionably in terms of the mean lower hemispherical value. It is not necessary or desirable to use a diffusing globe with lamps for outside lighting, as the light is already very well diffused, and is not sufficiently concentrated to cause discomfort or injury to eyesight. For inside lighting, in cases in which small units are used close to the eye, it is often found desirable to shield the eye from the direct light of a mantle by opal or frosted glass.

Professor H. Strache (Vienna) says the maximum efficiency which was attained in tests undertaken last year in the Testing Institution for Gas Lighting of the Vienna Technische Hochschule, was stated to be 0·697 litre per Hefner candle sub-hemispherical (37·0 Int. candles per cubic foot), with a gas pressure of 50 mm. (at 0° C. and 700 mm. barometric pressure). The gas was 4880 Cal. per cubic metre. In this Institution, the mean hemispherical efficiency of the source of light (unless any other particular method is specially desired) is determined as follows: The burner is rotated around its vertical axes, and readings are taken in eight different positions. Subsequently, readings at intervals of 10 degrees in a vertical flame are taken, and the polar curve is obtained. Then the calculation is made by the aid of the Rousseau curve in the usual way. The renewal of the mantles intended for outdoor lighting should be effected when their efficiency has diminished by 20 per cent. In our most important gas-works the adjustment and cleaning of globes, as well as the replacement of mantles, is not carried out by the gas company itself, but especially by sellers of mantles. Small gas-works sometimes undertake this maintenance for some fixed price; and it would be very beneficial if all gas companies would do so. Another beneficial plan would be for both gas-burners and electric lamps to be maintained by some independent company for a fixed price per annum. It is not necessary to screen high-pressure lamps in the streets with some form of diffusing globe, since the intrinsic brilliancy of such mantles is very much less than that of the electric light. Experience of high-pressure street gas lighting in Berlin suggests that the eye is not too much affected by the glare of open pressure-gas lighting; but indoors it is advisable to screen high-pressure gas-lamps by some diffusing globe.



Herr M. Scholz (Director of Messrs. Ehrich and Graetz, of Berlin) says the maximum efficiency obtainable in practice at the present time is according to his experience with Graetzin high-pressure gas-lamps 4600 British candles at a gas consumption of 71·4 cubic feet, which corresponds to 64·3 candles per cubic foot. The pressure used amounts to about 54 inches of water. The highest efficiency attainable with low-pressure gas-lamps is 42·9 candles per cubic foot. This efficiency is obtained with "Triumph" Graetzin low-pressure high candle-power lamps of about 920 British candles at a gas consumption of 21·4 cubic feet per hour; and it may be pointed out that this lamp produces its highest candle power (1100) at an angle of about 40° to 50°. The above curve of this lamp shows that its light-distribution much resembles that of the high-pressure gas-lamp, and is of the best type for street lighting purposes. The high efficiency mentioned above has been obtained by superheating both the primary air

supply and the gas and air mixture. The pressure of this lamp is controlled by an automatic gas-governor arranged on top, which keeps the gas inside the lamp under a constant pressure of 1·35 inches. Another type yielding about 550 British candles at a gas consumption of 14·2 cubic feet per hour (equal to 38·7 candles per cubic foot) is being extensively employed in the lighting of Berlin. The most accurate method of expressing the efficiency of a lamp is, in my opinion, the calculation of the mean lower hemispherical candle power, the measurements of the different angles to be taken at intervals of 10 degrees. The average life of a mantle for low-pressure indoor and outdoor lighting should not be less than 500 burning hours; and for outdoor high-pressure lighting not less than 200 to 300 burning hours. It depends, however, entirely on the quality of mantle used. I do not think it desirable to provide high-pressure gas-lamps with some form of diffusing globe; the intrinsic brilliancy of these lamps not being sufficient to injure the eyes of the public, provided always the lamp is not hung any lower than 17 feet (the height of the mantles above the road surface).

MEDICAL OFFICERS AND GAS LIGHT AND HEAT.

The Electrical Press and the New Gas Lighting and Heating Arrangements at the Society of Medical Officers of Health Meeting Place.

In "Public Health"—the official organ of the Society of Medical Officers of Health—mention was made of the irritation that has been caused to the Electrical Press by the wisdom of the Society of Medical Officers of Health in making use of gas for the heating and lighting of the principal rooms—the meeting and exhibition rooms—at their offices. What transpired is reported below. Particular attention is drawn to Dr. Reginald Dudfield's remarks (printed in italics), and to the fact that the resolution, which presumably was intended to reopen the question, was lost by a large majority.

Dr. Charles Porter (Marylebone) on the plea of urgency asked the Chairman's permission to read a paragraph which had been published in an electrical paper relating to the installation of gas in the Society's premises, and which appeared to reflect upon the judgment of their Council in the matter. The paragraph having been read, Dr. Porter said he felt so strongly on the point that he would move that the whole question be referred to the General Purposes Committee for report.

The resolution having been seconded,

Dr. Reginald Dudfield (Paddington), speaking as the Chairman of the Committee who had been entrusted by the Council with the supervision of the new heating, lighting, and ventilating arrangements, said that he considered it beneath the dignity of the Society to pay any attention to *ex parte* statements published in the electrical trade press. He would merely add that *no member who had experience of their meeting-room under the old conditions could deny the improvement that had taken place since gas had been substituted for the electric light and the new system of heating and ventilation had been installed.*

Dr. Charles Sanders (West Ham) and other members strongly deprecated the proposed resolution, which, on being put to the meeting, was lost by a large majority on a show of hands.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Fulham Works of the Gaslight and Coke Company.

On Saturday afternoon, the members of the London and Southern District Junior Gas Association, to the number of about fifty, paid a visit to the Gaslight and Coke Company's works at Fulham. They were met on their arrival by Mr. J. W. Randell, Engineer, Mr. A. C. M'Minn, Assistant-Engineer, Mr. W. W. Scadding, and Mr. J. E. Aylott, who conducted them round the works, which were described in the issue of the "Journal" for Oct. 11 last (pp. 102, 118).

After the inspection the party assembled in the Men's Institute, where tea was provided.

The President (Mr. L. F. Tooth) subsequently proposed a hearty vote of thanks to the officers and staff for their kindness in receiving them at the works.

Mr. D. J. Winslow, in seconding, said they were grateful to the Directors and Mr. Randell for the opportunity of seeing the works and machinery that afternoon—a special feature of which was the Fiddes-Aldridge stoking machine.

The vote having been heartily accorded,

Mr. Randell, in thanking the members, said that, with reference to the Fiddes-Aldridge machine, they found it most efficient—there being a complete absence of noise and dirt. The Directors of the Company were very kind in putting in the way of all who desired to learn every information possible to enable them to improve their position. In his early days, such a state of things was not possible. It was only right that, in connection with the vote of thanks, he should mention his Assistant, Mr. M'Minn, also Mr. Scadding and Mr. Aylott, who had much to do with the clean and orderly state in which they found the works that afternoon, and which he was pleased to say was the normal state.

MANCHESTER UNIVERSITY LECTURES.

Dr. Colman on "Carbonizing."

The third lecture of the series arranged to be given at the Manchester University under the auspices of the Manchester and District Junior Gas Association, supported by the Manchester District Institution of Gas Engineers, was delivered on Saturday afternoon by Dr. Harold G. Colman, who had for his subject "Carbonizing." There was a large attendance of members of the two Associations; the Chemistry Theatre at the University being well-filled when the chair was taken by Mr. H. Kendrick, the President of the Manchester District Institution.

Mr. Kendrick, in opening the proceedings, said Dr. Colman needed no introduction from him to such an audience, and added that the two lectures which that gentleman had delivered recently in the South showed the grasp he had of his subject. He (Mr. Kendrick) believed that Dr. Colman received much of his early training at the Manchester University, and therefore would feel quite at home in delivering his lecture in that room.

Dr. Colman then delivered his lecture, which appears elsewhere in to-day's issue—see p. 707.

Mr. S. Meunier (Stockport), in moving a vote of thanks to Dr. Colman, said he had listened very carefully to the lecturer, half expecting they might have something definite laid down on the subject in hand for their guidance. However, he was not surprised at the caution displayed by Dr. Colman in giving them the results of many years' experiments on the question of carbonizing, especially having regard to the complexity of the subject. Dr. Colman had told them if they did so-and-so they would get such and such results; but if, on the other hand, they tried something else, they would probably get better results. So it seemed to him (Mr. Meunier) that, in their efforts, by a sort of rule-of-thumb, without absolute scientific experience, they had come out "there or thereabouts." The point with them as gas engineers was how to get the best financial results and maximum yield per ton of coal; and it was the scientific work of such men as Dr. Colman and Professor Harold B. Dixon that would help them to attain this end.

Mr. T. Duxbury (Oldham) seconded the motion. He said that Dr. Colman had laid before them several important points which they could with advantage investigate for themselves in their spare moments. He was particularly interested in the suggestion that what they should aim at was a uniform quality of gas. This he regarded as being most important. He believed if they could give a uniform quality of gas throughout the 24 hours, greater satisfaction would result to the consumers; and it was his opinion that vertical retorts were going to help them very considerably in securing uniform results. Dr. Colman's remarks on the chemical manufacture of gas were deeply interesting; and he (Mr. Duxbury) would have liked to hear more on this part of the lecture. At one time, he thought Dr. Colman was going to tell them what maximum heat was required in the retort before the fuel began to deteriorate; but he seemed to stop short. He quite understood why Dr. Colman did this. It was because almost every coal required a different maximum temperature. He would like to put down a plant himself for a week or a month's run with a particular coal, to find out the maximum heat required before it began to deteriorate. They ought to investigate this matter independently—say, with Barnsley or Wigan coal—and he was certain such experiments would be of use to them. He agreed with Dr. Colman that the higher the heat the larger make per ton they obtained, and that, although there was a greater amount of naphthalene, they had a cheap way of overcoming this difficulty.

Professor Harold B. Dixon supported the vote. In the course of his remarks, he expressed the hope that Mr. Duxbury would summon up courage and carry out the experiments he had mentioned with regard to different classes of coal.

Dr. Colman, responding, agreed that he had not dealt as fully with some parts of his lecture as he might have done. His whole difficulty had been to compress his remarks into an hour—he had exceeded this time as it was—and he had not known exactly what to leave out on this most complex subject. He had intended to say that if they could, by controlling the reaction in some way—and he had reason to believe that it could be done—increase the amount of methane produced and that coming over the coke, it would be of the highest importance, even if it was 1 per cent. With reference to Mr. Meunier's observations, in these complex things they had to balance the advantages against the disadvantages of particular processes, and adopt that which possessed the maximum of advantages and the minimum of disadvantages. And what might be found to be of advantage at one place, would be a disadvantage at another. It was not for him to take away from a gas engineer the responsibility of finding out and deciding what was best suited for his particular purposes. He was prepared to agree with Mr. Duxbury as to the advantages of having a uniform quality of gas. He believed, in spite of legislative procedure, that to have a uniform quality of gas was of much more importance than what that quality should be. Further, gas ought to be supplied at a uniform pressure.

This concluded the proceedings at the University. Members of the Association, however, held a meeting subsequently, at which various points raised in the course of the lecture were discussed among themselves.

RETORTS v. LARGE CHAMBERS FOR A MAKE OF 750,000 CUBIC FEET OF GAS PER DIEM.

At a Meeting of the Mid-Rhenish Association of Gas and Water Engineers held recently at Gmünd, interesting accounts were given of experiences with different types of carbonizing plant for works having a productive capacity of about 20,000 cubic metres (about 700,000 cubic feet) per diem; and a general discussion ensued. The following brief account of the proceedings is taken from the full report in the "Journal für Gasbeleuchtung."

The President of the Association, Herr Frahm, Manager of the Baden-Baden Gas-Works, called upon Herr Käfer, the Manager of the Frankenthal Gas-Works, to open the debate by giving an account of the working and results of an installation of Klönne horizontal carbonizing chambers which had been in operation at his works for some time past.

Horizontal Chambers.

Herr Käfer said that it had been decided a year and a half ago, after much deliberation, to instal the plant referred to at Frankenthal. Horizontal chambers had been preferred to inclined on account of their being less costly; and, notwithstanding the favourable views held by many gas engineers as to vertical retorts, it seemed to him that for a works such as that at Frankenthal, where the annual make of gas was about 70 million cubic feet, corresponding with an average make per diem in the summer months of about 160,000 to 175,000 cubic feet, and in the winter months to as much as 350,000 cubic feet, large chambers were more suitable. He had not anticipated, however, that the working of the chambers would be so convenient as it had proved to be. Primarily the cessation of night-work was an advantage which could only be properly appreciated by those who had experienced it. At night, they had now only one mechanic and one boiler fireman at work. The settings were looked at hourly by the mechanic to see that all was in order. He also charged the producers from a special charging waggon when required. The next most important factor was the reduction of labour. Formerly about 15 men were employed in the retort-house and yard. Now only six men were required.

Six months' working experience had shown them that the large chamber was not too great a carbonizing unit for works of the size of those at Frankenthal. They had two settings of three chambers and one setting of four chambers. The chambers were 17·2 feet in length, 7·2 feet in height, and had an average width of 1·4 feet. They were slightly wider on the discharging side. Early in March, when the installation was first brought into use, the setting of four chambers and one setting of three chambers were required; and all the chambers were charged once in twenty-four hours. Subsequently, the chambers in the setting of four were charged once in twenty-four hours, and those in the setting of three once in 36 hours. Later, for some time, work was interrupted on Sundays, and, later still, the setting of three chambers was only charged once in 48 hours, and finally wholly dispensed with. Thus in the summer months the setting of four chambers only was at work; and this was kept in regular use. It will be seen therefore that the working of chamber settings can be readily accommodated to the fluctuations in the output of the works. Latterly the reverse procedure has been followed, and a setting of three chambers has been brought into use—in the first instance, with 36-hour charges.

The speaker was of opinion that large chambers could be adopted with advantage even by smaller gas-works than those of Frankenthal, especially if a setting of four chambers was divided so that two could be worked alone. As to the relative merits of horizontal or inclined chambers, he had not had experience of the latter; but as Herr von Gässler, of Hanau, would subsequently speak in regard to them, those present would be able to form their own opinion as to which system was really best. In his view, local conditions must influence the choice considerably. The chambers at Frankenthal were charged for the first time on March 2 last, and the old carbonizing plant was put out of action on March 4. Diagrams and tables are given, showing the make of gas per ton of coal on each day from March 15 to Aug. 31 last, and the calorific power of the gas. The average make per ton of coal in this period amounted to 12,484 cubic feet. The maximum make per ton on any one day was 13,634 cubic feet, and the minimum make, 10,765 cubic feet; the latter being on the days when the working was partially suspended. In regular working, the make only twice fell below the average of 12,484 cubic feet; and in these cases the coal carbonized was of the description usually supplied to coke-ovens.

Excluding the two occasions of low make, the average yield of gas per ton of coal from the middle of May to the end of August was 12,739 cubic feet. It might therefore be assumed that in regular working, year in and year out, a make of over 12,560 cubic feet per ton of coal would be secured. This was without the admission of steam. Ordinarily, the chambers were charged at 8 o'clock in the morning and 3 o'clock in the afternoon. The make of gas per hour rose immediately after charging; but the calorific power, which was taken by a Junkers' recording calorimeter, began to rise 1½ to 2 hours after charging. The diagrams showed, however, that the calorific power of the gas produced over the twenty-fours varied only between the limits of about 522 and 627 B.Th.U. per cubic foot. Quite commonly the fluctuations covered a much less wide range. The coke consumed in heating the chambers amounted to 14·8 per cent. by weight of the coal carbonized. The producer was charged with freshly-quenched coke containing a good deal of moisture; and if the fuel consumption were reckoned as dry coke and the coke recovered from the clinker was deducted, the amount of coke consumed became 12·2 per cent. The yields of tar and ammonia were not determined. There were no stopped ascension pipes. Scurf forming on the walls of the chamber was expelled with the slab of coke. The use of chambers in place of retorts at Frankenthal has resulted in a saving on coal of about £1000, and on wages of about £600 per annum. The coke-expelling machine was driven by electric power, and had given no trouble. No complaints had been received of want of uniformity in the quality of the gas.

Inclined Chambers.

Herr von Gässler, the Manager of the Hanau Gas-Works, next spoke with special reference to the installation of Munich carbonizing chambers at his works. He pointed out first that the determining factor in the choice of a system of carbonizing plant ought not to be simply its initial cost, but that durability, trustworthiness, and cost of repairs ought to be taken into consideration also, as well as the make of gas and the fuel consumption. After weighing all these points, he had decided to recommend the adoption of Munich carbonizing chambers at Hanau; and they now had an installation of eight settings, each containing three chambers of this type, guaranted to give an output of 1,130,000 cubic feet per diem. Though the total gasholder capacity of the works was only about 630,000 cubic feet, and therefore very small relatively to the output, so that there was no opportunity for mixing gas of very variable quality if such had been produced, actually no trouble had ensued on this account. The fluctuations of make every hour were no larger than with retorts. The chambers were charged once in twenty-four hours; and the gas made was passed into the largest holder, and thence direct to the town. The calorific power of the gas distributed was ordinarily between 522 and 543 B.Th.U. gross per cubic foot. A large proportion of the gas sold was employed for technical purposes, such as brazing and melting metals, and for gas-engines; and no complaints had been received consequent on the change from retorts to chambers.

When three settings were in use, the retorts in one were charged at 7 o'clock in the morning, in another at 11 o'clock, and in the third at 5 o'clock in the afternoon. This arrangement distributed the work and the make of gas fairly uniformly. At night there was only one man in the retort-house to charge the producers and watch the working. The cessation of night work had been found a great advantage. Two stokers were employed in the daytime, and while charging was actually in progress they were assisted by a fitter, who attended to the quenching of the coke and to the opening of the doors; but at other times he was employed in the shops. About a quarter-of-an-hour was occupied in discharging and recharging the three chambers of a setting; the charge per chamber being about 4·13 tons of coal. The time might be somewhat longer if the charge did not slide out of a chamber at once. This might occur if the charge were not fully worked off, or if there were much scurf, or if, through carelessness, the chamber had been overfilled so that coal had been left in the necks through which the chambers were charged and had consequently not been properly worked off. Generally speaking, at least 90 per cent. of the chambers discharged themselves automatically; and the services of the expelling machine were requisitioned in not more than 3 per cent. of the remainder. The chambers were scurfed once in three weeks by allowing air to pass through before recharging, and removing the loosened scurf by means of long rakes.

The cramped site available for the carbonizing house at Hanau had been a predominant factor in determining the type of plant to be put in it; and it had been found that no other system required so little space for the settings for a given capacity as the Munich carbonizing chambers. The whole bench of eight settings, inclusive of very stout end columns, covered an area of only 2210 square feet, and the retort-house, including chimney, occupied only an area of 4748 square feet. In direct connection with the retort-house was a Rank's inclined coal-tank of 6000 tons capacity, constructed in reinforced concrete. This occupied an area of only 4496 square feet. By the adoption of the Munich chambers and this coal-storage tank, there had been obtained, instead of the former productive capacity of 283,000 cubic feet per diem, one of 1,130,000 cubic feet; and the arrangement admitted of this being doubled without more land being required. Having regard to the high cost of other available sites for a gas-works in Hanau, the relatively expensive Munich chambers had in this instance proved extremely economical.

The results of a four days' working trial of two of the settings, in which nuts from the Saar pits of Altenwald, Maybach, and Dudweiler were carbonized, were given. One setting was charged at 5 o'clock in the afternoon and one at 7 o'clock in the morning; the charge averaging 4·11 tons per chamber. The total amount of coal carbonized was 98·68 tons, containing, on the average, 6·62 per cent. of ash and total moisture 8·09 per cent. The total volume of gas made, corrected to 60° Fahr., 30 inches, and saturated, was 1,331,740 cubic feet. This gave a make of gas per ton of coal carbonized of 14,399 cubic feet, or, per ton of dry and ash-free coal, of 15,726 cubic feet. The average gross calorific power was

553 B.Th.U. per cubic foot at 60° Fahr. and 30 inches. The coke used as fuel contained 9·95 per cent. of ash and 10·11 per cent. of total moisture. The total consumption of coke amounted to 14·35 tons. This worked out to a consumption of dry and ash-free coke of 11·77 per cent. by weight of the coal carbonized, or 13·71 per cent. of the ash-free and dry coal. The fuel consumed amounted to 19·6 lbs. of ash-free and dry coke per 1000 cubic feet of gas made. The average temperature in the lower heating passages of the settings was about 1260° C., and in the chambers 1040° C. The make of gas per diem per chamber averaged 55,348 cubic feet.

After some remarks by Herr Heinrich, the Manager of the Pforzheim Gas-Works, in the course of which he asked for definite figures which could be checked as to the make obtainable with the 1910 pattern of Dessau vertical retorts, which were stated by Dr. Geipert to be superior to carbonizing chambers, the President asked those present who had had experience of vertical retorts to give their views on their working; and after they had spoken, Dr. Blum, of the Berlin-Anhalt Engineering Company, would conclude the proceedings by addressing the meeting.

Vertical Retorts.

Herr Röhrich, the Manager of the Offenbach Gas-Works, said that the installation of vertical retorts at his works had proved satisfactory; the make of gas per ton of coal, with steaming, averaging 13,098 cubic feet, and the fuel consumption amounting to 15·5 lbs. of coke per 100 lbs. of coal carbonized.

Herr Foertsch, the Manager of the Gas-Works at Ludwigshafen-on-the-Rhine, said that the installation of vertical retorts there was one of the first introduced in South Germany; having been erected four years ago. They had proved satisfactory, and any difficulties which had occurred were due to the nature of the coal used. If the block of coke hung-up in the retort, it was not an easy matter to get it out, and the man below had to be careful to avoid injury from it. Ordinarily, the make of gas averaged 11,842 cubic feet per ton of coal; and the coke consumed as fuel amounted to 15 per cent. by weight of the coal carbonized.

The President, having drawn attention to the difference in the makes of gas quoted by the speakers—11,842 cubic feet per ton at Ludwigshafen with vertical retorts, 12,560 cubic feet per ton at Frankenthal with horizontal chambers, and 13,634 cubic feet at Hanau with inclined chambers—asked Herr von Gässler if he would say if the last-named result referred to an exhibition trial or to ordinary working. Herr von Gässler replied that the figures quoted were not for a trial in exceptional conditions, but that they had at times been surpassed in regular working. He had brought his carbonizing book with him, and asked those present to verify the results which he had quoted.

Dr. Blum, of Berlin, said that both vertical retorts and the different systems of carbonizing chambers presented an enormous advance in methods of carbonizing and afforded a greatly increased make of gas. That the vertical retort was to the fore was due to the circumstance that experiments had been made under the guidance of Dr. Bueb at Dessau for many years, and, therefore, the Dessau Vertical Retort Company were able to put forward a type which was the result of prolonged testing and experience. Consequently, Dessau settings had been introduced into a very large number of gas-works, and repeat orders had been placed by numerous gas-works where they had been tried. The new, or 1910, type of Dessau setting was at the present time being introduced at the Mannheim and Frankfort Gas-Works. The trials at Mariendorf made with it by the Carlsruhe Instructional and Experimental Works had shown that it had afforded further economy of fuel and an increased make of gas, but at the same time the Munich carbonizing chambers had been elaborated and further improved by Herr Ries, the Manager of the Munich Gas-Works; so that results such as those just communicated by Herr von Gässler were obtainable from them.

Horizontal chambers had been more recently put on the market; and Herr Käfer had reported results obtainable with them. But they had not yet been long in use; and it remained to be seen whether they could be kept sufficiently sound to prevent the nitrogen in the gas becoming excessive in quantity. The firm of Koppers had introduced both horizontal and inclined chambers; but comparative working figures had not yet been obtained in Germany with them. After referring to the doubts at one time felt in the gas industry as to the advantages of inclined retorts and of producers for heating retort-settings, and expressing the view that the doubts now similarly expressed as to the merits of the new systems of carbonization would be equally dispelled in a short time, the speaker went on to say that the system of carbonizing which should be preferred was one which, in addition to giving the highest yields of gas, ammonia, and tar, required the smallest amount of attendance and adapted itself in the simplest way to the supply of the coal and the removal of the coke, while showing favourable figures in regard to repairs and maintenance.

Results obtained at different gas-works were only comparable if they were on the same basis and, in particular, if they were obtained from the same coal. It was therefore desirable that the Carlsruhe Instructional and Experimental Gas-Works, which had already carried out trials of vertical retorts at Mariendorf and Zürich, should be given the opportunity to make similar trials on the other systems of carbonization. It remained for the manager of every gas-works to form his own opinion from what had been communicated as to which system was preferable. There was no doubt that for the size of works under discussion all the types of carbonizing plant mentioned were applicable. So much must depend on local conditions; it was not everywhere, for instance, that settings could be erected in the open without protection from rain and snow, as had been done at Innsbruck. Such a procedure cheapened the cost of installation, but was not in keeping with German views as to improvement in the conditions for the workmen. The method of bringing in the coal and taking away the coke also must depend largely on local conditions, and the coke could be removed more simply from vertical retorts than from chamber settings in most cases. On the other hand, with large installations like Munich, Regensburg, and Hanau, the method of coke removal left nothing to be desired.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

A Meeting of the Western Division of the Scottish Junior Gas Association was held in the Technical College, Glasgow, on Saturday evening. There was a good attendance, presided over by Mr. J. Frazer, of Provan, the President for the year.

Mr. G. Braidwood (Coatbridge) read a paper on the subject of

THE CALORIMETRY OF FUELS.

To determine the calorific value of a solid or gas, the combustion is carried out under such circumstances that the whole of the heat liberated is communicated to a known volume of water at a known temperature; such determination being carried out by means of instruments known as calorimeters. The calorific value of coal gas is a subject which is assuming more importance daily. When we consider that, with the sole exception of flat-flame burner lighting, gas is sold for fuel purposes, and that all fuels are valued chiefly by their heating powers, it seems right we should fall into line by adopting a calorific power standard, and abolish the illuminating power test, which has now become, or is fast becoming, obsolete.

That the test for illuminating power must be abolished sooner or later there can be no doubt; for if coal gas is to improve, or in fact retain, its position in the fuel field, it must be freed from unnecessary restrictions, which, by limiting the use of lower grades of coal in its manufacture, makes its price prohibitive for general fuel purposes. It is held by some that a relationship exists between illuminating power and calorific value; but experimentalists have entirely failed to evolve an algebraic formula which meets the case of gases of varying candle power. Much work has been done in attempts to prove such relationship; but he would be a bold man indeed who would state a definite calorific value for a given candle power. In the fixing of a calorific standard, the fact should not be lost sight of that, for incandescent lighting, gas of a high flame temperature is of more value than one of high calorific value.

The calorimetry of solid fuels may still be considered of secondary importance with us as gas engineers; but why this should be, I have long been at a loss to understand. The agitation in favour of smoke prevention in manufacturing centres should awaken gas engineers to the fact that they have in coke probably the best smokeless fuel in existence, and as such its calorific power is of paramount importance. The calorific value of coal is a matter which is entirely ignored by gas engineers in this country; but it is a significant fact that German engineers are already quoting their carbonizing results in percentage of the total heat units of the coal used. With a knowledge of the calorific value of our coal, coke, and gas, the loss of heat units to the tar-well would be interesting and instructive knowledge.

Before proceeding to describe the different types of calorimeters in general use, a few notes on the construction and corrections common to all the types may be of interest. In the construction of calorimeters, every care is taken that the material of which they are made should absorb as small an amount of heat as possible, and also that heat should not be lost by radiation. These results are obtained by having the metal of which the instrument is constructed as thin as is consistent with strength, and highly polished. Perhaps the most important part of a calorimeter is its thermometers, as the accuracy of an experiment is wholly based on their being correct. Mercury-glass thermometers are not by any means faultless, and should, where certainty is desired with regard to their accuracy, be tested against a standard thermometer, and the true reading at various points along the scale noted. When once fitted into their places, they should not be disturbed.

It has been suggested with flow calorimeters to change the inlet with the outlet thermometer at regular intervals; but I do not approve of this course, as it is well known that when a thermometer is first used for a low temperature, then exposed to a high one, and finally brought back to the first low temperature, it will give a lower indication than before. The effect is due to the glass not contracting at once to its original volume on cooling; the contraction sometimes taking days. The most important correction with solid-fuel calorimeters is that of water value or water equivalent of the apparatus, which value varies according to the amount of heat absorbed by the material of which the instrument is constructed. This value may be obtained by

taking the weight of the different parts of the calorimeter and multiplying by their respective specific heats. Should the vessel be of glass, only that part in contact with the water is taken; but if of metal, owing to its higher conductivity, the whole is taken.

Another method, and perhaps a more practical one, is to burn a known weight of a substance of a known calorific value and note the loss. There are a number of pure substances suitable for this purpose. A correction must also be made for the fuse employed. The heat developed by the fuse may be found by burning a certain weight of it. Where a high degree of accuracy is required, a correction must also be made for loss due to radiation. With the bomb type of calorimeters, this correction is carefully arranged for; but with the ordinary constant pressure type, a sufficiently accurate result may be obtained by having the temperature of the water at the beginning of the experiment 1·5° below that of the room. The rise of temperature usually being about 3°, the heat absorbed by the apparatus before reaching room temperature roughly equals that given off by radiation.

The essential parts of all solid fuel calorimeters are the combustion chamber and the calorimeter vessel. The calorimeter vessel is usually beaker shaped, made of copper, silver or nickel plated to prevent loss of heat by radiation. As a further guard against radiation loss, the vessel is usually surrounded by an outer casing having an air space between. The combustion chambers vary according to the type of calorimeter, but may be divided into three classes. (1) That in which the substance is burned with oxidizing substances, as in the Lewis Thompson calorimeter. (2) Calorimeters in which the substance is burned in a stream of oxygen at slightly above atmospheric pressure; this type being known as constant-pressure calorimeters. (3) Where the substance is burned in oxygen at an initial pressure of about 25 atmospheres in a closed vessel known as a calorimetric bomb.

In the first and second types, the products of combustion escape; but with the bomb, all the products are confined, and so no heat is carried away. There are hosts of solid-fuel calorimeters on the market; but the three which I propose to deal with will serve to illustrate the different types.

The Lewis-Thompson type of calorimeter is very common—being found in most laboratories. But, unfortunately, where a reasonable degree of accuracy is desired, its use cannot be recommended. Its faults are many, and are too well known to require repetition.

In the Parr calorimeter, as in the Lewis-Thompson, the substance is burned in the combustion chamber with an oxidizing mixture; but with this difference, that the products of combustion unite with the oxidizing agents. The combustion chamber consists of a cylinder of german silver, the bottom of which is closed by a screwed plug, while the top is closed by a conical valve held shut by a spiral spring. It is through this valve that a short piece of hot nickel wire is dropped into the chamber, to ignite the charge while the calorimeter is running. Vanes are sprung on to the sides of the chamber to cause a thorough circulation of the water in the calorimeter vessel; the chamber being revolved by means of a small electric motor. The calorimeter vessel is insulated by two outer casings, with air spaces between; while the vulcanite lid is provided with suitable openings for the spindle of the combustion chamber and thermometer. The oxidizing agents used in the combustion chamber are sodium peroxide, tartaric acid, and potassium persulphate, in different proportions for different classes of coal.

The proportions and weights of coal used are as under:—

	Lignites.	Bituminous.	Anthracites.
Coal	1 gm.	0·5	0·5
Tartaric acid	—	0·5	0·5
Sodium peroxide	10 gm.	10·0	10·0
Potassium persulphate	—	—	1·0

The coal must be small enough to pass a sieve 0·3 m.m. mesh and thoroughly dried at 105° to 110° C. to prevent premature ignition of the charge by moisture. To make an experiment, the combustion chamber, with its contents and stirring vanes in position, is placed in the calorimeter vessel containing 2000 grammes of water at 1·5° C. below room temperature, the cover put on, the connection made with the motor, and stirred for five minutes, when the initial temperature is taken. The small length of nickel wire is then heated to redness, and dropped into the bore of the spindle without stopping the motor, and the valve depressed, when the charge will ignite; the maximum temperature, when reached, being then noted. The reaction of the products of combustion with the sodium peroxide gives 27 per cent. of the total heat evolved; and, consequently, 73 per cent. of the heat is due to combustibles. Of course, in all cases the heat due to the iron wire, tartaric acid, and persulphate (when used) is deducted from the observed rise. The weak part of the apparatus is in the correction due to the chemical reactions, which varies with different classes of coal. Errors of from 1 per cent. to 1·5 per cent. high may be expected with the apparatus, although experimentalists are not agreed as to the maximum error. The instrument, naturally, can only be recommended for use where a supply of oxygen is not available.

The Gray-Thompson calorimeter, of the constant-pressure type, was originally of the William Thompson design, but has been considerably modified by Dr. Gray, of the Glasgow and West of Scotland Technical College, which modifications considerably enhance its value as an instrument of accuracy. The most important alteration is in the uprights, which have been arranged to allow of electric ignition. Alterations have also been made in the glass combustion chamber and baffle-plates; while means have been adopted to gauge the rate of oxygen passing through the apparatus, and to show the pressure. The instrument consists of a glass calorimeter vessel, capable of containing rather more than 2000 grammes of water, enclosed in a metal jacket, electro-plated to prevent radiation. The combustion chamber consists of a glass bell about $6\frac{1}{2}$ inches long by 2 inches in diameter, which sits loosely on a perforated metal base.

A brass tube for supplying the oxygen passes through a thick walled rubber tube fitted over the drawn-out end of the combustion chamber. Fixed to the metal base are two brass tubes joined at the top by a vulcanite cross-piece, and provided with terminals to transmit the current for igniting the charge. The tubes are in metallic connection with the metal base, and through one of them an insulated wire passes from the terminal to a short insulated vertical rod inside the combustion chamber. A second rod, bent in the form of a ring to support the crucible in which the coal is burned, is in metallic connection with the base. The upper ends of these two rods are on a slightly higher level than the top of the crucible, and are connected by means of a thin plantinum wire, which can be made to glow by the passage of an electric current. To carry out an experiment, one gramme of the coal, if of a bituminous nature, is compressed in the form of a pellet and attached to the thin platinum wire by means of a piece of sewing cotton, and dropped into the crucible. The combustion chamber is then lowered on to the base, and held in position by the screw fixed in the cross-piece. In the case of anthracite or coke, which cannot be made to form a pellet, the fuse is inserted into the powder in the crucible. Moist oxygen is then passed through the combustion chamber at a rate of 2 litres per minute, which is then immersed in the calorimeter beaker containing 2000 grammes of water, the temperature of which is 1·5° to 1·75° C. below that of the room.

After an interval of ten minutes, the temperature of the water is read to 1-100° on a thermometer graduated in tenths, with the aid of a lens. The fuse is then ignited by connecting up to the battery. When the combustion is complete, the rubber tube connecting the oxygen supply with the calorimeter is detached, to allow the water to enter the combustion chamber, when the water is thoroughly stirred by using the apparatus as a stirrer. Connection is again made with the oxygen supply, to continue the mixing, when the maximum temperature is observed. The calorific value is calculated thus:

$$\frac{(2000 \text{ water value})\ (t_1 - t_2) - \text{Fuse correction}}{\text{weight of coal}} = \text{calories per gr.}$$

Determining the water value of the instrument by the standard coal method, results from 0 per cent. to 1·5 per cent. low may be expected with bituminous coals; the error being due to the escape of gaseous hydrocarbons whose complete combustion is difficult.

The Langbein calorimeter, a modification of the Berthelot—one of the many types of bomb calorimeters on the market—has been found to give excellent results. The combustion chamber consists of a nickel-plated mild steel bomb, lined with platinum foil, of 300 c.c. capacity, tested up to a pressure of 2000 lbs. per square inch, with a lid which is capable of being screwed firmly on; a lead washer ensuring a gas-tight joint. Through the lid passes the entrance gas-channel, which is fitted with a needle valve. The entrance tube is continued into the bomb, and acts as an electrode, the other electrode also passing through the lid, but insulated from it. To determine the calorific value of coal, 1 gramme is impressed into a pellet, the fuse attached, and connected to the platinum wire, through which the current passes from an electric battery. 2172 grammes of water at room temperature is weighed out and placed in the calorimeter vessel, while 10 c.c. of water is added to the bomb, and the cover to which the coal is supported screwed on. Oxygen at an initial pressure of 25 atmospheres is then added to the bomb, which is transferred to the vessel containing the 2172 grammes of water. The wires are then connected to the bomb, and the calorimeter vessel covered with the vulcanite plates.

The stirrer, which is driven by an electric motor, is then started, and readings taken every minute for five minutes, at the end of which time the combustion is started by making the connection between the wires and the battery. The temperature rises quickly, reaching the maximum in about three minutes, when it begins to fall gradually; readings being taken during the fall for five minutes to obtain the cooling correction.

The stirrer is then stopped, and the bomb removed from the water, the top removed, and the contents of the lower part of the bomb washed into a beaker with water. The amount of sulphuric and nitric acid formed during the combustion is then estimated to find the number of calories to deduct for the formation of same. This is found by boiling the liquid washed out from the bomb, to eliminate carbonic acid, and titrating $H/_{10}$ Ba $(OH)_2$, using phenolphthalein as an indicator:—

$$2\ H\ NO_3\ Ba\ (OH)_2 = Ba\ (NO_3)_2\ 2\ H_2O$$
$$H_2SO_4\quad Ba\ (OH)_2 = BaSO_4\quad 2\ H_2O$$

Twenty c.c. of Na_2CO_3 of 3·706 grammes per litre strength is then added; 1 c.c. of this solution being equal to a quantity of HNO_3, in forming which one calorie is liberated.

$$Ba\ (NO_3)_2\ Na_2\ CO_3 = Ba\ CO_3\ 2\ Na_2\ NO_3$$

Filter, and to the filtrate add methyl orange, and titrate with

N/10 HCL. One c.c. N/10 HCL being equal to 1·429 c.c. Na_2CO_3, the correction for HNO_3 may be stated thus: 20 – 1·429 N/10HCL. The percentage sulphur in the coal may be calculated from the figures obtained:

$$\frac{(\text{HCL Ba(OH)}_2 - 14) \times 0{\cdot}16}{\text{weight of coal in grammes}} = \text{percentage of sulphur.}$$

For every 1 per cent. of sulphur, a deduction of 22·5 calories must be made.

In the fitting up of a gas calorimeter, too much attention cannot be paid to having a water supply of constant pressure and uniform temperature. This is best attained by having a water-tank fixed overhead in the same room as the calorimeter. The tank should contain sufficient water to make a number of tests, and have an arrangement fitted to shut off the gas supply from the calorimeter, should the tank be allowed to empty itself by accident. The room in which the calorimeter is fitted should be free from draughts and vibration, and capable of being maintained at a steady temperature. The governed gas supply to the calorimeter should be registered by an experimental wet meter, registering directly from the drum, and not one geared to the index.

One is rather at a loss where to begin a review of the gas calorimeters at present on the market, most of which are thoroughly reliable instruments. Perhaps the calorimeters which have met with most success in this country are the Junkers and Simmance-Abady instruments for general oil and gaseous fuel testing; while the Boys calorimeter has been introduced with success for testing coal gas only. The Junkers and Féry recording calorimeters, with the necessary correction for temperature and barometric pressure, can be relied on for accurate results, and, as well as providing an indisputable record, are of much more value in checking the make than an occasional laboratory test by the ordinary method.

The general construction of the calorimeters mentioned is well-known to you; so I will confine my remarks to the good or bad points in their design which have appealed to me when working them.

The Simmance-Abady calorimeter, although perhaps among the cheapest on the market, is by no means the worst. This calorimeter, in one form, may be used for testing any combustible gas or oil. The water, passing upwards through concentric annular spaces, has a passage of 96 lineal inches. By means of a mirror, fixed at an angle on the burner, the flame is visible throughout a test; while the water pressure can be watched in a gauge fitted beside the thermometers. The mirror possesses an obvious advantage; but it is questionable if the water-gauge is quite as good as the arrangement on the Junkers and Boys instruments, having an overflow to waste; thus ensuring a constant head, no matter from what source the water is drawn. A distinct advantage in intermittent testing is that the burner may be placed exactly in position, without adjusting screws or disturbing the apparatus in any way. It is claimed for this apparatus that an actual test may be made under one minute; but while this point may appeal to many, my experience has been that speed in experimental work does not always tend towards accuracy. The calorimeter is well adapted for intermittent testing.

The Junkers calorimeter, introduced at a much earlier date than the Simmance-Abady or Boys instruments, has met with much favour on the Continent and in this country. Like the Simmance-Abady instrument, it is adapted for the testing of all combustible gases and oils. Unfortunately, its price is high, and this will no doubt act as a bar to its introduction to works where a reliable instrument at a fair price is required. The arrangement for regulating the water rate of flow through the instrument by means of a quadrant cock is very useful, and permits the operator to increase or diminish the flow through the calorimeter without moving about; while the overflow funnel insures a constant head. The instrument can be recommended for sound construction, ease of working, and accurate results.

The Boys calorimeter, prescribed by the Gas Referees for use in London, serves the purpose well for which it is intended—namely, testing the calorific value of coal gas of about 14 candles. Constructed on entirely different lines from the Simmance-Abady and Junkers instruments, there is room for improvement in its design. Flat-flame burners are used for the combustion; and it is doubtful if complete combustion can be obtained with richer gases. Perhaps a more serious fault is that to light the burners the body of the calorimeter must be lifted off its stand. This, in a works where intermittent testing is required, is a bad point; and the average assistant is not blessed with the patience necessary to await the proper flow of condensed products from the disturbed reservoir. In the hands of an experienced operator, however, very consistent results may be obtained. The apparatus lends itself to repair much better than either the Junkers or Simmance-Abady instruments.

The Junkers recording calorimeter, very much like the ordinary Junkers in design, is fitted with a meter arranged to pass constant quantities of gas and water. The quantities of gas and water passed being fixed, it follows that any rise of temperature is due to an increase in the calorific value of the gas. By means of a thermocouple, any alteration is communicated to a galvanometer or recording chart. The apparatus records gross value, which, of course, requires correction for temperature and atmospheric pressure. As the instrument is intended only to keep a check on the manufacturing process, absolute figures need not be expected.

The essential parts of the Féry recording calorimeter consist of a thermocouple, heated by the products of combustion of a flame, and connected by two conducting leads to a thread recorder. The thermocouple is formed of 15 vertical strips of nickel and constantan soldered in series, and insulated from one another by sheets of asbestos. These strips are placed inside a brass cylinder standing upon an insulating plate supported by two feet. The gas under test is passed through a meter, then through a regulator to the burner, and burns in the centre of the space formed by the strips, and between their upper and lower junctions. The products of combustion escape between the spaces in the upper junctions which they heat. The air necessary for combustion passes between the lower junctions, which remain at the temperature of the room.

The vertical strips are cooled by a current of air passing inside the brass cylinder, which is pierced with holes at its lower part. The temperature of the hot junctions is not raised above 200° C. under ordinary working conditions, the junctions therefore do not deteriorate with use. The difference in temperature between the hot and cold junctions gives rise to an electromotive force which is proportional to their difference in temperature. Being arranged differentially, the difference of potential between the thermocouple junctions is not influenced by variations in the external temperature. Experiments with the calorimeter have shown that, within very wide limits, the electro-motive force is proportional to the calorific power. The difference in potential is registered by means of a thread recorder, which is arranged to show net calories. The calorimeters are standardized in 1000 calories—viz.: From 1000 to 2000 for petroleum gas; from 2000 to 3000 for water gas; and from 4000 to 5000 for coal gas.

In closing, I may say that it was my intention to bring before you a number of experimental figures; but a change in my position made this impossible. Without the intended figures, the paper has less value.

Discussion.

Mr. T. Wilson (Coatbridge) said the members were all much indebted to Mr. Braidwood for the time he had taken in preparing the paper; but he had not given them matter for discussion. The possibility was that they would learn much more in reading than in discussing it.

Mr. J. Wilson (Falkirk) said Mr. Braidwood's observations on the subject of thermometers were exceedingly interesting to him. He thought at first that the changing of thermometers was a good idea; but he was afraid he was now beginning to alter his opinion. The members might have entered the room with a little knowledge of calorimetry; but he was sure this would not be the case when they left, because they would have learned a great deal in the short time Mr. Braidwood had been reading his paper.

Mr. F. Cuthbert (Kirkintilloch) considered that in the case of gaseous fuel it was a proved fact that the products of combustion should have the same temperature as the ingoing water; otherwise all the heat would not be registered by the thermometer, and consequently a false result would be obtained. He understood that with the Boys calorimeter, though it required a longer time to make a test, the accuracy of the experiment was much greater than in the case of other instruments. In all the calorimeters on the market, the essential feature was that the whole of the heat of the burning gas was transferred to the water circulating through the instrument, and also that it should be well insulated. He was pleased to see that the author approved of thermometers being always used at the standard.

Mr. F. L. MacLaren (Dumbarton) said it was refreshing to get the different points about calorimetry brought up to date and presented so carefully. He much appreciated the electrical ignition of the calorimeter. He recollected the trouble they had in bygone days to ignite their charges by means of a fuse; and very often they failed half-a-dozen times before they succeeded in getting one proper result. He noticed the bell-shaped glass jar, and was wondering how it stood the heat. He remembered that they used to break very frequently. But an ingenious individual devised an arrangement with an incandescent vertical funnel, with a plug at the end and a tube screwed tightly into it; and the hard glass stood up to the great heat of combustion, whereas the cast glass bell very often gave way with the difference in temperature between the water outside and the hot gases within. However, he had no doubt it would be perfect now. Certainly the electrical igniting arrangement was good.

The President remarked that Mr. Braidwood had had a very long and varied experience in connection with calorimetry in the laboratory; and what he had just given the members was the outcome of that experience. One thing he (the President) noted—and he might say he expected Mr. Braidwood would touch upon it—was the general idea which was gradually spreading in the gas industry, that with the advent of incandescent lighting the illuminating value of gas was of less account than its calorific value or flame temperature. Mr. Macfarlane, their Chemist at Provan, had been making quite a series of tests of the calorific value of the gases for the purpose of ascertaining the real difference between the illuminating and the calorific value. He was surprised to notice, from time to time, that when the gas was of fairly high illuminating power, the calorific value was low, and that when they had a low candle power the calorific value was high. They knew the reason for it; but the value of the fact was that it went to point to them that the improved heating value of gas was against the illuminating power. Many gas engineers

were advocating the adoption of a new standard—calorific value instead of illuminating power; and from this point of view the paper was an opportune one. As had been said, Mr. Braidwood had not left them any room for discussion. He had certainly brought his subject up to date.

Mr. Braidwood thanked the members for the very cordial reception they had given his paper; and he most specially thanked Mr. Wilson, of Coatbridge, for his kind remarks. Mr. Cuthbert was of opinion that more accurate results were obtained with a Boys calorimeter than with other instruments. He (Mr. Braidwood) could not agree with this. He had had very large experience with the Boys calorimeter; and, in his opinion, it could not be compared with the Junkers for accuracy. He questioned whether it could be compared with the Simmance-Abady instrument. Mr. MacLaren spoke about the combustion chambers breaking. He had carried out a considerable number of tests with the calorimeter before them, and had not had many breakages. In the Rosenheim calorimeter, they put in an ordinary incandescent funnel in place of the bell-shaped one. He believed it was giving excellent results; but he had never worked with it. The President made some remarks about the tests which were being made at Provan for the purpose of trying to arrange a table that would show the comparison between the candle power and the calorific value of gas. He himself had been trying this for two years; and he had not arrived at any figure for a given candle power. In his opinion, the introduction of the calorific power standard in place of the candle power one must come. In works where a high candle power was maintained, lime had to be used to take out the carbonic acid; whereas if a calorific test were instituted in place of one for illuminating power, oxide of iron might be used, and the carbonic acid allowed to go forward—it being well known that this had not the same effect on the calorific value as on the illuminating power of gas. One per cent. of carbonic acid reduced the candle power of gas 3½ per cent.; while it only reduced the calorific value 1 per cent. Consequently, a considerable saving in the cost of purification would be effected if calorific value instead of illuminating power should be adopted as the standard.

The Last Examinations in "Coal-Tar Products."

In another part of the "Journal" will be found a notice of the portion of the report on the work of the Department of Technology of the City and Guilds of London Institute for the session 1909-10 which deals with the last examinations in "Gas Engineering" and "Gas Supply." Readers are aware that examinations are also held in "Coal Tar Distillation and Products." The report shows that there were three centres where this subject was taught, and that 19 students attended the classes. There were, however, 24 candidates for examination, and 15 of them passed—2 first class in the Honours grade, and 8 first class and 5 second class in the Ordinary grade. The failures were 37·5 per cent. There were four prize winners, whose names were given in the "Journal" for the 2nd of August last (p. 317). The Examiner in this subject (Dr. J. C. Cain), in his report, says that in the Ordinary grade the standard attained by the candidates was distinctly better than last year. The programme for the session 1910-11 was issued in June last; but the syllabus in "Coal-Tar Distillation and Products" could not be included, as it was under revision. It will therefore be issued separately.

The will of Mr. William Bishop, one of the Directors of the Stroud (Glos.) Gas Company, has been proved at £43,266, with a net personalty of £40,550.

At the meeting of the Graduates' Association of the Institution of Mechanical Engineers next Monday, Mr. J. C. Briggs, of Workington, will read a paper on "Requirements of Illumination and the Status of Gas Lighting." Mr. H. E. Jones will preside.

Alderman Abbey has just completed his jubilee as a member of the Brighton Corporation. He was elected in 1860, was chosen as an Alderman in 1867, and was Mayor in 1875. He rendered conspicuous service to the town in connection with the negotiations which resulted in the purchase of the undertaking of the Brighton, Hove, and Preston Water-Works Company in 1872.

Mr. J. M. Grundy, of the Borough Treasurer's Department, St. Helens, has been appointed Audit Clerk to the Aldershot Gas, Water, and District Lighting Company—a position advertised recently in the columns of the "Journal," under No. 5317. Mr. F. J. Alban, the Deputy-Accountant to the Pontypridd District Council, was on Wednesday last appointed Accountant to the Pontypridd and Rhondda Joint Water Board. Mr. Alban was previously engaged under the Pontypridd Board of Guardians and the Llantrisant Rural District Council.

This month's arrangements for the London and Southern District Junior Gas Association (beyond the visit to the Fulham Gas-Works on Saturday, as noticed elsewhere) include a "coffee" meeting on the 16th inst., at 7 o'clock, when various questions sent in by members will be discussed, to be followed at 8 o'clock by an address by Mr. L. F. Tooth, of the Commercial Gas Company, entitled: "The Industrial Aspects of Gas." The Secretary (Mr. S. A. Carpenter) intimates that fifteen new members have just been elected—eleven from the staff of the Gaslight and Coke Company, two from the South Metropolitan Gas Company, and one each from the Commercial and Sevenoaks Gas Companies.

REGISTER OF PATENTS.

Combustion of Mixed Gases.

Bone, W. A., of Leeds University, Wilson, J. W., of Armley, near Leeds, and M'Court, C. D., of Balham Hill, S.W.

No. 25,808; Nov. 9, 1909.

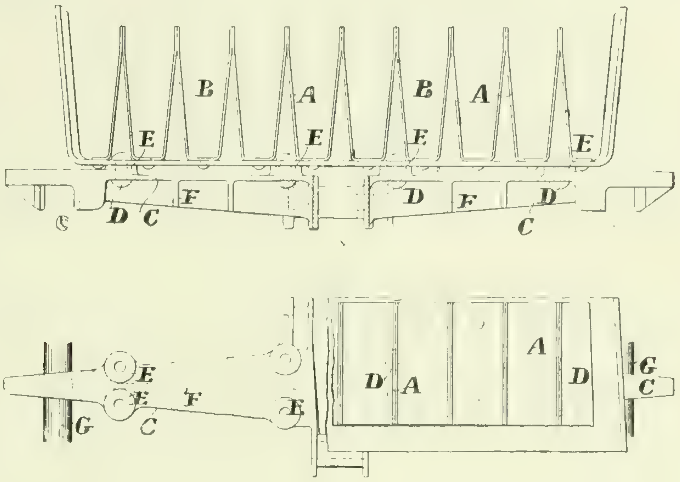
[See *ante*, p. 711.]

Carriers for Use in Apparatus for the Distillation of Coal.

Richards, R. S., of Wraysbury, and Pringle, R. W., of Richmond, Surrey.

No. 22,421; Oct. 1, 1909.

This invention relates to carriers for use in the carbonization of coal, and is particularly applicable to endless conveyors used in the manufacture of partially distilled fuel, but "is applicable generally in cases where carbonaceous material is caused to travel on endless conveyors in or through flues or chambers where the material is subjected to heat." One of the patentees' specifications dealing with coal distillation was summarized last week, p. 650.



Richards and Pringle's Coal Carriers for Distillation Apparatus.

According to the present invention, the conveyor is composed of trays—preferably open-ended and of considerable width relatively to their length in the direction of travel. The trays are divided by longitudinal ribs into a transverse series of open-topped compartments for the material to be treated; and the ribs or dividing walls "may with advantage be so arranged as to form compartments of downwardly tapering section." The trays may be of sheet iron, and the dividing walls be formed of plates bent to channel shape, which may widen upwardly to provide downwardly tapering compartments. The dividing walls or plates are preferably arranged so as to provide rounded corners for the compartments. The trays are secured to an endless transporting device; and it is preferred to attach them one to each link of a chain passing round chain-wheels at the ends of the stretch. The links may be relatively narrow and lie below the middle line of the trays, and be formed with lateral arms or extensions for supporting the trays. The outer ends of the arms may run on rails, and may be sloped out to adapt themselves to the form of the rail or bearer so as to act as a guide.

With an arrangement described, the carbonaceous material fed into the trays falls into the several compartments, and "is thus subdivided into separate small charges by the dividing walls—thus securing more intimate application of the heat by conduction; the dividing walls themselves serving to store and transmit the heat to the contents of the tray compartments." The construction of the trays also allows of their travelling readily around the chain wheels or drums at the ends, and of conveniently discharging the material from the transverse compartments of the trays.

The patentees say they have found, from experiments, it is difficult to distil completely a greater depth than 2 inches of fuel on a travelling conveyor of ordinary construction; but by the use of their trays, they "are able efficiently to heat material disposed in the trays to a considerably greater depth."

The tray is formed (as shown) of a wide and relatively short container of sheet iron, of channel-like form, open at the top and ends. Inside the container are riveted a series of dividing walls A, of sheet iron bent to upwardly tapering channel shape; so as to subdivide the tray into a transverse series of tapering compartments B having rounded corners at the bottom. The tray extends at one end beyond the dividing walls, so as to overlap the end of the adjacent tray. The trays thus form a continuous conveyor. The trays are bolted to the links of an endless conveyor chain (one link of which is shown). The links are formed with lateral supporting arms C extending for about the width of the tray which is riveted to the supporting arms D—preferably as shown, so as to leave the forward end of the tray free of the link and arms. The arms are formed with bosses or projections E to provide bearing surfaces for the tray at the points of attachment, and with strengthening ribs F. Recesses at the outer ends of the arms fit over supporting rails G, on which the arms may travel. The links thus constructed are pinned together at the eyes so as to form the conveyor chain, which may run round chain wheels or drums as will be readily understood.

Combustion of Gaseous Fuel.

Bone, W. A., of Leeds University, Wilson, J. W., of Armley, near Leeds, and M'Court, C. D., of Balham Hill, S.W.

No. 29,430; Dec. 16, 1909.

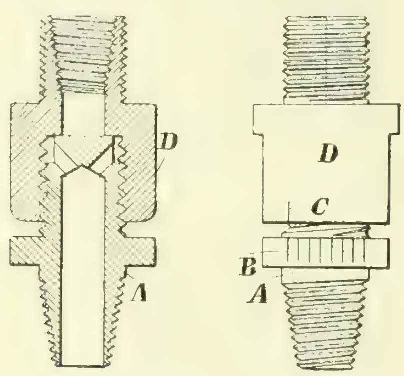
[See *ante*, p. 712.]

Regulating the Gas Supply to Burners.

Preston, J. N., of Glasgow.

No. 29,720; Dec. 20, 1909.

This device for regulating the gas supply to burners is of the kind in which an inner cap or nipple secured at its lower end to the gas-pipe is provided with an external cap or nipple adapted to be regulated by screwing one part on to the other; also there is an index mark on one part adapted to register with a scale on the other part to indicate the amount of gas passing in a given time, and not merely to show whether the valve is open or closed.



Preston's Regulator for Gas-Burners.

The governor consists of a nipple A and nut D. The nipple is screwed and tapered at its bottom, while its top is screwed and reduced slightly in diameter. It is axially bored to within a short distance of the top, and has two small holes bored radially through the side of the reduced part at its top at an angle. A scale B is cut upon part of its circumference for regulating the consumption; and for this purpose there is an index mark C on the outer cap D. Each scale mark would conveniently indicate a consumption of 1 cubic foot of gas per hour; and as there are seven marks, the device would register from 0 cubic foot to 7 cubic feet per hour. The consumption of gas is governed by unscrewing the nut, which is a tight fit, so that the part D cannot be moved without the aid of a suitable tool.

Incandescing Bodies for Gas Lighting.

Unruh, Max von, of Charlottenburg, Berlin.

No. 30,148; Dec. 24, 1909.

The inventor's patent for the use of a mixture of oxide of thorium with organic fibrous materials, which are impregnated with lighting-salts—for instance, of thorium and cerium and with magnesium oxide and an organic binding substance—has already been described in the "Journal" for April 6, 1909, p. 33. Experiments have since shown that a mixture of suitable organic and inorganic salts of thorium, cerium, erbium, zirconium, and thallium, or a mixture of the double salts of these elements, or mixtures of these salts and double salts, together with organic fibrous materials which are impregnated with lighting-salts, give better results than if oxide of thorium only is used, together with organic fibrous materials impregnated with salts.

The process of manufacturing the new mixture is as follows: The salts of thorium, cerium, erbium, zirconium, and thallium are thoroughly mixed (in any desired order) with organic fibrous materials, which are impregnated with lighting-salts; and, if desired, to this mixture an addition of suitable salts of magnesium, and, further, an addition of an organic binding substance may be made. The plastic material thus obtained is then either pressed into the form of the incandescent body, dried, and subjected to sufficient heat, or threads are pressed from the material, and the body is then formed from them in a suitable manner.

The process of preparing the organic fibrous substances which are impregnated with the lighting-salts, was described in patent No. 17,596 of 1908 (referred to above) and need not further be described.

Experiments have shown that the best organic binding substance preferably added to the mixture is a colloid, with an addition of suitable chemicals—such as sugar, glycerine, water, and the like. Sugar is a crystalloid; and therefore it cannot make a material plastic, while it is of importance for obtaining a certain rigidity and cohesion. Gelatine makes the material plastic and prevents the crystallizing of sugar. Glycerine increases the plasticity of the material; water is only used as a solving agent.

In the new process, salts of magnesium may optionally be used for obtaining rigidity and resistance of the incandescent body against shocks when red-hot; the salts of thorium and zirconium are used to prevent the shrinking of the body when subjected to sufficient heat to destroy the organic substances; the salts of erbium are used for obtaining a higher rigidity of the body; whereas thallium salts are used for obtaining a white light. The light of the other lighting-salts is reddish; while the green colour of the thallium salts acts as complimentary colour and makes the light white.

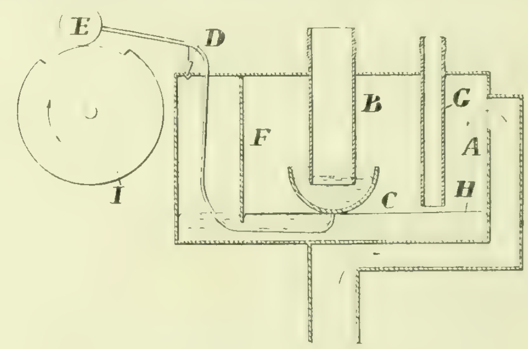
Incandescent bodies from the mixture can be made in different ways. For instance, fine threads can be laid vertically over a suitable mould or core, while a single long thread is laid almost horizontally round the core, whereby a reticular incandescent body is obtained, which is dried and subjected to heat. The incandescent bodies can also be made by pressing the material in suitable moulds in which an incision corresponds to every thread of the finished body.

Lighting and Extinguishing Apparatus for Gas-Burners.

Morand, G. A. A., of Orléans, France.

No. 9202; April 15, 1910. Date claimed under International Convention, Nov. 5, 1909.

This apparatus, for automatically lighting and extinguishing gas-burners, consists of a cylindrical receptacle the upper part of which communicates, through the opening A, with the gas inlet pipe, and is provided (preferably in its central part) with a pipe B for the burner. A cup-shaped vessel C, filled with mercury, is arranged underneath the pipe B, being fixed on to the end of a lever pivotally mounted at D upon the wall of the receptacle. The outer arm of the lever is provided with a counterweight E, the weight of which is slightly greater than that of



Morand's Gas-Burner Lighter and Extinguisher.

the vessel C together with the mercury contained in it. The receptacle is divided into two compartments by a vertical partition F interrupted at its lower end, and is filled with mercury, so as to form a tight seal between the two compartments, thereby preventing the gas admitted into the right-hand compartment from escaping into the other one. A gas-pipe G, serving for the feeding of a bye-pass flame, comes to lie with its lower end at a small distance away from the level of the mercury H.

The lighting and extinguishing of the burner are effected at predetermined hours by a clock movement rotating a notched disc I or a cam arranged beneath the counterweight E. In the position illustrated, the counterweight has fallen into the notch formed in the disc, thereby raising the vessel C, and closing the lower opening of the pipe B by the mercury contained in the vessel. When the apparatus is in this position, the gas passing through the opening A into the right-hand compartment cannot reach the burner, but can feed the bye-pass flame owing to its free access to the pipe G.

The disc I rotates continuously in the direction of the arrow, and at the moment the notch at the top raises the counterweight, the vessel C descends and the mercury renders free the lower opening of the pipe B. The gas can now pass to the burner, and is lit by the bye-pass flame, which is at the same time extinguished by the cup-shaped vessel descending on to the mercury H, thereby causing the level of it to rise and close the opening of the pipe G. During the further rotation of the disc, the counterweight falls again into the notch, and causes the vessel C to rise and allow the mercury in it to close the passage of the gas to the burner, and the level of the mercury H to descend and allow the gas to flow into the bye-pass and be lit by the flame of the burner which is dying out.

Cooling Coal Gas.

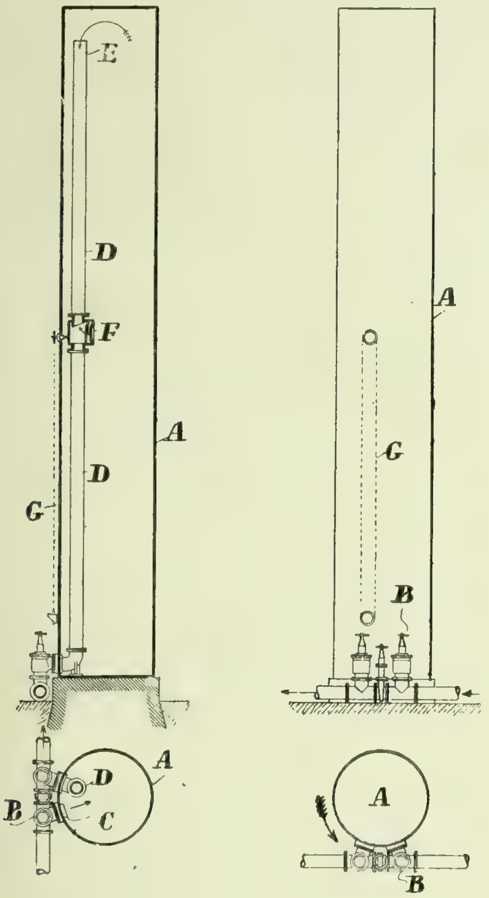
Benninghoff, O., and August Klönne, of Dortmund, Germany.

No. 13,978; June 9, 1910.

This invention, relating to the cooling of coal gas, has for its object "to obviate the objectionable consequences resulting from the condensation of naphthalene," concerning which the patentees say: "In accordance with the treatment heretofore usual, the gas is first cooled in a gas-cooler having by day a temperature of from 60° to 70° C.; and it is then still saturated with naphthalene to an extent corresponding with its temperature—the naphthalene, however, separating out when the gas, during its further treatment, is passed through the system of pipes and is thus further cooled. Now, according to this invention, the condensation of the naphthalene in the pipes (heretofore inevitable) is prevented by again slightly heating the gas after it has been cooled to the ordinary atmospheric temperature, with the result that it enters the apparatus in which it is subsequently treated or utilized at a temperature somewhat above the lowest temperature to which it has been cooled in the gas-cooler. By the treatment in the cooler, the quantity of naphthalene contained in it has been decreased correspondingly with the fall in temperature; while by the subsequent heating, it is rendered possible to cool the gas in the intermediate pipes down to the coolest temperature prevailing in the gas-cooler without bringing about the condensation of naphthalene, which would only begin to take place if a still further fall of temperature occurred in the pipes. Should the gas now be led to various apparatus for further treatment, the precipitation of the naphthalene in the pipes themselves will be avoided. Care must, of course, be taken to prevent naphthalene from again becoming absorbed when the gas is reheated; and to this end the reheating of the gas is effected only as it leaves the cooler—reliability in the operation of the apparatus being thus secured."

The apparatus for carrying out the process described is provided by

arranging the outlet pipe of the gas-cooler within the interior of the cooler, and by so arranging it that the warm entering gases flow around it. As shown, the cooler consists of a cylinder A into which the gas enters at C through the valve B. The warm gas on entering flows around the outlet pipe D; and, as it passes through the cooler, it is cooled down to the ordinary atmospheric temperature. It then passes at E into the outlet pipe D, and is, during its passage through this pipe, again slightly heated by the gases entering at C, with the result that the outflowing gas is heated to an extent sufficient to prevent the



Benninghoff and Klonne's Gas Cooler.

condensation of naphthalene. At a suitable height there is provided in the outlet pipe D a valve F, which is actuated from the outside by controlling gear G, by means of which a portion (or, if necessary, the whole) of the gas in the cooler can be allowed to escape should the temperature within the cooler fall so low as to bring about excessive cooling of the gas. This valve may at the same time shut off the upper half of the pipe D; so that by the use of a single valve only half the cooling surface of the cooling chamber can be made use of when desired.

APPLICATIONS FOR LETTERS PATENT.

26,961.—Crawshaw, N. S., "Gas-regulators." Nov. 21.
27,024.—Mackay, J. F., and Leeson, G. W. T., "Adapters for burners." Nov. 21.
27,056.—Smith, C. C., "Indicating and recording the rate of flow of water." Nov. 21.
27,146.—Shaw, P. E., "Incandescent burners." Nov. 22.
27,154.—Bornong, M. P., "Igniting-tap for gas-burners." Nov. 22.
27,158.—Okey, P., "Gas-engine governors." Nov. 22.
27,228.—Goodwin, W. G., "Engine for the immediate production of power by steam and gaseous pressure." Nov. 23.
27,292.—Bour, E. F., "Gas-turbines." Nov. 23.
27,332.—Kent, W. G., and Hodgson, J. L., "Fluid meters." Nov. 24.
27,334.—Hodgkinson, T., "Artificial fuel." Nov. 24.
27,356.—Davey, W. R., "Preventing unauthorized persons from unscrewing or removing the unions from main cocks or gas services and meters." Nov. 24.
27,398.—Wilton, G., "Purification of coal gas and the manufacture of sulphate of ammon.a." Nov. 24.
27,430.—Draper, R., and Tabberer, G., "Washing coke." Nov. 25.
27,450.—Farnham, R. V., "Gas-producers." Nov. 25.
27,469.—Safety Non-Explosive Reservoir Company, Limited, and Tempest, A. J., "Air-gas generator." Nov. 25.
27,478.—Bleichert, M. A., & M. P., "Quenching and removing coke." Nov. 25.
27,504.—Wilson, G., "Wet meters." Nov. 25.
27,525.—Hunt, W., "Exhauster or compressor for gases." Nov. 26.
27,545.—Knowles, A. E., "Gas analyzing apparatus." Nov. 26.
27,572.—Compagnie pour la Fabrication des Compteurs et Matérial d'Usines à Gaz, "Revolution counters." Nov. 26.

The Malta and Mediterranean Gas Company announce an interim dividend at the rate of 4 per cent. per annum (2s. per share) on the ordinary shares for the past half year.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas and Electric Lights in a Fog.

Sir,—A point of some considerable public importance was forcibly brought home to my mind last week (on Nov. 22), when driving home through the fog—namely, the marked difference between gas-lamps and electric lamps as aids to the fog-bound traveller.

Going along Piccadilly, the new gas-lamps made driving quite safe at a normal pace; but when we got past St. James's Street into the region of electric arc lamps—fairly numerous as they are along the Green Park—we were compelled to crawl, and only reached Knightsbridge (after repeatedly getting lost) by the aid of a link-man. Then we got into gas lighting again, and were able to progress at a steady rate of about seven miles an hour, although the fog was exceedingly dense along the side of the park.

It is quite evident that arc lamps up in the clouds are valueless for street lighting in foggy weather; and it is to be hoped that the new gas lighting now in use in St. James's Street and the neighbourhood will shortly be extended throughout the West-end.

Electric light has obvious advantages for many purposes, but none for street lighting; and, in the interests of public safety and convenience, it is to be hoped that this will be more clearly recognized in future.

Nov. 29, 1910. D. G.

Mr. Johns' Paper on Ammonia Recovery.

Sir,—My attention has been called to the figures given in the reply to the discussion on my paper recently read before the Midland Junior Gas Engineering Association; and I regret to find, on looking into the matter, that the figures given had reference to an exceptional period of working ten years ago, when heavy renewals had to be effected, and that the usual cost of sulphate making at Bath comes out at less than £3 per ton.

Birmingham, Dec. 3, 1910. W. H. Johns.

Dr. Colman's Lecture to the Southern Junior Association.

By an error in our last issue, we attributed to Mr. S. A. Bevington a set of questions asked of Dr. Harold G. Colman, at his lecture before the London and Southern Junior Gas Association on "Gaseous Combustion." We find they were handed in by Mr. T. F. Canning, the Senior Vice-President of the Association, and were as follows, and not as reported.

(1) In a retort-setting, is pressure conducive to more perfect combustion and a higher temperature?

(2) Taking two retort-settings, one with a greater number of transverse walls than the other, would the setting with the extra walls require more fuel to maintain a constant working temperature than the one with the lesser number of walls? If so, what becomes of the extra heat?

(3) Taking a water-circulator heated by a luminous gas-flame, or series of luminous gas-flames, what is the total amount of heat lost as light energy, and in apparatus of this kind can absence of carbon monoxide in the waste gases be relied upon to give conclusive proof of perfect combustion?

PARLIAMENTARY INTELLIGENCE.

GAS AND WATER PROVISIONAL ORDERS FOR 1910.

The Board of Trade have issued a report upon their proceedings under the Gas and Water Works Facilities Act, 1870, during the past session. It shows that last December twenty applications were made to the Board for Provisional Orders—fifteen relating to gas and five to water undertakings. The amount of capital proposed to be authorized was £359,941 by shares and £123,476 by loan—£289,941 share and £104,310 loan capital being for gas, and £70,000 share and £19,166 loan capital for water purposes. The Gas Orders related to Brownhills and District, Builth Wells, Burnham (Somerset), Chertsey, Cranleigh, Dinnington and District, Dunblane, Highbridge, Llanidloes, Pinner, Ripley, Rowley Regis and Blackheath, Sheffield, Sudbury and District, and Swansea; and the Water Orders to Barnstaple, Chelsham and Woldingham, East Kent District, South Kent, and Sutton District.

Gas Orders.

The principal objects of the applications in regard to gas were as follows: To empower the Ogley Hay and Brownhills Gas Company, Limited, to continue their existing works, construct and maintain further works, and manufacture, store, and supply gas in the urban district of Brownhills and the parish of Ogley Hay rural, in the county of Stafford. To authorize the Builth Gas and Coke Company, Limited, to maintain and continue gas-works, and manufacture and supply gas within the urban district of Builth Wells and the parishes of Llanddewir Cwm and Rhosferig, in the county of Brecknock, and the parish of Llanelwedd, in the county of Radnor. To empower the Burnham Gas Company, Limited, to maintain and continue existing gas-works, and manufacture and supply gas within the urban district of Burnham and parts of the parishes of Burnham Without, Brent Knoll, and Berrow, in the county of Somerset. To empower the Chertsey Gas Consumers' Company, Limited, to raise additional capital. To authorize the Cranleigh Gas and Coke Company, Limited, to construct and

maintain further works for the manufacture and storage of gas. To empower the Dinnington and District Gas Company, Limited, to maintain and continue existing gas-works, and manufacture and supply gas in certain parishes or townships in the West Riding of York. To empower the Dunblane Gas Company, Limited, to maintain and continue existing gas-works, construct and maintain further works, and manufacture, store, and supply gas in the parish of Dunblane, in the county of Perth. To empower the Highbridge Gas Company, Limited, to maintain and continue existing gas-works, and manufacture and supply gas in the urban district of Highbridge and parts of the parishes of Burnham Without and Huntspill, in the county of Somerset. To empower the Llanidloes Gas, Coal, and Coke Company, Limited, to maintain and continue existing gas-works, and manufacture and supply gas in the borough of Llanidloes and the parish of Llanidloes Without, in the county of Montgomery. To authorize the Pinner Gas Company, Limited, to raise additional capital. To empower the Ripley Water-Works and Gaslight and Coke Company, Limited, to maintain and continue existing gas-works, construct and maintain further works, and manufacture and supply gas in certain parts of the townships of Pentrich and Ripley, in the county of Derby. To extend the limits for the supply of gas by the Rowley Regis and Blackheath Gas Company. To make provision with respect to the quality of gas supplied by the Sheffield United Gaslight Company. To authorize the Sudbury Gas and Coke Company, Limited, to maintain and continue existing gas-works, and manufacture, store, and supply gas in the borough of Sudbury and the parishes of Great Cornard and Chilton, in the county of Suffolk. To extend the limits for the supply of gas by the Swansea Gaslight Company. Nine of the applications—viz., those coming from Brownhills, Builth Wells, Burnham, Dinnington, Dunblane, Highbridge, Llanidloes, Ripley, and Sudbury—were in respect of existing non-statutory undertakings. All the others had reference to undertakings authorized by Special Acts or Provisional Orders. The promoters of the Sudbury and District Gas Order withdrew their application shortly after it had been made.

There was no opposition to the Chertsey, Cranleigh, and Pinner applications; and the objections lodged in the cases of Builth Wells and Highbridge were withdrawn.

The objections made in respect of the Brownhills, Burnham, Dinnington, Llanidloes, Ripley, and Sheffield applications were fully considered by the Board of Trade. In the case of the Dunblane application, a local inquiry was held on behalf of the Board, and in each of the other cases, with the exception of Burnham, an inquiry was held at the office of the Board. In each instance they decided to grant the Order, subject to such modifications and amendments as were required.

The promoters of the Rowley Regis and Blackheath and the Swansea Orders failed to obtain the consents of some of the local and road authorities concerned, and requested the Board of Trade to exercise their powers under section 4 of the Gas and Water Works Facilities Act, 1870, and dispense with such consents. In the case of the former application, a local inquiry was held on behalf of the Board by Mr. Raymond Asquith, and as a result they decided to dispense with the consents of the Cakemore Parish Council and the Halesowen Rural District Council and grant the Order. In the case of the Swansea application, an inquiry was held at the office of the Board. It appeared that the local authorities had refused their consent except on certain conditions with regard to the price of gas in the added area of supply and the laying of additional mains; and the Glamorganshire County Council desired the insertion of a clause relating to the reinstatement of roads. The Board decided to dispense with the consent of the authorities concerned—viz., the Llansamlet Parish Council, the Clase and Cockett Rural Parish Councils, the Swansea Rural District Council, and the Glamorgan County Council—and grant the Order; allowing a maximum price for gas in the added area higher by 4d. per 1000 cubic feet than that charged within the borough of Swansea.

In the following Orders, a maximum price per 1000 cubic feet of gas was fixed: Brownhills, 4s. 6d.; Builth Wells, 5s. 6d.; Cranleigh, 4s. 6d.; and Llanidloes, 5s. 5d. A standard price with a sliding-scale as to dividends was fixed as follows: Burnham, 3s. 9d.; Dinnington, 4s.; Dunblane, 5s.; Highbridge, 3s. 9d.; and Ripley, 3s. 8d.

An illuminating power of 14 candles was prescribed in the Brownhills, Builth Wells, Burnham, Cranleigh, Dinnington, Dunblane, Highbridge, Llanidloes, and Ripley Orders; and of 15 candles in the Sheffield Order. The illuminating power previously prescribed in respect of the Cranleigh undertaking was 12 candles, and 16½ candles in respect of the Sheffield undertaking.

In the Builth Wells Order, power was given to the undertakers to grant a lease of the undertaking, subject to the approval of the Board of Trade. The Burnham and Highbridge Orders contain clauses relieving the undertakers from any obligation to supply gas to users of suction-gas plant, if and so long as, in the opinion of the undertakers, the giving of such a supply would interfere with, or jeopardize, the supply to other consumers. A clause was inserted in the Dinnington and District Order limiting the price for gas supplied for public lighting to 3s. 6d. per 1000 cubic feet. In the Sheffield Order, the undertakers were required, in consideration of the reduction allowed in the prescribed illuminating power of the gas, to supply new burners to consumers free of charge. The limits of the Brownhills and District Order included an area comprised within the statutory limits of the Lichfield Gas Company, which had not been supplied with gas by that Company. By agreement, a clause was inserted in the Confirming Bill, repealing the powers of the Lichfield Company in the area in question. Clauses were inserted, by agreement, in various Orders for the protection of road and other authorities.

Water Orders.

The principal objects of the applications for Water Orders were as follows: To extend the limits of supply of the Barnstaple Water Company. To empower the Chelsham and Woldingham Water-Works Company, Limited, to maintain and continue water-works, and supply water in the parishes of Chelsham and Woldingham and parts of the parishes of Oxted, Limpsfield, and Titsey, in the county of Surrey. To empower the East Kent District Water Company to extend their limits of supply. To authorize the South Kent Water Company to raise additional capital. To empower the Sutton District Water Company to extend their limits of supply, sanction and confirm the construction of their existing works, and authorize the construction of further works. With the exception of the Chelsham and Woldingham Order, which was in respect of an existing non-statutory concern, all the applications related to undertakings already authorized by Special Acts or Provisional Orders.

There was no opposition to the South Kent application; and the objection lodged in respect of the East Kent District application was withdrawn. A late objection was received from the Barnstaple Corporation with respect to the Barnstaple Order. The Corporation submitted a clause for their protection; but, in the absence of an agreement between the Corporation and the promoters, the Board of Trade did not insert it. Provisional Orders were granted in each of these cases, subject to such modifications and amendments as seemed necessary. The objections in respect to the Chelsham and Woldingham application were fully considered by the Board after an inquiry at their office; and it was decided to grant the Order, subject to certain modifications. In the case of the Sutton District Water Company's application, the promoters failed to obtain the consents of some of the local and road authorities concerned; and, an objection having been lodged by the Kingswood Water Company, Limited, an inquiry into the application was held at the office of the Board. Having regard to all the circumstances, they decided to dispense with the consents and grant the Order.

The limits of supply of the Chelsham and Woldingham Water Company included an area within the statutory limits of the Limpsfield and Oxted Water Company which had not been supplied with water by them. By agreement, a clause was inserted in the Confirming Bill repealing the powers of the Limpsfield Company in respect of the area in question.

Confirmation of Orders.

Bills to confirm the Orders granted by the Board were introduced as follows: In the House of Commons, the Water Provisional Order Bill, to confirm the Sutton Water Order.

In the House of Lords, the Gas Orders Confirmation (No. 1) Bill, to confirm the Brownhills, Builth Wells, Chertsey, Cranleigh, and Llanidloes Orders; the Gas Orders Confirmation (No. 2) Bill, to confirm the Burnham, Dinnington, Dunblane, Highbridge, and Pinner Orders; the Gas Orders Confirmation (No. 3) Bill, to confirm the Ripley, Rowley Regis and Blackheath, Sheffield, and Swansea Orders; and the Water Orders Confirmation Bill, to confirm the Barnstaple, Chelsham and Woldingham, East Kent District, and South Kent Orders. After the Gas Orders Confirmation (No. 2) Bill had been introduced, the promoters of the Dunblane Order informed the Board of Trade that they did not wish to proceed further; and the Board accordingly withdrew the Order when the Bill was in Committee of the House of Lords.

A petition was lodged in the House of Commons against the Water Provisional Order Bill by the Kingswood Water Company, Limited. The Company were promoting a Bill to authorize them to supply water in the parish of Kingswood, where they were already supplying without statutory powers. An application by the Company for a Provisional Order in the session of 1909 was opposed by the Sutton and District Water Company; and the Board of Trade refused to grant an Order. The Committee to whom the Bill and Provisional Order were referred decided to reject the Bill and pass the Order.

Petitions were lodged in the House of Lords against the Gas Orders Confirmation (No. 1) Bill, in respect of the Brownhills Order, by the Walsall Corporation and the Walsall Wood Colliery Company, Limited. The Corporation asked for the reinstatement of certain agreed provisions for their protection, which had been disallowed by the Board of Trade. The Committee decided to insert the clause in its original form; and an appeal clause for the protection of the colliery owners was also inserted. A petition was lodged in the House of Lords, by the Halesowen Rural District Council, against the Gas Orders Confirmation (No. 3) Bill, in respect of the Rowley Regis and Blackheath Order; but it was withdrawn. A petition was also lodged against the same Bill by the Butterley Company, Limited, in respect of the Ripley Order; and agreed clauses were inserted. The Swansea Order, which was included in the same Bill, was petitioned against by the Glamorganshire County Council, the Swansea Rural District Council, and the Great Western and other Railway Companies. Agreed clauses were inserted on behalf of the County Council and the Rural District Council. The petition of the Railway Companies was withdrawn; but it was again lodged in the House of Commons, and an agreed clause was inserted.

A petition was lodged in the House of Lords against the Water Orders Confirmation Bill, in respect of the Chelsham and Woldingham Order, by owners and occupiers of property in the parishes of Chelsham and Woldingham. Amendments were agreed to, and the petition was withdrawn.

With the foregoing exceptions, the Orders were unopposed; and all the Confirmation Bills received the Royal Assent on the 3rd of August.

Scotch Provisional Orders.

In addition to the Orders previously noticed, applications were made to the Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899, for various powers in connection with gas and water supply. The Gas Orders have already been dealt with (*ante*, p. 249); and the Water Orders may be briefly noticed here.

The Clydebank and District Water Trustees have been authorized to construct additional works, consisting principally of the enlargement of their Burn Crooks reservoir, a catchwater or aqueduct, and a conduit or pipe-line, and to abandon certain works sanctioned by their Order of 1906. The new works are to be completed within seven years.

The Town Council of Fraserburgh have obtained an Order authorizing them to provide an additional water supply and construct and maintain new works, comprising an embankment for the purpose of raising and storing the waters of two confluent streams, a service reservoir in the parish of Strichen, and various conduits, a road diversion, &c., to be completed within five years.

The Kirkcaldy Corporation Order enacts that from and after Whit-

sunday, 1911, the limits for the compulsory supply of water, as defined by the Water Act of 1867 and extended by an Act passed in 1876, are to include such portions of the burgh as are not at present within these limits; and all the provisions of the Kirkcaldy and Dysart Water-Works Acts, 1867 to 1908, applicable to the present limits of compulsory supply are to apply to the extended area.

The Montrose Town Council have been empowered to maintain and continue their existing water-works and construct a number of others, comprising a storage reservoir and several aqueducts, conduits, or lines of pipes, which, with one exception, are to be completed within six years.

The Parliamentary Agents for the Clydebank and Montrose Orders were Messrs. Beveridge, Greig, and Co.; and for the Fraserburg Order, Mr. John Kennedy. The Town Clerk of Kirkcaldy (Mr. W. L. Macindoe) had charge of the Order relating to that town.

PROVISIONAL ORDER NOTICES (SESSION 1911).

The "London Gazette" last Tuesday contained the following additional notices of intended applications for Provisional Orders next session. They were published too late for inclusion in the list already given in the "Journal."

Liverpool Corporation (Fazakerley) Gas.—Application will be made to the Local Government Board by the Liverpool Corporation for authority to adopt the "Metropolitan" No. 2 argand burner, or any other of which the Board or the Board of Trade may approve, as a standard burner, in substitution for the one now in use for the official testing of the illuminating power of gas supplied by the Corporation in the parish and township of Fazakerley. It is proposed that the Order shall define the conditions and method of testing with the new burner, and the regulations to be observed in order to correct the volume of gas consumed therein to the standard atmospheric pressure and temperature.

West Gloucestershire Water.—The West Gloucestershire Water Company will apply to the Board of Trade for authority to take, and for the Clutton Rural District Council, or any other company, body, or person within the district of the Council, or in any adjoining district, to give, a supply of water at such point or points as may be agreed upon, or as may be prescribed by the Order. The applicants will ask to have conferred upon them and the Council, and any other company, body, or person, all necessary powers for the distribution of water throughout the Company's limits, or such part or parts thereof as may be defined or prescribed; and also authority to enter into agreements.

Witney and District Gas.—The Witney and District Gas and Coke Company, Limited, will apply to the Board of Trade for authority to maintain and continue their existing gas-works, construct others, and manufacture and supply gas within the parish and urban district of Witney, and the parishes of Hailey, Minster Lovell, Curbridge, Cagges, and Ducklington, in the rural district of Witney, in the county of Oxford. The present capital is to be regulated, and authority to raise more will be applied for.

Standard Burner Bills Royal Assented.—Immediately before the delivery by the Lord Chancellor of His Majesty's Speech proroguing Parliament on Monday last week, the Royal Assent was given to a number of measures which had reached their final stage. Among them were the Dundee Gas Commissioners' Order Confirmation Bill and the three Gas Companies (Standard Burner) Bills.

Settlement of the Gas-Burner Question in Liverpool.

At the meeting of the Parliamentary Committee of the Liverpool Corporation last Wednesday (the first since the municipal elections), the Town Clerk reported that an interview had taken place between representatives of the Corporation and the Gas Company with respect to matters in dispute in connection with the alleged loss of candle power which consumers would suffer if the burner proposed in the Gas Companies (Standard Burner) Acts were adopted. It was stated that, as the outcome of the conference, a satisfactory settlement had been arrived at. [The matter was alluded to in the "Journal" last week, p. 627.] At the same meeting, Alderman Bartlett was re-elected the Chairman of the Committee. In thanking the members, Alderman Bartlett said their sole business in the past year consisted in opposing the Gas-Burner Bills. This year, they were to have a Bill of their own. Whether it would be a contentious Bill or one that would go through without much difficulty, he did not know at present; but he would do his best to get Parliament to sanction any Bill which passed the City Council and the town's meeting.

Gas as a Mitigator of the Smoke Nuisance.—Writing in the "Manchester Guardian" last Tuesday, Dr. John Brown, of Bacup, dealt with the possibility of mitigating the nuisance of black fogs in the city. He said: "What is needed is joint action by all the towns within three to seven miles of Manchester having a conference. At present we can do much by smokeless coal, coalite, and cheap gas. Gas must be sold at prime cost. Manchester, in face of the evils of black fogs, cannot justify her present policy of making a profit out of gas. Liverpool has built, and is going to build, model dwellings. By these you concentrate on a limited area scores or hundreds of families, each with its domestic fire, with the result that the air within 200 yards in calm weather is heavily laden with soot and gases, so that the open window is neglected. In winter, the evils are greatly increased. All model dwellings in the future ought to be fitted up with domestic gas-ranges; and coal should be rarely, if ever, used. Gas should be sold at from 9d. to 1s. per 1000 cubic feet for cooking and heating purposes; and then to burn coal would be extravagant."

LEGAL INTELLIGENCE.

WATER SUPPLY TO FACTORIES.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

(*Before Justices* Phillimore *and* Coleridge.)

Metropolitan Water Board v. Colley's Patent, Limited.

This was an appeal by the plaintiffs from the decision of his Honour Judge Woodfall, at the Westminster County Court,* that water supplied to factories was a "trade" purpose, and not a "domestic" supply. The action was brought to recover four quarters' water-rate in respect of defendants' factory in Marine Street, Bermondsey. The Board charged £21 4s. for a "domestic" supply of water; and defendants paid into Court £9 2s. 1d. for a "non-domestic" supply.

Mr. Danckwerts, K.C., and Mr. A. B. Shaw (instructed by Mr. W. Moon, the Solicitor to the Metropolitan Water Board) appeared for the appellants; Mr. C. A. Russell, K.C., and Mr. C. A. M'Curdy (instructed by Messrs. Wells and Sons) represented respondents.

Mr. Danckwerts said the defendants' premises were supplied by one pipe, and they carried on the business of paper making and printing railway tickets—employing, on an average, about 50 hands. Water was used for, among other purposes, drinking, sanitary conveniences, and cleansing the premises. Prior to the coming into operation of the Board's Charges Act of 1907, the premises were supplied under contract, by meter for "trade" and "domestic" supply. In anticipation of the Act coming into operation, notice was given to determine the contract; and it came to an end at the time when the commencement of the supply now in question was given. As a matter of fact, since the termination of the contract, the parties had been unable to agree—the defendants having refused the combined contract which the Board were in a position to offer; and consequently the supply went on by meter. The present action was brought to recover the statutory rate of 5 per cent. on the rateable value of the premises under section 8 of the Act. The learned Judge decided that the Factory Act did not apply in the Metropolis, and that the case depended on certain sections of the Public Health Act, so that water supplied for drinking and other purposes came within the definition of a "trade" purpose.

Justice Phillimore: That is in opposition to the decision of Mr. Justice Neville in the South Suburban Gas Company's case.

Mr. Danckwerts agreed that this was so. He said the Court of Appeal had decided that the London and Brighton Railway Company's case was distinguishable; the Master of the Rolls saying they must not be taken as approving or disapproving of the Gas Company's case, as it was not before them. His contention was that the County Court Judge should have followed the decision of Mr. Justice Neville, when the case could have been taken to the Appeal Court. Section 25 of the Charges Act defined the words "domestic purposes" as not including (among other things) water for a gas-engine or for any "trade, manufacture, or business." There were a series of decisions in which it had been held that the nature of the supply depended not on the character of the premises, but on the use to which they were put. [Counsel cited the cases of *South-West Suburban Water Company v. Guardians of the Poor of St. Marylebone, Chester Water-Works Company v. Chester Union, Frederick v. Bognor Water Company, South Suburban Gas Company v. Metropolitan Water Board*, all of which have been reported in the "Journal."] The supply in the present case was clearly for "domestic" purposes; and Counsel submitted that on the decision of the Gas Company's case, the learned County Court Judge should have found for the Water Board.

Mr. Shaw said the Judge in the Court below had held that a supply of water to a factory could not be regarded as a "domestic" supply within the meaning of section 8 of the Charges Act; and this went beyond anything that had been brought before the Courts. If such a decision was right, all business premises in the Metropolis where only a caretaker resided would be entitled to be supplied by meter.

Mr. Russell contended that the water was supplied for a manufacturing or business purpose. In order to arrive at what the purpose was for which the water was used, it was not enough to use general terms, such as "washing," "cleansing," and the like, but account must be taken of all the circumstances connected with the user of the water. In each case it was necessary to look at the ordinary habits of mankind, and their duties having regard to these habits. The contention on the part of the Water Board, if successful, would lead to a position of affairs never contemplated by the Act. By section 20, the Board had the right to insist on a supply by meter; and the present case was an attempt to put in their hands a power to supply either by that method or at the "domestic" rate, whichever paid them best. But the Act of Parliament did not give them any such right. The matter had to be looked at broadly; and it was for the Court to say whether the supply to these premises was one for trade or domestic purposes. His submission was that the only answer could be that it was for trade purposes, as the element of domesticity was entirely wanting.

Mr. Shaw having been heard in reply, judgment was reserved.

ACTION FOR DAMAGES FOR PERSONAL INJURIES.

In the King's Bench Division of the High Court of Justice, Mr. Justice Bray and a Common Jury had before them, last Thursday and Friday, the case of *Jones and Wife v. South Metropolitan Gas Company*. It was brought to recover damages for injuries sustained by the plaintiff, Annie Louisa Jones, by the alleged negligenoe of the defendants or their servants.

The plaintiff, Henry John Jones, is a postman, and on the 12th of January last was residing with his wife at 165, Rotherhithe New Road.

* See "Journal," Vol. CXI., p. 402.

On that date the defendants were engaged in putting in a gas-meter, for which purpose they made in the hall of the premises a hole which it was said they left unlighted and unguarded, and of which they gave no warning to the plaintiff—thereby creating a trap in the hall. The female plaintiff fell into the hole, and received personal injuries, in consequence of which she had been caused considerable pain, and both plaintiffs had sustained damage and loss. The defendants denied that either they by themselves or their servants were guilty of negligence. They further denied that the female plaintiff had suffered the injuries alleged; and, alternatively, they pleaded that if she had sustained injury, it arose from her own negligence in not looking where she was going when walking along the passage, where the flooring had to her own knowledge been removed.

Mr. Norman Craig, K.C., and Mr. Douglas Hogg (instructed by Mr. Gilbert Robins) appeared for the plaintiffs; Mr. Shearman, K.C., and Mr. Ernest Charles (instructed by Messrs. Hicklin, Washington, and Pasmore) represented the defendants.

In the course of her cross-examination, Mrs. Jones denied that the workmen who made the hole warned her about it, and said it was never covered over as it should have been. When the accident occurred, the workman said: "I thought you knew the hole was there." The husband gave corroborative evidence, in the course of which he said a foreman of the Company called on him and told him he was always speaking to the men about leaving holes uncovered. He also said he wondered there were not more accidents than there were.

Evidence having been given on the other side, the Jury gave the plaintiffs £25 damages. Judgment was entered accordingly; stay of execution being refused.

LIABILITY FOR A DEFECTIVE STOPCOCK BOX.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, Nov. 24.

(*Before the* Master of the Rolls *and Lords Justices* Moulton *and* Farwell.)

Rosenbaum v. Metropolitan Water Board.

This was an appeal by the defendants from the judgment of Mr. Justice Channell, who tried the action early in June last without a Jury, and awarded the plaintiff damages in respect of an injury sustained by her through falling by catching the heel of her shoe in a stopcock box in Oxford Street.*

Mr. C. A. Russell, K.C. (with him Mr. A. B. Shaw), said the question raised by the appeal was whether there was any liability upon the Water Board to pay compensation in respect of an accident caused by tripping over a stopcock box. The box in question, which was fitted flush with the surface of the road (the hole being 2⅞ inches diameter), was put down by the Board under the power contained in section 28 of the Water-Works Clauses Act, 1847. In the case of the *East London Water Company v. St. Matthew, Bethnal Green*†, it was held that a box of this kind was included in the works authorized by the section cited. It was not contended for the plaintiff that the absence of a cover to the box was a matter of complaint. But it was said, on the authority of *Osborne v. Metropolitan Water Board*,‡ that it was the practice of the Board to put in the hole a wisp of straw known as a "wad;" and it was suggested that had there been an efficient wad, there would have been no ground of complaint, but that the wad was not efficient. His contention was that there was no evidence to show that the absence of the wad caused the accident; for a wad was not intended to afford protection to the public, but merely protect the apparatus from frost.

Lord Justice Farwell pointed out that the Act cast upon the Water Board the duty of reinstatement; and if they left a hole 3 inches in diameter, surely they were guilty of breach of duty.

Lord Justice Moulton said he was not sure that the right issue had been tried, which was whether or not there was a nuisance.

Mr. Norman Craig, K.C., for the respondent, said the whole argument in the Court below proceeded upon the assumption that a box without a cover might be used, so long as adequate steps were taken to prevent it being a nuisance. Evidence was given that about fourteen accidents had occurred from this particular box not having been efficiently covered. If there was no obligation on the Board to fill in the hole, so as to protect the public, what was the limit the other way? What was the size of hole which could be permitted?

The Master of the Rolls: Your difficulty is greatly increased by your having relied on the judgment of Mr. Justice Phillimore in the Osborne case, which I have some difficulty in following.

Mr. Norman Craig said he had not relied upon this judgment.

Mr. Russell: But Mr. Justice Channell did.

Mr. Norman Craig said the law, as laid down by the House of Lords, was that if the damage could be prevented by the reasonable exercise of defendants' powers, there was cause of action. Here the learned Judge had found as a fact that a hole with a proper wad was not dangerous.

As there appeared to be a difference of opinion as to the findings of fact, Lords Justices Moulton and Farwell went and saw Mr. Justice Channell. On their return,

Lord Justice Moulton said Mr. Justice Channell did not decide the question of whether the hole was a danger without the straw. He thought that, by reason of defendants always having put the straw there, it was an admission that the hole was to be regarded as dangerous without it.

The Master of the Rolls said it was difficult to come to the conclusion that there had been a distinct finding of fact upon the point; and under these circumstances it would be better that there should be a new trial.

Mr. Russell contended that, upon the evidence before Mr. Justice Channell, the finding could not be upheld, and that he was entitled to judgment, as the case was deliberately fought upon the footing that, apart from the question of the wisp of straw, the hole was not a nuisance. If this admission had not been made, the defendants were prepared to give evidence to show that it was a proper box.

The Master of the Rolls: We cannot decide it upon the evidence already given.

Lord Justice Moulton: When you put a manhole cover in the road, it cannot possibly continue at the same level; and it may be described as a source of danger. There must be some more definite finding before we can apply the law to it.

The Master of the Rolls said the Court could not satisfactorily deal with the case; and therefore it must go down for a new trial. He would suggest that, when it was again tried, neither party should rely too much upon the judgment of Mr. Justice Phillimore.

The order was then discharged; all costs to abide the result of the new trial.

* See "Journal," Vol. CX., p. 706.
† *Ibid.*, Vol. XLVIII., p. 243. ‡ *Ibid.*, Vol. CIX., p. 444.

RECOVERY OF WATER-RATES FOR TENEMENTS.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Saturday, Nov. 26.

(*Before the* Master of the Rolls *and Lords Justices* Moulton *and* Farwell.)

Metropolitan Water Board v. Brooks.

This was an appeal by plaintiffs from the judgment of Mr. Justice Channell in an action tried without a Jury for the recovery of water-rates from Midsummer, 1904, to Lady Day, 1908, on certain blocks of buildings in the East End of London.*

Mr. Danckwerts, K.C., and Mr. A. B. Shaw appeared for the appellants; Mr. C. A. Russell, K.C., and Mr. Giveen represented the respondent.

Mr. Shaw, in opening the appeal, said the premises in question, which were erected in 1903 by one Davies, consisted of separate tenements under £20 in value; so that the owner, not the occupier, was liable for the water-rate. The supply was by meter at an agreed price of 1s. per 1000 gallons. Davies paid the rate down to Midsummer, 1904; but since that date nothing had been paid. The premises were mortgaged to the Norwich Union Insurance Company, who in 1906 appointed the respondent as receiver of rents; and the question was whether he was personally liable for the water-rate under the section which provided that in the case of small properties the person actually receiving the rent was deemed to be the person liable. Mr. Justice Channell decided that Brooks was not liable.

The Master of the Rolls: A receiver does everything in the name of the mortgagor.

Mr. Shaw agreed that this was so; but he said the appellants relied on the special sections of the Act that in certain cases the person collecting the rent was liable. The occupiers paid a sum as rent which included water. It appeared from the evidence that the actual person who received the rent was one Smith; but he was merely the agent for the owner.

Mr. Danckwerts pointed out that under the Water-Works Clauses Act, 1847, upon non-payment of the rent, a water company were entitled to cut off the supply; and by section 72 the owner was made liable in the case of small properties. The Act of 1847 was incorporated in the East London Water Act of 1853; and as it was thought that a hardship might be inflicted on the occupiers, the Water Companies (Regulation of Powers) Act of 1887 was passed, which restrained companies from cutting off the supply in such cases, and the rent was made a charge upon the premises. His contention was that Brooks, and not Smith, answered the description of "owner" in the Act.

Monday, Nov. 28.

On the resumption of the hearing to-day,

Mr. Danckwerts read the judgment delivered in the Court below, and submitted that the learned Judge had come to a wrong conclusion, and that judgment should be entered for the appellants.

Counsel for the respondent were not called upon.

The Master of the Rolls, having stated the nature of the appeal, said Mr. Justice Channell based his judgment upon the construction of section 4 of the Act of 1887. Without expressing any opinion in the least adverse to the learned Judge on this point, he thought the difficulty of the appellants began at a much earlier stage. By section 72 of the General Act of 1847, provision was made that in the case of small tenements the owners and not the occupiers were to be liable; and the section went on to say that the person receiving the rent from the occupier, either on his own account or as agent or receiver, should be deemed to be the owner of such house or tenement. Now, what were the facts in the present case? These small tenements belonged to Davies, who in 1907 appointed Smith to collect the rents; and when he was appointed, certain things happened. What was the position of things at that time? Smith was the man appointed by Davies as agent to collect the rents of these houses, and authority was given to him to relet any that might become empty. Therefore Smith was exactly the one person contemplated by section 72 of the Act of 1847. Then came the mortgage to the Norwich Union Insurance Company and the receivership deed. There was no suggestion of any fresh appointment by Brooks as receiver. All that appeared was that Smith continued to collect the rents as he had done before, with apparently such authority as he already had; and he handed them over to Davies, and afterwards to Brooks. He had nothing to do with the period during which Brooks entered into possession, in the sense that he turned out Smith. From first to last, Smith was the person who received the rents and profits from the occupiers as agent for the person interested; and Smith, and he only, was the person who could be sued. For these reasons, he thought Mr. Justice Channell was right in the conclusion at which he arrived. He might also say that he thought the decision was really in favour of the Water Board. The effect of

* See "Journal," Vol. CIX., p. 880.

the section was this—that an agent of a receiver appointed to collect the rent had *prima facie* no right to do anything more than hand over the rent to his employer. But here the section said for "the benefit of the water company;" so that there was an express provision imposing an obligation upon the agent to pay the water-rate, and only to hand the balance to his employer. If this was the meaning of the section, it was very much in favour of the Water Board.

Lords Justices Moulton and Farwell concurred.

The appeal was accordingly dismissed, with costs.

COWDENBEATH GAS COMPANY'S SHARES IN DISPUTE.

Question as to the Right to Participate in an Issue.

In the "Notes from Scotland" in the "Journal" for the 25th of October, reference was made to an action brought in the Court of Session by Mr. Alexander Waddell, of Dunfermline, and Mr. Forbes Waddell, of Queensferry, against Mr. James Hutton and Mr. G. B. Tweedie to recover the sum of £1010, in respect of shares in the Cowdenbeath Gas Company, Limited.

Messrs. Waddell and the defendant Hutton were all interested in the Company as shareholders; and the nature and extent of their respective rights were set forth in an agreement dated Nov. 14 and 19, 1903, and in a memorandum of variations dated Feb. 13 and 18, 1904. At the date of the agreement, the shares were allotted in the following proportions: To Messrs. Waddell, 611; to Mr. Hutton, 354; and to other parties, 57—making 1022. The plaintiffs had to borrow money in order to enable them to pay for the shares allotted to them; and the defendant Hutton, who was Chairman of the Company, became a creditor. On Oct. 14, 1905, a further issue of 178 shares was made; and these were all issued to Mr. Hutton and to nominees—bringing up their total holding to 532 shares, or 79 short of the number allotted to Messrs. Waddell. Of these, Mr. Forbes Waddell had sold 12; so that their holding was then 599 shares. On Dec. 3, 1906, a further issue of 300 shares was made; and it was in connection with this issue that the dispute had arisen. Plaintiffs averred that, according to the Company's Articles of Association, the shares were in the first instance offered to the then members of the Company in proportion to the existing shares held by them, and in particular that there were offered to the defendant Hutton 283 shares; this being in proportion to the number of which he and his nominees were the registered proprietors. These shares included the 599 truly belonging to the plaintiffs, but standing in Mr. Hutton's name. The number which, under article 10 of the agreement, he required to take up in order to equalize the holding of himself and his nominees with the original holding of the plaintiffs was 79. Deducting these shares from the 283 offered to him, there remained 204; and these, according to the plaintiffs, had to be offered in the proportion of 103 shares to Mr. Hutton and his nominees and 101 to them. Mr. Hutton declined to take up more than the 79 shares required to bring his holding up to 611, and did so without consulting the plaintiffs as to whether or not they wished to take up the shares to which they were entitled, and without informing them of the intended issue; and they averred that they had sustained loss in consequence. The value of the shares was at least £20 for each fully-paid share of £10; and the plaintiffs could have disposed of their allotment rights at a premium of £10 a share.

The question before the Court was whether Mr. Hutton—the 599 shares being registered in his name, though he really held them only as security for a debt—was under any obligation to notify to the plaintiffs that an allotment of new shares had been offered to him in respect of these shares. It was argued that, as security holder, he was not bound to take any steps towards furthering his debtors' interests, and that there was no duty upon him to take up the shares. Lord Armidale, in giving judgment, said there was much force in this contention; but, on the other hand, a creditor must have some regard to the interest of his debtor. As he read the agreement, he thought it was certainly an implied term of it that, as between the defendant Hutton and the plaintiffs, the latter were to be treated as continuing shareholders of the Company; and that the possibility of new shares being offered to them was within the contemplation of the parties. If it was incumbent on the defendant Hutton to give notice to plaintiffs of the offer of new shares, as he (his Lordship) considered it was, he further thought that Hutton would have been bound to take such steps as would have been necessary to make the allotment available, subject always to his own security not being in any way affected thereby. It seemed to him, therefore, that Hutton was liable to account for any damage that was occasioned to the plaintiffs by his failure to make them aware of the allotment in question. He should accordingly allow them a proof, so far as their action was directed against Hutton. With regard to the defendant Tweedie (who was the Law Agent of the Company), he thought there were no averments relevant to support the conclusion of the summons directed against him; and he should accordingly dismiss the action, so far as he was concerned, with expenses.

On Saturday last, a reclaiming note for Mr. Hutton was lodged with the First Division of the Court; so that the decision of Lord Ormidale will be brought under review.

QUESTION AS TO A WATER-SUPPLY AGREEMENT.

At the last sitting of the Truro County Court, his Honour Judge Granger heard a case in which the Truro Rural District Council sued Lord Falmouth for the recovery of £1 6s. 3d., as water-rate for two houses in the parish of St. Agnes. Mr. Coulter Hancock, for the plaintiffs, explained that, at the request of the Local Government Board, the District Council provided a supply of water for part of the parish of St. Agnes; and this parish being a "contributory place" within the meaning of the Public Health Acts, the cost of the scheme had to be charged to a special expenses account. Under the Public Health Act, 1875, the owner or occupier of a dwelling-house within 200 yards of a stand-pipe provided by the rural authority was liable to pay a water-rate. In the present case, Lord Falmouth disputed his liability; and the action was brought in order that the point might be decided. His Lordship met the Council in every possible way in connection with the supply, and the action was of a friendly nature.

Mr. W. S. Sitwell, who appeared for the defendant, said that when the water supply was provided Lord Falmouth granted a lease, under which the Council had obtained certain land whereon a reservoir and pumping-station had been constructed, and also the water rights and other privileges. The lease contained covenants relating to the supply of water to Lord Falmouth; and his contention was that his Lordship's tenants were to have a supply from the stand-pipes, subject to the terms of the declaration in the lease. Lord Falmouth conveyed to the Council the whole of the water supply which was the supply of his tenants. Mr. Hancock, who appeared for the Council, argued that if the clause in the lease on which Mr. Sitwell relied meant anything, it was *ultra vires* and inoperative.

His Honour said it was perfectly clear that when the lease was entered into there was a limiting of the plaintiffs' power to make a special rate, and that by the declaration they were prohibited from obeying the Statute. The Council had no right to enter into an agreement by which they were prohibited from fulfilling the Statute of 1875. The declaration was *ultra vires*, and judgment must therefore be given for the Council.

GAS COMPANIES AND INCOME-TAX.

Scotch Company Obtains Depreciation Allowance.

The appeal of the Bo'ness Gaslight Company, Limited, for allowance in respect of depreciation, was heard on Nov. 30 before the District Commissioners at Linlithgow. The Company were represented by Mr. David Ballantine, Solicitor, of 205, Hope Street, Glasgow.

In this case, depreciation had been allowed in former years; and it had now been disallowed by the Surveyor, acting on instructions from the Board of Inland Revenue to abandon the depreciation system in assessing gas companies, and allow them renewals of plant instead. Mr. Ballantine contended that the method which the Board of Inland Revenue wished to be adopted was wrong in point of law, as being entirely contrary to the provisions of section 12 of the Customs and Inland Revenue Act, 1878, and of section 26 of the Finance Act, 1907; and he informed the Commissioners that if they did not see their way to conform to the provisions of these sections, and allow the deduction for wear and tear, the Company would be obliged to ask them to state a case for the opinion of the Court on the matter.

After hearing all the arguments, the Commissioners sustained the appeal, and decided to allow depreciation at the rates fixed by them on June 7, 1904, in a former appeal by the same Company on the question of depreciation. The rates then fixed, and again allowed, were 2½ per cent. on the written-down value of the holder, and 4 per cent. on the written-down value of all the other plant and machinery.

Claim for a Gas-Saving Apparatus.

At the Wandsworth County Court on Wednesday, before his Honour Judge Harrington, Messrs. W. Tice and Co., of Union Street, S.E., claimed from Mr. Walter John Sawyer, of the Cedars Laundry, Putney, £6 10s. for a patent gas-saving apparatus, which, it was said, had been successfully fitted in several Government Departments, including the War Office and the Admiralty. Plaintiffs' case was that the apparatus was fixed at the defendant's laundry on the understanding that if at the end of three months his gas bill showed a saving of 15 per cent. he should buy it. When, after six months had passed, plaintiffs applied for payment, defendant asked for the apparatus to be removed, alleging that it was a failure. Defendant, in evidence, said the apparatus so reduced the pressure of gas that there was trouble in starting the engine. It did not effect a saving of gas, and there was such a dangerous leakage from it that he put it out of action. Judgment was given for the plaintiffs for the amount claimed.

In the report of the case Painter *v.* Petersfield and Selsey Gas Company, Limited, in the last issue of the "Journal," Mr. T. Webb, the Vice-Chairman of the Sunbury Gas Consumers' Company, Limited, who was one of the witnesses, was described as the "Manager of the Sunbury Gas-Works." This was incorrect. In his evidence, Mr. Webb stated that he was the Managing-Director, not the Manager, of the Sunbury Gas Company.

New Joint-Stock Companies Registered.—Among recent registrations of joint stock companies, may be noticed the following: British Lamp Manufacturers, Limited, with a capital of £2000 in £1 shares; offices, 40, Page Street, Westminster, S.W. Matchless Self-Lighting Syndicate, Limited, with a capital of £5000 in £1 shares; offices, 6, St. Swithin's Lane, E.C. Combination Gas-Steam Engine Syndicate, Limited, was registered on the 30th ult., with a capital of £500 in 1s. shares; offices, 9-15, Oxford Street, W.

Gas Exhibition at Theale.—A successful gas exhibition, under the auspices of the Theale Gaslight and Coke Company, Limited, was held at the Parish Room on Wednesday and Thursday last. Different types of appliances for heating and cooking were shown; many of the stoves, cookers, and radiators being in operation. A great variety of brackets and burners of the latest type were on view; and the room was brilliantly illuminated in the evening by inverted incandescent lights. In the afternoon and evening of each day, Mrs. Godfrey Sutcliffe gave lectures on cooking.

MISCELLANEOUS NEWS.

BELFAST GAS-WORKS EXTENSIONS.

A Meeting of the Belfast County Borough Council in committee was held last Wednesday, for the purpose of considering the recommendations of the Gas Committee with regard to extending the present gas-works.

Mr. J. A. Doran, the Chairman of the Gas Committee, in moving the adoption of the minutes of the Committee relating to the matter, outlined the steps that had been taken, and drew attention to the main features of the scheme. The minutes, of course, recommended the adoption of the report of the Manager (Mr. J. Dunlop Smith), which appeared in the "Journal" last Tuesday (p. 632), and which comprises a scheme for the re-arrangement of part of the existing works, and their extension on the site of the old abattoir.

Mr. Edwin Squire moved an amendment that was identical with one which had been defeated on a previous occasion. It was as follows: "That having considered the proposal of the Manager for an extension of the gas-works, while we largely agree with the lines upon which his suggestions are framed, provided it be necessary to maintain the works upon the present ground, we are, however, of opinion that the site proposed does not allow enough room for economical working or possible technical development, while it allows no room whatever for further extension; and we also consider that eighteen years is too short a period to arrange for when providing a site for requirements of such magnitude, especially taking into account the large amount of money now proposed to be expended. We therefore recommend the Council to authorize the Gas Committee to secure a larger site, where the coal can be delivered direct from the ship to the works, and, if possible, to arrange with the Harbour Commissioners to again negotiate for a portion of their ground."

After considerable discussion, the amendment was put to the meeting, and defeated; 12 voting for it, and 28 against. The minutes of the Gas Committee were then adopted.

The subject came before the full Council at their Monthly Meeting next day—the Lord Mayor (Mr. R. J. M'Mordie) in the chair.

Mr. Doran, in moving the adoption of the minutes of the Council in committee, said he wished to call attention to several points in the able scheme submitted by the Gas Manager. He could assure the Council that the matter of extensions had received very close and careful attention by Mr. Smith since he took charge of the works; and the result of his investigations was that very little could be done in the way of expansion unless portions of the present plant were brought up to date. After allowing for reserve, he found that their highest possible make of gas, when utilizing every available retort, would amount to 12,870,000 cubic feet per day; or if they left out the retort-house under injunction, 10,925,000 cubic feet. Last year their maximum day's make was 11,772,000 cubic feet; and the greatest output per 24 hours was 12,608,000. From these figures it would readily be seen how urgent the necessity was for immediately dealing with the matter of extensions, as if any serious breakdown occurred, they might at any time be placed in a most serious position. The question of the percentage of water gas to be used had long been a very vexed one, not only in Belfast, but all over the country. In Belfast, they had been using during the winter months as much as 50 per cent.; and as the Gas Committee were anxious to reduce this amount, instructions were given to Mr. Smith, when dealing with extensions, to so arrange that at no time would more than 25 per cent. of water gas be sent out. This wish of the Committee had been given effect to in the report submitted; but, of course, it would be impossible to do anything until some of the new plant had been erected. Another important matter was the cost. It was estimated that the total expenditure, as outlined in the plan, would be £600,000. It must, however, be borne in mind that the work would be undertaken in sections; and the first or heaviest portion would take about five or six years to complete, at a cost of £250,000, or £50,000 per annum. They would, of course, continue to use the present plant until this section was completed; and by that time the old machinery would be worked out, and would require renewal in any case. The saving due to improved results from the new plant would be more than sufficient to meet the interest and sinking fund payments on their capital expenditure. The balance of the money would probably not be wanted for many years, and only when the demand for gas necessitated it. Even should all the £600,000 be charged to capital account, their capital per million cubic feet of gas made would be as low as that of any other large gas undertaking in the United Kingdom. Probably the most urgent matter was to provide a new 10 million cubic feet gasholder and tank. Had it not been for the use of their water-gas plant, this must have been erected long ago, and they would not now have to pay for it. Their total storage was just over 6 million cubic feet, which was totally inadequate for such large works as theirs. The advantages to be derived from adopting the proposals made by the Manager were so obvious, that he did not think it necessary for him to go more fully into the matter. He trusted the members would confirm the decision arrived at on Wednesday by the Council in committee, and he was sure the results would justify their action.

Alderman Craig seconded the motion.

Mr. Squire said he objected to the passing of the minutes, and wished to move an amendment. [This was in the same terms as the one given above, but with the omission of the clause referring to the Harbour Commissioners.]

The Lord Mayor said he did not consider the amendment in order. He thought, after all the discussion that had taken place, it would be better to have a vote for or against the motion.

Mr. Squire said he would accept this ruling. This, he supposed, was the last act of the drama; and it was only a sense of public duty that induced him to rise on this occasion. He had tried to find out from his constituents what their opinions on the subject were; and he was perfectly certain that in his action he had a large number of them at his back. No reason had been given for going to the centre of the city and leaving the site they formerly selected for the gas-works.

Mr. Doran said it was to save half-a-million of money.

Mr. Squire said his first argument against the present works was that the space was too limited. They were reducing the output of water gas and increasing the quantity of coal gas, with the result that their make of coke would be doubled—reaching very soon 100,000 tons per year. They could not deal with all the coke with the space at their disposal. Not only was the space limited, but, according to the Gas Manager, the reconstructed works would only provide for their requirements for a period of eighteen years. This was not satisfactory. He did not wish to go into the question of scrapping. There was not a single thing that might be scrapped to which he objected; he was willing to scrap everything that did not pay. Neither did he object to the spending of £600,000 on additional works. What he contended was that the money should not be spent on works in the heart of the city. The Manager had told them himself that he had never been asked to report on any other site. He (Mr. Squire) asserted that they could put up the same works on another site for the same money as was now proposed to be spent. It was said that within thirty years they would have paid back all the borrowed money. He believed they would. But during these thirty years, if they had the works on a water site, whereby they could take the coal direct from the ships, they would save on an average £4000 a year, and at the end of the time have a saving of about £10,000 a year. At great expense, they had brought over experts to guide and advise them; and these gentlemen, as well as their responsible officials, told them that the Twin Islands was the proper place to go to. In the teeth of this advice, the Council now went back on their previous decision, and overthrew everything they had done.

Mr. Workman said, as he had intended to second the amendment, he should like to make a few remarks. He pointed out that it had been most strongly impressed upon them by experts and their own officials that they should have at least 2 acres per million cubic feet of gas; and 2½ acres was not considered out of the way. It was felt that they could not have too much room. It was now proposed, however, to do a thing which none of them had thought of up till now; for the Manager proposed to make a million cubic feet of gas on three-quarters of an acre. They should move very cautiously in this matter They did not know what the future might bring forth in the way of light, and how advantageous it might be to them to have plenty of room; and he submitted that all the space that could possibly be wanted could be had at the Twin Islands.

After some further speeches for and against the motion, it was put to the meeting and carried. A poll was then demanded, which resulted as follows: For the motion, 32; against it, 12—majority, 20 (one member of the Council not voting).

LISBURN GAS-WORKS PURCHASE.

Settlement of the Price.

It will probably be remembered that in the spring of this year an arbitration was held in London to determine the price to be paid by the Lisburn Urban District Council for the undertaking of the Lisburn Gas Company, Limited. The Arbitrators were Mr. Corbet Woodall for the Company, and Mr. H. E. Jones for the Council; the Umpire being Mr. A. J. Ram, K.C. In his award, which was published in the "Journal" for the 9th of August (p. 415), he gave two prices, dependent upon whether the Company was decided to be a statutory or a non-statutory one. The award was stated in the form of a special case, which came before the King's Bench Division of the High Court of Justice of Ireland on the 22nd ult.

It was contended before the Umpire, on behalf of the District Council, that, though at the date of the notice to treat the Company's undertaking was non-statutory, and not subject to any legal restriction as to the amount of profit which could be divided, the Umpire and Arbitrators were bound to take into account the likelihood that the Company, if it had continued to exist, would have become a statutory Company, and to use their own judgment as to when that time would have arisen, and what restrictions, according to the practice of Parliament, would have been imposed. It was further contended on behalf of the Council that, in fixing the purchase price, the maintainable profit as from that time should be taken at a sum not exceeding that which under statutory restrictions the shareholders would have been allowed to divide. For the Gas Company, the contention was put forward that the Umpire ought not to have regard to the considerations mentioned, but that in ascertaining the sum to be paid by the Council to them he must regard the maintainable profits of the Company existing as a non-statutory one. If the Court should be of opinion that the contentions put forward for the Council were correct, and that they ought to be taken into consideration, then the Umpire awarded that the sum of £31,445 should be paid to the Company; if, on the other hand, the contentions put forward for the Company were correct, he awarded £34,227 as the purchase price.

The case had been partly stated by Mr. Ronan, K.C., for the District Council when the Court adjourned, and the matter remained in abeyance. It was, however, in the list to be mentioned last Wednesday, when a consent was handed in, and made a rule of Court, bringing the questions in dispute to a satisfactory settlement. It provided that the purchase price should be £33,000, possession to be taken by the Council, together with all existing contracts for the supply of gas material and other stores. It was further provided that the Council should take over the Company's employees under their existing engagements.

The *agenda* for the December meeting of the Manchester City Council includes two notices of motion relating to the quantity of gas supplied for 1d. to prepayment-meter users. Both Mr. Jennison and Mr. Hailwook ask for greater consideration to "penny-in-the-slot" consumers of gas.

GENEVA MUNICIPAL GAS SUPPLY.

Report and Accounts for 1909.

The number of the "Journal des Usines à Gaz" for the 20th ult. contained the official report on the working of the gas undertaking of the Geneva Municipality in the year ended Dec. 31 last. It furnishes the following particulars.

The past year, it may be remembered, was marked by the terrible explosion which occurred on the 23rd of August. It is not considered necessary to give any details of this catastrophe in the report; all that is said about it being that the repair of the damage to the plant and the reconstruction of the buildings occupied the officials up till the end of the year. The restoration of the gasholder to its proper working condition was a troublesome job; and it was not finished till early in February last. In the first months of the present year, the completion of the repairs was effected. The stoppage of the furnaces for seventeen days after the accident did them some injury; and it is considered that their working life will be somewhat shortened in consequence. A project for the construction of an installation of vertical retorts and the erection of new coal-stores, the consideration of which was interfered with by the explosion, has been again brought forward with the view of some definite action being taken to carry it into effect, as the present productive power of the works is altogether inadequate. A sum of 141,000 frs. (£5640) voted by the Municipality in March allowed of various extensions being made to the buildings and plant.

The total production of gas last year was 11,049,110 cubic metres, or 390,033,590 cubic feet; the total consumption being 11,046,660 cubic metres, or 389,947,090 cubic feet—a difference of only 2450 metres, or about 86,500 cubic feet. Of the total make, 1,454,450 cubic metres, or 13·16 per cent., was carburetted water gas. The quantity of coal carbonized was 29,931,870 kilos., or 2,653,670 kilos. less than in 1908. The average price delivered on the works was 34 frs. 66 c. per ton, against 35 frs. 15 c. before. The average yield per 100 kilos. (220 lbs.) was about 70 cubic feet more than in 1908. For making water gas, 625,645 kilos. of oil and 935,000 kilos. of large coke were used. The oil cost 9 frs. 67 c. per 100 kilos. delivered on the works, compared with 10 frs. 70 c. before. The average charge of coal per retort per day was 682 kilos.; the average production, 252 cubic metres (8900 feet).

Turning to the statistics relating to the residual products, we find that the quantity of coke produced was 24,011,050 kilos., or 80·22 per cent. of the coal carbonized. Of the entire bulk, 16,373,800 kilos. were sold or used in the municipal buildings, and 7,637,250 kilos. utilized on the works. The proportion of coke used for heating the furnaces was 18·25 per cent. of the coal carbonized; the coke sold representing 68·19 per cent. of the total production and 54·70 per cent. of the coal carbonized. There were produced 1,566,014 kilos. of tar, or 5·23 per cent. of the coal. A large quantity of it was sold for use on roads. The greater portion of the tar resulting from the manufacture of water gas was mixed with the ordinary coal tar. The pitch, which is very difficult to sell, was used in a crude condition in the horizontal retorts. The production of ammoniacal liquor was 260,080 kilos.; its ammonia content being 21·6 per cent., or equal to 56,180 kilos. of ammonia. The concentrated liquor constituted 0·87 per cent. of the coal carbonized. The yield of ammonia was 0·188 kilo. per 100 kilos. of coal.

As already stated, the total consumption of gas—or rather the total quantity sent from the works—was 11,046,660 cubic metres. It was disposed of as follows:—

	Cubic Metres.		Per Cent.
Consumption by meter.	9,125,407	..	82·61
,, by fixed burners (court-yard and stair lighting)	430,498	..	3·90
,, for public lighting . . .	804,664	..	7·28
Used on works, in offices, &c. . . .	126,858	..	1·15
Unaccounted for.	559,233	..	5·06
Total	11,046,660	..	100·00

The quantity of gas sold was the total of the first three items—*i.e.*, 10,360,569 cubic metres. The population served being 113,079, the total output was equal to 97·7 cubic metres, or about 3450 cubic feet, per head. The unaccounted-for gas, as shown above, was 5·06 per cent., compared with 3·69 per cent. in 1908. There were at the close of the year 28,054 consumers by meter; and they burnt 325·2 cubic metres, or about 11,480 cubic feet, each. In 1908, there were 26,748 consumers; and they used 346·5 cubic metres, or 12,232 cubic feet, per head. The total length of mains at the close of the year was 238,137 metres, or nearly 262,000 yards.

The number of meters on hire at the close of last year was 27,889; the total number fixed being 28,688, representing 202,586 burners. They were divided as follows: Wet, 18,159; "Duplex," 8280; dry, 2242; prepayment, 7. The number of cooking and heating appliances sold during the year was 1919; bringing up the total sold in the past ten years to 14,304. Since 1892, the year in which installations were first made on account of the Municipality, the number of cooking and heating stoves sold by their agents has been 30,778; and since 1886, when cooking-stoves were first fixed gratuitously, the number sold has been 37,719. There were 16 gas-engines at work last year, or three more than in 1908. The number of public lamps in use on Dec. 31, 1909, was 2832, or 69 more than at the close of 1908. The total includes 197 lanterns with two burners, nine with three, and one with four. With few exceptions, all the lamps have incandescent burners, and 15,844 mantles and 3929 chimneys were used in connection with them last year—an average of 5·6 mantles and 1·3 chimneys per burner.

Coming to the portion of the report dealing with finances, we find that the sale of gas produced 2,080,558 frs. (£83,222), or 32,548 frs. (£1302) less than in 1908. The sale of gas for public lighting yielded 115,980 frs. (£4640), or 389 frs. (£15) more than before. The revenue derived from the sale of residuals and from other sources than the supply of gas amounted to 592,723 frs. (£23,709). The total working

expenses for the year, less the above-named sum, came to 1,245,075 frs. (£49,803); being at the rate of 12·017 c. per cubic metre of gas sold. Adding 5·5 per cent. on the outstanding capital, 4·876 c., makes 16·893 c. per cubic metre, or about 3s. 9½d. per 1000 cubic feet, compared with 16·237 c. per cubic metre, or 3s. 7⅝d. per 1000 cubic feet, in the year 1908.

RATES AND GAS, ELECTRICITY, AND WATER CHARGES.

We have received from Mr. James Carter, the Borough Treasurer of Preston, a copy of his tabulated statistics of rates levied, together with charges made for gas, electricity, and water, and profits and losses on municipal undertakings in a number of Provincial towns and a few Metropolitan boroughs, for the year 1910-11. There are in all ninety-four places referred to, which is the same number as in the previous compilation. The populations range from 767,606 (Liverpool) down to 21,584 (King's Lynn).

The rateable values are highest in Westminster (£6,433,299), Liverpool (£4,796,943), Manchester (£4 556,925), Kensington (£2,445,268), and Leeds (£2,149,919), and lowest in King's Lynn (£86,484), Bacup, (£87,390), Brighouse (£88,981), and Stafford (£92,459). The places most heavily rated are: Norwich, 10s. 3d. in the pound; East Ham, 9s. 10d.; West Ham, 9s. 9d.; Sheffield, 9s. 7d.; Wolverhampton, 9s. 5d.; Leeds, 9s. 4d.; Bristol, 9s. 2d.; Rotherham, 9s. 2d.; Preston, 9s. 1d.; Brighouse, 9s.; Halifax, 9s.; and Middlesbrough, 9s. Those which have the lightest rates are: Oxford, 4s. 3d. in the pound; and Bournemouth, 5s.

Out of the rents of property and profits transferred from municipal undertakings, the rates are reduced in the following towns to the extent of 1s. or more in the pound: Nottingham, 1s. 7d.; Macclesfield, 1s. 6¾d.; Warrington, 1s. 4½d.; Darlington, 1s. 4¼d.; Stockport, 1s. 4¼d. (water profits placed to reserve fund); Stafford, 1s. 3¼d.; Burnley, 1s. 2d.; Bolton, 1s. 1¾d.; Leicester, 1s. 1d. (water, electricity, and tramways profits placed to reserve fund); and Oldham, 1s. On the other hand, small profits in aid of rates were contributed by East Ham, 1d.; Eastbourne, ¾d. (electric light profits to reserve fund); West Hartlepool, ¾d. (electric light profits to reserve fund); Hampstead, ½d.; Middlesbrough, ½d. (gas and electric light profits to reserve fund); and Leamington, ¼d. Out of the total of ninety-four places included in the list, fourteen made no profit for the reduction of the rates; and a separate table gives forty-two instances in which the rates have been increased in consequence of losses on undertakings which were probably in most instances intended to be remunerative. The largest individual loss chronicled has again arisen in connection with docks at Preston (£40,000); the next highest figures have reference to water; while gas does not appear at all in this particular part of the return. Water losses at Bacup were responsible for an addition of 1s. 11d. in the pound to the rates, and at Swansea of 1s. 4½d. Electric light losses were incurred at Brighouse, Barrow-in-Furness, Hastings, and York.

Coming to the table giving the charges for gas and water, we find that the price of gas for domestic supplies is again highest at King's Lynn—3s. 6d. per 1000 cubic feet; while as usual it is the lowest at Widnes, at 1s. 2d. per 1000 cubic feet, with, of course, an even lower rate for large consumers and engines. The following towns also enjoy the privilege of a gas supply for domestic lighting at 2s. or less per 1000 cubic feet; Sheffield, 1s. 4d.; Plymouth, 1s. 8d.; Belfast, 1s. 9½d.; Bath, 1s. 11d.; Huddersfield, 1s. 11d.; Lancaster, 1s. 11d.; Sunderland, 1s. 11d.; Gateshead, 1s. 11¾d.; Newcastle, 1s. 11½d.; Bradford, 1s. 11¾d.; Bury, 2s.; Bristol, 2s.; Cheltenham, 2s.; Darlington, 2s.; Halifax, 2s.; Oldham, 2s.; and Tynemouth, 2s. The charge per B.T.U. for domestic lighting supplies of electricity ranges from 6½d. at Bournemouth and a flat-rate of 6d. at Hastings to 2½d. (average) at Lincoln, and 3d. at Ashton-under-Lyne, Wolverhampton (average), and West Ham (flat-rate). The charge for water for domestic purposes on a house of £15 rateable value is highest in Ashton-under-Lyne—2s. 1¾d. in the pound. It is lowest in the following towns: King's Lynn, 7d.; Southampton, 7d.; Liverpool, 7½d.; Brighton, 9d.; and Leamington, 9d. The other places in which the charges are less than 1s. are: Bournemouth, Gloucester, Oxford, Plymouth, Reading, Walsall, Widnes, and York. At Preston (Mr. Carter's own town), the rates are 9s. 1d. in the pound; and they are relieved to the extent of 7d. by the profits transferred from reproductive undertakings. On the other hand, however, there is the deficiency on the docks, which, it is stated, increases the rates by 1s. 10½d. in the pound. The price of gas at Preston for domestic lighting is 2s. 11½d. per 1000 cubic feet; of electricity, 4½d. per unit; and of water, 1s. 2d. in the pound on £15 houses.

There is a table showing the amount estimated for the current year to be transferred to the borough, district, or other fund from the various profitable undertakings.

Metropolitan Water Board and the Sewage of Hertford.—At the meeting of the Metropolitan Water Board last Friday, it was decided to introduce a Bill into Parliament for the cancellation, on terms fair and reasonable to both parties, of the lease held by the Board of the Hertford Sewage Works. This lease was granted to the East London Water Company in 1899 for a term of thirty years; and under it the Board, as successors to the Company, have to dispose of the sewage of Hertford, taking over the liabilities of the Corporation in connection therewith, on consideration of a yearly payment of £700. The Board have brought forward a scheme for discontinuing the use of the Manifold Ditch as an effluent outfall, substituting a new outfall which would join the River Lea at a lower point. The Corporation and the Board have, however, failed to come to terms.

SALFORD GAS CHARGES.

Ordinary Consumers to pay Twopence More per Thousand Cubic Feet.

An Adjourned Special Meeting of the Salford Town Council was held last Wednesday to consider the gas charges question.

The Mayor, as Chairman of the Gas Committee, moved the adoption of the Committee's report as to the gas charges (a summary of which was given in our last week's issue), with the following conclusions of the Committee on the position :—

(A.) That the reduction to consumers of large quantities of gas authorized on June 22 be cancelled, and the former scale restored, save and except as amended by clause "B."

(B.) That the price to all consumers, except by slot-meters, be increased by 2d. per 1000 cubic feet as from Dec. 21 next.

After the resolution had been seconded, Councillor Purcell protested against the adoption of the Gas Committee's recommendations. Manchester, he said, could afford 30 feet of gas for a penny to automatic meter consumers; and Salford ought to give the same quantity. He suggested that the report of the Gas Committee as to the gas charges was incorrect and had been manufactured to blind the public.

A somewhat heated discussion followed, during which Councillor Purcell left the Council chamber. Finally, the recommendations of the Gas Committee were adopted by 24 votes to 10.

Councillor Johnson's motion, to the effect that the quantity of gas supplied to slot-meter users be 30 cubic feet, instead of 27 feet, was, on a division, declared to be lost by 17 votes to 11.

PROPOSED IMPROVED LIGHTING AT ACTON.

Offer by the Brentford Gas Company.

At the last Meeting of the Highways Committee of the Acton Urban District Council, a letter was read from Mr. Alexander A. Johnston, the Engineer and Manager of the Brentford Gas Company, submitting proposals for improved lighting. Adverting to a letter sent by him early in June last, in which he offered to re-arrange the lighting of Acton, and at the same time quoted figures showing an annual saving to the Council of some £300 on their public lighting bill, he expressed his pleasure in submitting a revised and further reduced scale of prices. He said that if the District Council would accept the offer made in June, and would enter into a contract to continue the use of gas in the 1072 public lamps mentioned for a period of not less than five years, his Company would undertake to make a further reduction in the price charged for gas, lighting, extinguishing, cleaning, and maintaining the lamps at the following rates per annum: No. 1 Keith gas-lamps (nominal 1500 candles), £11 5s.; Welsbach 300-candle power lamps, £5 3s. 8d.; 4-feet Kern lamps, £2 18s. He further stated that if the Council were prepared to enter into a contract on the same lines for a period of ten years, the Company would also undertake to alter the existing lanterns so that they would take inverted burners of the latest and most up-to-date pattern free of all cost to the Council. The ten-years' contract would be terminable at the end of five or seven years on either party giving six months' previous notice; the Council agreeing, in the event of the contract being so terminated by them, to repay the Company's proportionate part of the capital cost—5-10ths if the contract was terminated at the end of five years, and 3-10ths if at the end of seven years. The cost to the Council for lighting the whole of their district would, under this scheme, be approximately £3984. Mr. Johnston added that this figure was necessarily an approximate one, as the Company did not know the number of lamps to be replaced. The Committee decided that, until the electricity question was settled, they could do nothing in the way of accepting the offer; and they therefore adjourned its consideration *sine die.*

ELECTRIC LIGHT QUESTION AT BISHOP'S STORTFORD.

District Council's Project Abandoned.

At the last Meeting of the Bishop's Stortford Urban District Council, the Electric Lighting Committee presented a report to the effect that they had considered the question of the Council proceeding to carry out their obligations under their Electric Lighting Order, and recommended that the resolution passed at the meeting on the 15th of February last, to proceed with an installation of electric lighting, &c., in the district, on the basis of a report by the firm of electric lighting engineers consulted, be acted upon.

Mr. Carruthers, the Chairman of the Committee, moved the adoption of the report. He pointed out that when this matter was discussed some months ago, a great number of people were willing to take the electric light; and from a study of the figures, he was sure that, after the first year of work, the scheme could be made to pay. What they would lose one year they would gain in another; and he also felt sure that the price of gas in the neighbourhood would be reduced. They had only to turn to the neighbouring town of Saffron Walden for evidence of this. There the price of gas was 2s. 11d.; and he was informed by a councillor from the town that this year there would be a surplus which would go to the relief of the rates. If in Stortford they had their own electric light in competition with the supply of gas, they would get cheap gas and cheap electricity. There was a demand for electricity, and he hoped the Council would not lose such an opportunity. If, as a Council, they had their own installation and supply of electric light and power, whatever profit there was—and there would be profit—would go to the relief of the rates.

Mr. Edwards, in seconding the motion, said he was still a believer in the electric light scheme. By undertaking this work, the Council

would do a good stroke of business for the town, because he thought very shortly they would have to go to more expense for providing power at the water and sewage works. If the Council could put a good light into every cottage, they would be doing a fine thing for the town without loss to the ratepayers. He heartily supported the resolution that the work should go forward.

Mr. WATTS quite agreed with Mr. Edwards that if it were possible to light every cottage for 1d. per 48 hours it would be a splendid thing; but he thought that instead of the scheme costing something like £12,000, as estimated, it would amount to £36,000. Each extension of the cable would increase the cost; and this would necessitate the enlargement of the capacity of the generating station. In addition to these objections, he considered the Council were working entirely in the dark, as they were simply assuming that they would get a certain amount of support. He hoped the Council would see at once the desirability of not entertaining the scheme.

Mr. W. J. GEE, the Chairman of the Council (who, being personally interested in the subject under discussion, had vacated the chair and been replaced by the Vice-Chairman), said that, in his opinion, judging from the figures submitted to them, to embark on electric lighting would not be a very good business arrangement for the Council. They would run some risk; and it seemed to him that they would not be justified in asking the town to lay out a large sum of money on an undertaking like the one before them. He thought it would be remembered that the point had been raised as to whether the old-fashioned electric lamp did not consume something like 50 per cent. more current than the new metallic filament lamp. Therefore they had to cut the last return (he believed for 1908) in two to come at their income.

Mr. KENT remarked that the area proposed in the estimate presented to the Council was larger than that proposed by the Gas Company.

Mr. WATTS remarked that a great deal had been said with regard to the tyranny of the Gas Company; but they need not fear them. The cottager would in the future be able to have his own light. He could install in his house a light at less cost than the gas by means of an apparatus one could almost put in his pocket.

The VICE-CHAIRMAN (Mr. J. L. Glasscock) said he agreed with Mr. Gee, and thought the proposed installation could hardly be carried out for less than £24,000. He consequently would not be able to support the resolution.

The CLERK (Mr. T. Swatheridge), in reply to a question, read the section of the Gas Company's recent Act to the effect that they cannot undertake the supply of electricity until any powers vested in the Council shall have been revoked or shall have ceased to exist.

After some further remarks, the motion was lost by seven votes to five.

The VICE-CHAIRMAN then gave notice that at the next meeting of the Council he would move that the resolution of the 15th of February last now standing upon the minute-book be rescinded.

It was afterwards unanimously resolved to communicate to the Board of Trade the result of the discussion; and it was announced that the Electric Lighting Committee would not be called together again.

REDHILL AND REIGATE PUBLIC LIGHTING.

Settlement of the Dispute with the Redhill Gas Company.

In the "JOURNAL" for the 8th ult. (p. 422), reference was made to a dispute which had arisen between the Corporation of Reigate and the Redhill Gas Company on the subject of the renewal of the contract for the public lighting. The matter was under consideration at the meeting of the Corporation on Monday last week, when letters were read which showed that a settlement had been come to. This was the result of negotiations which had taken place between the Town Clerk (Mr. Alfred Smith) on the instructions of the Highways and Works Committee, and the Engineer and Manager of the Gas Company (Mr. W. H. Bennett). The Town Clerk read a letter he had received from Mr. Bennett, in the course of which he said that, after consideration of the various points brought forward, and taking into account the improbability of the Council wishing to convert more than 10 per cent. of the existing lamps (as mentioned by their deputation), he accepted, on behalf of the Company, the offer for a further three years' contract on the following terms: To light, extinguish, clean, and maintain the existing 389 public lamps at £3 per lamp per annum in respect of each ordinary incandescent lamp, and £3 2s. 6d. per lamp per annum in respect of each Marriage suspension lamp—the Corporation to be permitted to convert 39 lamps during the period covered by the contract without charge, but they would be charged at the rate of £1 per lamp per annum in respect of each lamp converted beyond the number allowed. In reply, the Town Clerk wrote that he had little doubt as to the arrangement come to being confirmed by the Council. Mr. H. Ongley moved that the offer of the Gas Company should be accepted, and a contract in accordance with it sealed. He thought the thanks of the Council were due to the Town Clerk for the efforts he had made in bringing about a satisfactory conclusion to the difficulty. Mr. M. Dean seconded the motion; and it was carried.

Electricity Supply in London.—A joint conference of London electric supply authorities was held at the Cannon Street Hotel last Thursday—Mr. Ernest Debenham, Mayor of Marylebone, occupying the chair. An interim report of the Executive Committee, which was adopted, dealt with the extensive work which has been carried out during the past year in setting out the basis of a linking-up scheme under the London Electric Supply Act, 1908. Reference was made to the valuable information of a confidential character which had been collated by the Joint Engineers' Committee, bearing on the question of the supply to London, upon which the engineers are still engaged. The Executive Committee was reappointed. A resolution was passed expressing appreciation of the work of the Electric Supply Publicity Committee; and it was decided to subscribe a substantial amount to the funds of the Committee, on a revenue basis, for the purpose of the development of a still more vigorous advertising programme.

THE SMOKE EVIL.

A Lecture on the Subject at Glasgow.

In the course of a lecture under the auspices of the Glasgow Health Culture Society, on the subject of air purification, Mr. Peter Fyfe, Sanitary Inspector, made some interesting references to the bearing of gas on the question of the smoke evil. There were, he said, three classes of inhabitants to whom the matter of smoke abatement was apparently but of academic interest.

There was the person who, with gas served to him by the Corporation at 2s. per 1000 cubic feet, pleaded that for 12 hours' constant burning a gas-fire would cost 2½d. more than a coal-fire would. The man who grudged 2½d. per day for a gas-fire did not take much account of the dirt and ashes from a coal-fire, the labour of cleaning, sweeping, and dusting, and the deterioration of furniture and household belongings, all of which would be saved by the use of gas.

Then, secondly, there was the prejudiced person, to whom gas in the grate was insufferable. This person did not speak of the small extra cost, but of the fumes and the hot, stuffy atmosphere. He (the lecturer) was in no way prejudiced in favour of the gas-fire. He knew its drawbacks as compared with the bright, blazing coal-fire, its uselessness as a paper burner and refuse destructor, its comparative deficiencies under ordinary circumstances as a water-heater, and its weakness as compared with the coal-fire in gusty weather to resist down-draughts; but from prolonged observation and experiment, he was prepared to deny that it caused, if properly constructed, offensive fumes, or that it engendered a stuffy atmosphere in the rooms in which it was employed. It might be quite freely admitted that, in the older type of gas-fires, with the ball-fuel or asbestos shavings laid close to the flaming gas-jets, fumes were created and emitted which were objectionable. It was a trite saying that smoke was caused by imperfect combustion. Gas-fumes were also caused by imperfect combustion. Another statement of the prejudiced person was that with reference to the stuffiness of rooms heated with gas-fires, and the dry heat such fires gave in comparison with coal-fires. Here, again, recent experiments carried on continuously for six months proved the fallacy of such statements.

The third class of people for whom smoke abatement had no interest were the poorer citizens. He was bound to say at once that, even assuming they could afford to purchase, or even hire, gas-fires or gas-cookers, they could hardly afford to burn in them gas at 2s. per 1000 cubic feet. The poorer classes required some differential treatment. They got it now by law in the payment of their rates; and if the air of Glasgow was ever to be purified, they must also get it in the payment for their gas. If they could get gas supplied to them at 1s. 4d. per 1000 cubic feet, instead of 2s., he believed most of them could be induced to hire the stoves and rings they needed from the Corporation. An alternative to this was that the Corporation in their gas-works should produce in sufficient quantities a coke-fuel containing such a fair proportion of hydrocarbons or inflammable matter as would make a reasonable substitute for the raw coal now burned. To take all, or nearly all, the gas out of the coal and sell the residue as coke to the poor, would not effect the purpose in view. The fuel that did not light easily, that had little or no flame, and that required a good draught to consume it, was of no use in the humbler homes of Glasgow, no matter how cheap it might be.

Alluding to the utilization of electricity, he said there was not the least doubt in the mind of any unbiassed person that, for yielding both heat and power, electricity was in the forefront of all other agencies. It alone could make the ideal factory and dwelling-house; but its use was still beyond the citizen who had to study ways and means, being dear as compared with gas, and expensive as compared with coal.

MITIGATION OF THE SMOKE NUISANCE.

Advantages of Cheap Gas.

Last Friday, a deputation from the Manchester and Salford Sanitary Association had an interview, at the Manchester Town Hall, with the Gas Committee of the Corporation, for the purpose of urging the necessity of something being speedily done to mitigate the smoke nuisance.

Mr. T. C. Horsfall, the Chairman of the Association, said the people in Manchester were debarred from enjoying fresh air and light owing to the prevalence of smoke and fog, which alike were highly detrimental to the healthy development of the citizens. The deputation had come to beg the Gas Committee of the Corporation to encourage the use of gas in place of the small, smoky fires, by reducing the price. An apparent sacrifice might have to be made by the Corporation; but for every £1000 of loss the city would gain tens of thousands of pounds in the way of added health to the community.

Sir Alfred Hopkinson, the Vice-Chancellor of the University, expressed the view that cheaper gas would greatly diminish the density of fogs, for most of the black smoke came, he said, from the chimneys of dwelling-houses.

Mr. J. W. Graham, Principal of Dalton Hall, remarked that the use of gas was the only cure in sight for domestic smoke. At 2s. 3d. per 1000 cubic feet, gas was rather more costly than coal; but if the price were reduced to 1s. 9d., he felt sure a great extension of its use for fires and cooking purposes would follow. The immediate responsibility rested with the Council, who hitherto had not been willing to sell gas as cheaply as they could. He knew that 3d. per 1000 cubic feet taken off the price of gas would mean 4d. in the pound on the rates; but surely there were men courageous enough to lay this before the public. A week of fog in Manchester would kill between 200 and 300 people.

Other speakers having addressed the Committee,

Mr. T. C. Abbott, who introduced the deputation, read a letter from Professor Harold B. Dixon, who expressed his regret at being unable to

join the deputation, and add his voice to theirs in asking for cheaper gas. Professor Dixon wrote as follows: "I have been studying the chemistry of burning gases for more than thirty years, and the more I learn the more I am convinced that a cheap gas supply of moderate candle power is, by its efficiency, economy, and flexibility, a most valuable asset in the well-being of a large city. I say moderate candle power because I believe it is wasteful nowadays to supply a gas of high illuminating power, as tested by an official argand or a flat-flame standard burner. . . . The use of the incandescent mantle has made it possible to supply a gas which may be used economically both for lighting and heating. Many inventors are busy on the improvement of incandescent fires; and a cheaper gas would give an immense impetus to their development and use. The ratepayer who uses a gas-stove instead of a smoky fire is a public benefactor; and we mark our sense of obligation to him by fining him for the benefit of the others."

Alderman Gibson, the Chairman of the Gas Committee, in reply, said that, personally and for the Committee, he was influenced by the same feelings on the matter as those shared by the deputation. Nothing would conduce more to the purifying of the atmosphere of the city than a more general use of gas and electricity. He had done all he could to reduce the price of gas; and the figure in Manchester had never been so low as it was now. At the same time, so long as the Committee had to hand over £50,000 a year from the gas profits to relieve the rates of the city, it was altogether impossible for them to do more than they were doing at present. The great point to be borne in mind was that the Committee were taking thousands of pounds a year out of the pockets of poor consumers and putting them into those of rich ratepayers who did not use gas at all. This was a gross injustice, to put the matter in the mildest form; and he would recommend the Association to continue to educate opinion in the value of cheap and plentiful light.

Mr. Abbott thanked the Committee for their courteous reception, and the deputation withdrew.

NEW WATER SUPPLY FOR VIENNA.

As the result of ten years' labour and an outlay of about £4,200,000, Vienna was last Friday provided with a second main water supply by the opening of the new aqueduct from the region of the Seven Lakes, near Hochschwab. Some details of this great scheme were given in the "Journal" five years ago. The sources of the new supply are in the valley of the Styrian Salza, more than 7000 feet above the level of the sea. Thence the water is brought to the city, a distance of about 130 miles. For the greater part of the way it is conveyed through underground pipes, but in places by aqueduct bridges. The engineering difficulties were considerable; in one place it being necessary to tunnel the mountains for more than three miles. The longest aqueduct is 800 feet in length and 75 feet in height. Two rivers and several streams had also to be tunnelled under. An enormous quantity of material was required for the work. Among the principal items were 140,000 tons of cement, 33,500 tons of cast-iron piping, and 2600 tons of wrought-iron piping. The daily supply of water from the new works is estimated at 44 million gallons, which, added to the 15½ millions from the existing sources, will provide Vienna with all the water it can possibly need for several decades. The new supply is said to be of excellent quality; and every care has been taken to preserve its purity. The Municipality have bought 12,500 acres of land surrounding the reservoirs at the sources, besides which a very large district has been specially enclosed as a protective area, in which no mining or works of any other kind which could possibly affect the water there will be permitted. Owing to the great height of the springs supplying the aqueduct, the water distributes itself to all but the highest points of the Vienna municipal district; and it flows so rapidly that it provides electrical power sufficient to pump the supply to the places not otherwise reached. The opening ceremony was performed at the Rathaus by the Emperor touching an electric button; and it inaugurated the 63rd year of his reign.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners on Monday had a discussion upon the question of paying commission in respect of mortgages granted, which is understood to be commission to parties who bring to the Commission money to be lent on mortgage. That such a practice prevails in the district is shown by the circumstance that representatives of the Gas Commission, the Town Councils of Edinburgh and Leith, the Water Trust, and the Water of Leith Purification Commissioners, met in conference on the subject, and, by a majority, agreed to recommend that commission be paid to accredited agents of lenders. The Commissioners on Monday approved of the recommendation, and continued the subject; there being still undecided the amount of the commission to be allowed, and still unconsidered a proposal that the local bodies should meet annually to fix the rate of interest to be from time to time allowed on mortgage debt.

The Commissioners had read to them a letter by a Law Agent on behalf of Mr. F. Cochrane, of Leith, with regard to a statement by whom, during the recent municipal election, to the effect that members of the Corporations of Edinburgh and Leith obtained privileges over other gas consumers, objections were taken at the previous monthly meeting. The Law Agent said that his client informed him that the remark was based upon the faith of statements by individuals in the employment of the bodies mentioned; that his client had no desire that his informants should run any risk of being made to suffer for anything they had said to him; and that he could not, therefore, see his way to supply their names. It was pointed out, however, at the request of the client, that the statement had reference to some former members of the Edinburgh and Leith Corporations, and that when Mr. Cochrane made the statement he did not have in his mind, nor

mean to refer to, present members; his sole object being to elicit whether a similar practice to that mentioned was still in existence to any extent. His client authorized him to state that he gladly accepted Mr. Herring's assurance that, so far as the Gas Commissioners were concerned, the members of the Edinburgh and Leith Corporations were not treated in any way different from other consumers; and he instructed the writer to express his sincere regret if he had caused any pain or annoyance to the present members of the Corporations. Provost Smith, of Leith, pointed out that it was stated that the charge was not made with reference to the present members of the Corporations, and he went on to say that he did not know that this made the matter any better. It was, in his opinion, a slander upon their officials; and he thought that if they dealt with the matter further it should be in private. This was agreed to, and the subject was sent to the Finance and Law Committee to consider.

At the meeting of the Western District of the Scottish Junior Gas Association in Glasgow to-night, the important and appropriate subject of fuel calorimetry was considered. Mr. G. Braidwood, the Assistant Gas Manager at Coatbridge, who introduced the subject, was, as the President remarked, well qualified for the handling of the matter, having previously been Chemist at Dawsholm, with an up-to-date laboratory at his command. The subject is one which, it may be admitted, few except a junior could do justice to, because in a works sufficiently large to keep a laboratory going the Manager has not time to devote to systematic testing, which then devolves upon an assistant. Mr. Braidwood discharged his duty well, so that there was nothing for the members to discuss. But, of course, there must have been very few present who have had the experience which would have justified them in expressing an opinion. The paper was an informative one; and as such will be welcomed by many to whom the practice of calorimetric estimating is as yet a new subject.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 739.]

LIVERPOOL, *Dec.* 3.

Sulphate of Ammonia.

Although new orders from direct buyers have been somewhat scarce this week, the requirements of dealers for covering former sales have been sufficient to maintain values at the lower level reported last week. There has been a fair quantity of sulphate coming on the market; but it has been taken up as it has become available, and the quotations at the close remain £12 12s. 6d. per ton f.o.b. Hull, £12 13s. 9d. per ton f.o.b. Liverpool, and £12 15s. per ton f.o.b. Leith. Little interest is being shown by consumers for future delivery; buyers refusing to concede the price asked by manufacturers, and it being reported that second-hand sellers are offering at less money.

Nitrate of Soda.

The market is still without any new feature; the tone being quiet, and holders continuing to quote 9s. 4½d. per cwt. for 95 per cent. and 9s. 7½d. for 96 per cent. quality, on spot.

LONDON, *Dec.* 5.

Tar Products.

The markets for tar products have remained fairly firm during the past week. In pitch, there has been a fair amount of inquiry for forward delivery; but buyers will not pay the prices which are being asked on this side. On the other hand, distillers are very firm in their ideas of price. It is most difficult to do business at the prices being asked at the moment for benzol. Creosote is quiet, and transactions are reported at fairly low prices. In crude carbolic acid, makers still report that they are receiving offers at 1s. 1½d. to 1s. 2d. per gallon. On the other hand, consumers do not offer more than 1s. 0½d. to 1s. 0¾d. per gallon. Heavy naphtha is fairly firm.

The average values during the week were: Tar, 16s. 6d. to 20s. 3d. *ex* works. Pitch, London, 34s. to 34s. 6d.; east coast, 32s. 6d. to 33s. 6d; west coast, Clyde ports, 33s. to 34s., Manchester, 32s. to 33s., Liverpool, 32s. 6d. to 33s. Benzol, 90 per cent., casks included, London, 8d. to 8½d.; North, 7½d. to 7¾d.; 50-90 per cent., casks included, London, 8d. to 8½d.; North, 7¾d. to 8d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4¼d.; North, 3⅛d. to 3¼d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 11d. to 1s. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2⅛d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d.; west coast, 1s. 1d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market remains steady; and the Northern ports seem to be a trifle better than London. The inquiry has been fairly good during the past week. Outside London, makes are quoted at £12 6s. 3d. to £12 7s. 6d. In Hull, the price is £12 17s. 6d.; Liverpool, £12 17s. 6d.; Leith, £12 17s. 6d.; and Middlesbrough, £12 16s. 3d. to £12 17s. 6d. For the forward position, makers still maintain their ideas of high prices.

Public Lighting of Coedpoeth (Wrexham).—Last Friday witnessed the inauguration of the public lighting of Coedpoeth, as on the evening of that day the street-lamps recently fitted up were lighted for the first time. They have been erected, according to the directions of the Parish Council, by the Wrexham Gas Company, who have also extended their mains to a number of roads. Most of the residents will, therefore, be able to have the gas supply connected with their houses. The question of street lighting has been under consideration for many years; and now that it has been accomplished, its utility and benefit are recognized by all sections of the community. Though the necessary rate will be 6d. in the pound for the first three years, it is estimated that there will be a considerable reduction afterwards.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a better demand for coals, and the shipments have been heavier, and are likely to continue so, as there is a desire to accumulate a little stock before the coming holidays. In the steam coal trade, the request is fair, and prices seem a little firmer. Best Northumbrian steams are from 9s. 4½d. to 9s. 9d. per ton f.o.b., second-class steams are about 8s. 3d. to 8s. 6d., and steam smalls are from 4s. 9d. to 6s. 3d. In the gas coal trade, the demand is now at its fullest for this season, and deliveries on the long contracts take up most of the output of the chief collieries. Durham gas coals are from 8s. 3d. to 9s. per ton f.o.b. for the usual classes, according to quality. For "Wear specials," from 10s. 3d. to 10s. 6d. per ton f.o.b. is the current quotation. There has been a sale of some 40,000 tons of gas coal for delivery over the next four months, at a price which is calculated to leave 8s. 6d. per ton f.o.b. There are also more contracts in negotiation for the supply of the London Gas Companies, and it is stated that in some instances about 1s. 3d. less than the prices under the contracts now running is being offered in the new contracts; but the bargains are not yet complete. Coke is quiet. Good gas coke is about 14s. 6d. per ton f.o.b., with a heavy supply.

Scotch Coal Trade.

Home trade is more active, but not sufficient to affect prices. In the foreign trade, orders are very limited. Small stuffs are difficult to sell. The prices now quoted are: Ell, 9s. 3d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 6d. to 9s. 9d.; and steam, 9s. to 9s. 3d. The shipments for the week amounted to 300,840 tons—a decrease of 3746 tons upon the preceding week, and of 6163 tons upon the corresponding week last year. For the year to date, the total shipments have been 14,649,476 tons—an increase upon the corresponding period of 671,807 tons.

Strabane Water Supply.—The Strabane Urban District Council have adopted the estimate of the Engineer in connection with the proposed water scheme, at a cost of £3545, and have decided to apply for a loan of £4000 to carry out the work.

Gas-Works Damaged by Floods.—Owing to the recent heavy rains, the towns and villages along the banks of the Loire, the Rhône, and the Saône are being inundated. A similar state of affairs prevails at Samur, where both the gas-works and the electric light station are flooded. The town was in darkness last Wednesday night, as was also the town of Angers. Ancenis, further up the river, is without drinking water, gas, or electricity.

Burst in a Liverpool Water-Main.—A burst occurred last Tuesday on the Liverpool water-pipe line at Cotebrook, a village seven miles from Northwich. A fissure 5 feet in length was caused in the pipe, which is 3 feet in diameter and 1¼ inches thick, through which large volumes of water rushed, tearing up a field for 30 yards, and forming a chasm 20 feet deep and 30 feet wide, and another of smaller dimensions. The main road was torn up and the Northwich Council's water-works were flooded. The Liverpool mains being in duplicate, the supply of water to the city was not affected.

Ventilation of Street Boxes.—In view of the explosions which have occurred, the Woolwich Borough Council recently sent a circular-letter to the other Metropolitan Borough Councils, asking them to communicate with the London County Council and urge the desirability of regulations being framed to secure the ventilation of street inspection boxes. The Battersea, Bethnal Green, Bermondsey, Chelsea, Deptford, Finsbury, Hampstead, Kensington, Lewisham, and Stepney Councils agreed to support the request; the Paddington and Westminster Councils replied that they were not in favour of the proposal; and the Holborn, Marylebone, and Wandsworth Councils wrote that they had decided not to take any action in the matter.

Chertsey Gas Company, Limited.—The annual meeting of this Company was held last Tuesday—Mr. William Moir in the chair. The Secretary (Mr. John Moir) read the Directors' report, in which they recommended the payment of the statutory dividends of 12 and 9 per cent., less income-tax. The Chairman, in moving the adoption of the report, said he thought, if the shareholders looked at the figures in the accounts, they would agree with him it was an excellent report, and showed a good year's working. The Directors were quite exuberant at the success of their invitation for tenders for the new capital, which was over-subscribed by £2000. The Company were making headway in every direction. Mr. W. Kempson seconded the motion, and heartily congratulated the Directors on the excellent condition into which they had brought the undertaking. The report was adopted. In acknowledging a vote of thanks to the officers, Mr. J. Moir said both he and the Manager (Mr. H. J. Hamilton) had done their level-best for the Company ever since they had been connected with it.

Local Legislation Committee's Report.—The special report from the Select Committee on Local Legislation (ordered by the House of Commons to be printed on the 22nd ult.) has now been issued. Only two paragraphs of it are of particular concern to our readers. Noticing the Middlesbrough Corporation Bill, the Committee say: "Middlesbrough gave evidence of the fraudulent operations of coke-hawkers, who give short weight, or damp the coke to make it heavier; and, when approached by the Inspector of Weights and Measures, profess to be selling by bag and not by weight. A clause was allowed, compelling coke-hawkers to have every sack labelled with its correct weight of coke." Dealing with the smoke nuisance clauses of the London County Council Bill (which were opposed by, among many other petitioners, the London Gas Companies) the report contains this paragraph: "In order to deal with smoke nuisance, the London County Council sought to amend the law dealing with a nuisance produced by smoke, by the omission of the defining word 'black.' Your Committee heard a considerable volume of evidence, both on behalf of the promoters and of the opponents—including the London Chamber of Commerce. As the County Council were unwilling to accept any limitation on their suggested clause, your Committee, in view of the serious effect it might have on the industries of London, did not allow the clause."

The Tottenham and Edmonton Gas Company having agreed to fix automatic lighting appliances to street-lamps in certain agreed positions, to enable the Highways Committee to see the system at work, the Surveyor has been instructed to arrange with the Company for the erection of them at their own expense.

In view of the approaching "shopping week" at Reigate and Redhill, which has been fixed for the period between the 10th and 24th inst., the Redhill Gas Company secured the back page of the "Surrey Mirror" for last Friday for a very effective advertisement of their commodity, which is characterized as "the convenience of the age and the best domestic servant."

At to-morrow's meeting of the Association of Engineers-in-Charge, a paper will be read by Mr. John B. C. Kershaw, F.I.C., entitled "Practical Notes on the Working and Control of Steam-Boilers." Dr. H. S. Hele-Shaw, F.R.S., will take the chair.

As the result of excessive grief consequent upon the loss of his wife, a young man named William Henry May, an employee of the South Metropolitan Gas Company, died in St. Bartholomew's Hospital on the 26th ult. from the effects of taking poison. At the Coroner's inquest on Tuesday, a verdict of "Suicide" was returned, as there was not sufficient evidence to show the Jury the state of May's mind.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Dec. 3. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	21/-	18/6—21/-	19/——21/3	18/6—21/-	18/6—21/-	—
Pitch	,,	35/-	32/——32/6	32/6	33/-	32/——32/6	32/6
Benzol, 90 %	per gallon	-/9	-/7¼—/8	-/8	-/7¼—/7½	-/7¾—/8	-/8
Benzol, 50-90%	,,	-/9½	-/8¼—/8½	-/9	-/8—/8¼	-/8—/8¼	—
Toluol, 90%	,,	-/10	-/9—/9¼	-/10	-/10	-/9½—/10	-/10
Crude naphtha, 30%	,,	—	-/3¼—/3½	-/3½	-/3¼—/3½	-/3¼—/3½	—
Light oil, 50%	,,	—	-/3¼	-/3½—/3¾	-/3—/3⅛	-/3—/3⅛	—
Solvent naphtha, 90-160	,,	—	-/10½—/11	-/10	-/10—/10½	-/11½—1/-	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11	-/11¼—/11¾	-/11½—1/-	-/11
Creosote in bulk	,,	-/2½—/2¾	-/2—/2¼	-/2	-/2—/2⅛	-/2—/2⅛	-/2
Heavy oils	,,	-/3¼	-/2½	-/2¼	-/2¾	-/2¾—/3	-/3
Carbolic Acid, 60's	,,	1/1	1/—1/1	1/1	1/0½—1/1	1/0½—1/1	1/1
Naphthalene, crude drained salts	per ton	—	42/6—45/-	40/——42/6	47/6	47/6—50/-	—
Naphthalene, pressed	,,	—	60/-	63/-	60/-	60/—72/6	—
,, whizzed	,,	80/-	—	—	70/——72/6	70/——75/-	65/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 701.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
551,863	Stk.	Oct 14	5	Alliance & Dublin Ord.	83—86	..	5 16 3
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	90—98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6½—6¾	..	5 3 8
40,000	5	..	7	Do. New, £4 paid	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	..	4 3 7
75,000	10		6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
3[illegible]0,000	Stk.	Aug. 12	12½	Brentford Consolidated	248—251	..	4 19 7
3[illegible]0,000	,,		9½	Do. New	185—188	..	5 1 1
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
220,000	Stk	Aug 31	1	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,		8	Do. A Ord. Stk.	158—161	..	4 19 5
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	..	5 0 11
5[illegible],000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	90—92	+2	4 17 10
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk.	106—109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	..	3 14 1
800,000	Stk.	June 10	4†	Continental Union, Ltd.	88—93	..	4 6 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
143,995	,,	Oct 14	5	East Hull 5 p.c. Ord.	103—105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¾—24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
15,1[illegible]9,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	104¾—106¾	+¾	4 7 5
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	112—114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	185—187	+1	4 16 3
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	163—165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4¾—5	..	6 0 0
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¼—12¾	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	136—138*	+2¼	5 15 11
60,000	5	Sept. 15	8	Ottoman, Ltd.	6¼—6¾	..	5 18 6
31,800	53	Aug. 31	13	Portsea Island A.	131—133	..	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼—7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	95—97*	..	4 2 6
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	109—111	..	4 10 1
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 0
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	113—115	..	4 6 11
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c.	140—142	..	4 15 1
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	74—76	..	3 18 11

Prices marked * are "Ex div." † Next dividend will be at this rate.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.

Brotherton and Co., Ltd., Chemical Manufacturers, Works: Birmingham, Leeds, Sunderland, and Wakefield.

WANTED—Tar and Ammoniacal Liquor. Any Quantity.

Grindley and Company, Limited, Rawcliffe, near Goole, Yorkshire.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

CALCIDUM, a Limpid, Colourless, Neutral Liquid; does not affect Metals, freezes only at -67° F., and, therefore, when mixed with Water in Gas Meters, Engines, Generators, &c., prevents these Freezing in the most severe weather. It is also the best means of thawing everywhere, for Extinguishing Fires, and for working Mortar and Cement in Winter. Used regularly for Eight Years by one English Gas Company.

Richard Simon and Sons, Limited, Nottingham.

AMMONIA.

Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.

It is also used for the enrichment of Gas.

Manufactured and supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim House, Newcastle-on-Tyne.

Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

GAS-COAL Salesman wanted. Must have large Turnover, First-Class Abilities, and Connection. Every facility Offered.

Apply, in strictest confidence, to W. H. Bowater, Limited, Birmingham.

WANTED for Gas-Works in Colliery District in the North of England a WORKING FOREMAN. Must understand Generator Furnaces and Gas-Works Routine. No District Work.

Apply, by letter, giving full Particulars, and stating Wage required and Age, to No. 5328, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—Forty-Nine 21 in. by 15 in. ◯ to Round MOUTHPIECES, Self-Sealing. Fourteen now being Removed on Introduction of Machinery.

Apply to the Secretary, Gas Offices, Sutton, Surrey.

GRIDS for Purifiers, about 3000 Square Feet ORDINARY and 1500 Cubic Feet HURDLE GRIDS, at 20s. per 100 Feet Respectively. Sold in Smaller Lots.

Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

THE Tonbridge Water-Works Company, Limited, have for Disposal a Horizontal Duplex Compound PUMPING ENGINE, in excellent order, capable of delivering 25,000 Gallons per Hour. Can be seen at work; Also a similar One capable of delivering 6000 Gallons per hour, to be removed to make room for larger Plant; Also Two CENTRIFUGAL PUMPS and One Worthington Boiler-Feed PUMP.

All Particulars can be obtained from Jas. Lees, Engineer and Manager, 4, The Terrace, Tonbridge. November, 1910.

FOR SALE—Complete Gas-Making PLANT, including New Gasholder and Steel Tank, 10,000 Cubic Feet capacity, ready for delivery, with Condensers, Scrubber, Purifiers, &c. Erected complete in England for £1200. Detailed Plan and Specification submitted.

TWO PURIFIERS, 12 ft. by 8 ft. by 5 ft. deep. Three Purifiers 5 ft. 6 in. square, complete with Four-Way Valves and Connections. Re-Erected cheap for immediate Sale.

GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.

STORAGE TANK, 18 ft. long, 13 ft. 6 in. wide, 6 ft. deep, of ⅜-inch thick Boiler Plate. Also CAST-IRON TANKS. Inquiries Solicited.

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THE UNIVERSITY OF LEEDS.
(Department of Fuel and Gas Engineering.)

SPECIAL LECTURE COURSES OPEN TO THE PUBLIC.

(*A*.) The Distribution and Uses of Coal Gas.—

A COURSE of 22 Lectures on Wednesdays at Six p.m. and Thursdays at Nine a.m., during Eleven consecutive weeks, as under:—

1911.

Jan. 11 to Feb. 2.—Eight Lectures on "Distribution of Coal Gas," by Mr. Walter Hole, of Leeds.

Feb. 8 to 16.—Four Lectures on "Gaseous Combustion and Structure of Flames," by Professors Bone and Smithells.

Feb. 22 to March 9.—Six Lectures on "The Uses of Coal Gas for Heating Purposes," by Mr. John Bond, of Southport.

March 16 to 24.—Four Lectures on "Gas Lighting and Photometry," by Mr. Jacques Abady, of London.

Fee for the whole Course £1 1s., or 10s. 6d. for a Single Section thereof.

(*B*.) Bye-Product Coking Processes.—

A Course of Eight Lectures on Saturdays at 3.30 p.m. Commencing Jan. 21, 1911, by Mr. Ernest Bury, M.Sc., of the Skinningrove Iron Company, Limited.

Fee for the Course, 10s. 6d.

For further Particulars Apply to the Registrar.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
South Kensington, S.W.,
including the
ROYAL COLLEGE OF SCIENCE,
ROYAL SCHOOL OF MINES, and
CITY AND GUILDS COLLEGE.

THE Second Part of a Special Course of ADVANCED LECTURES, as follows, will begin during January next:—

Subject:
"GASEOUS FUEL AND COMBUSTION."
Conducted by
Professor W. A. Bone, D.Sc., Ph.D., F.R.S.

Particulars of this, and other Courses to Follow, Free on Application to the Secretary.

LLANDUDNO URBAN DISTRICT COUNCIL.

THE Council invite Tenders for the Supply of Ordinary and Prepayment Dry GAS METERS, size 3 Light and upwards, during a period ending the 31st of March, 1912.

Tenders to be sent in to the undersigned not later than the 31st of December, 1910, endorsed "Meters."

The Council do not undertake to accept the lowest or any Tender.

By order,
(Signed) Alfred Conolly,
Clerk to the Council.

Town Hall, Llandudno,
Dec. 1, 1910.

COUNTY BOROUGH OF SALFORD.
(Gas Department.)

THE Gas Committee invite Tenders for the Supply of RETORTS, FIRE-BRICKS, &c., required at their various works.

Full Particulars may be obtained on Application to Mr. William W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.

Sealed Tenders, endorsed "Tender for Fire-Clay Goods," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m. on Thursday, the 15th of December, 1910.

L. C. Evans,
Town Clerk.

Salford.

CORPORATION OF GLASGOW.
(Gas Department.)

GAS STOVES AND GRILLERS.

THE Corporation invite Tenders for the Supply of GAS STOVES and GRILLERS as may be required during the next Two Years.

Forms of Tender may be had on Application to Mr. Alexander Wilson, Gas Engineer, 45, John Street, Glasgow.

Sealed Offers, marked outside "Tender for Stoves, Gas Department," must be lodged with the Subscriber on or before Tuesday, the 27th of December prox.

The lowest or any Tender may not be accepted.

A. W. Myles,
Town Clerk.

City Chambers, Glasgow,
Nov. 30, 1910.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of the Company, so far as they relate to DEBENTURE STOCK, WILL BE CLOSED from the 14th to the 21st of December, 1910, both days inclusive.

The Interest for the Half Year to Dec. 31, 1910, will be payable on the 1st of January to the Proprietors Registered on the closing of the Books.

By order of the Board,
E. Topley,
Secretary.

Chief Offices of the Company:
639, High Road, Tottenham,
Nov. 30, 1910.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK and BONDS, WILL BE CLOSED at One o'clock p.m., on Saturday, the 10th prox., for the Half Year ending on the 31st prox., and WILL BE RE-OPENED on the Morning of Monday, the 12th prox.

The Interest for the Half Year will be payable on the 2nd of January next to the Proprietors Registered on the closing of the Books.

By order,
Henry Rayner,
Secretary.

Chief Office: Horseferry Road,
Westminster, S.W., Nov. 28, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for
METERS, FIRE-CLAY GOODS, OXIDE OF IRON AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
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PATENT
CANDLE SAFETY LAMPS.

Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.

43, Manchester Street, Gray's Inn Road, W.C.

COOKE, ENNEVER & TULK,
Stock Brokers,
17 & 18, NEWGATE STREET, E.C., and
PRINCE'S CHAMBERS, BIRMINGHAM.

We are Buyers and Sellers by Private Treaty of Stocks, Shares, and Debentures in approved Old Established Water or Gas Undertakings, and make this a speciality. Prices quoted on Application.

New Capital issued, Municipal Loans arranged.

COOKE, ENNEVER & TULK,
'Phone City 4660. Tele.: "Bipunctual London."

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analyses, and Report, to the

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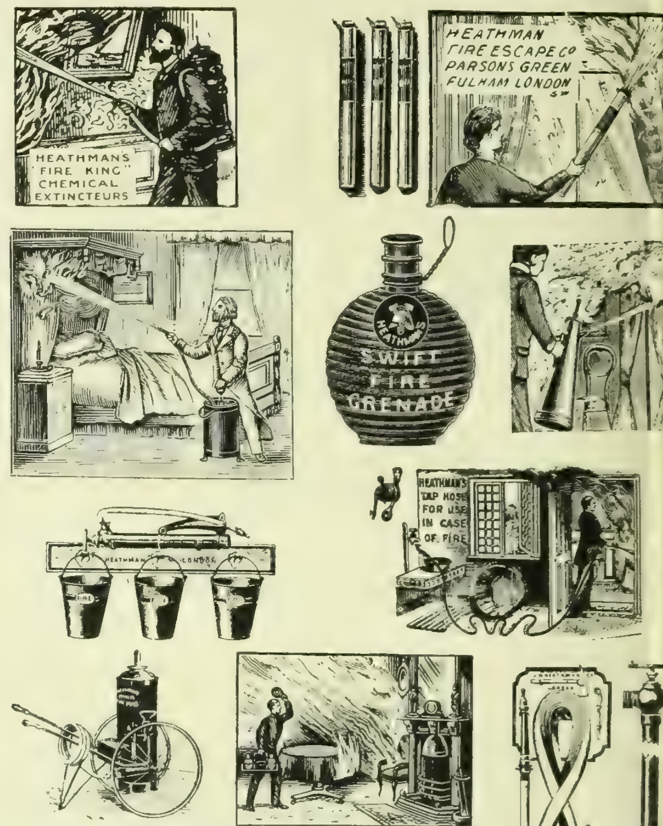
LONDON: 16, Park Village East, N.W.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
and
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large Stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

Note.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.



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WHAT
GAS ENGINEERS
STATE:—

"COALEXLD is the only Smokeless Fuel that lends itself to the assistance of Gas Engineers, and therefore ought to be adopted by them."

For Terms, apply to COALEXLD LIMITED, LANCASTER.

CLAYTON SON & CO.
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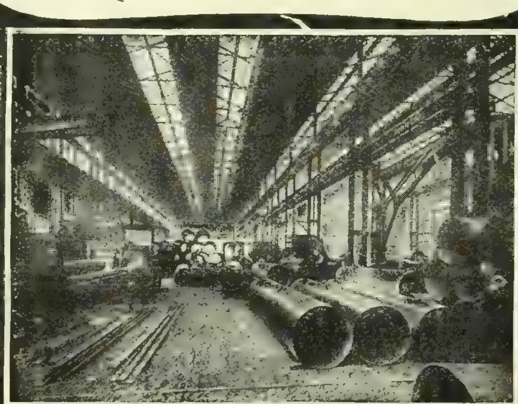
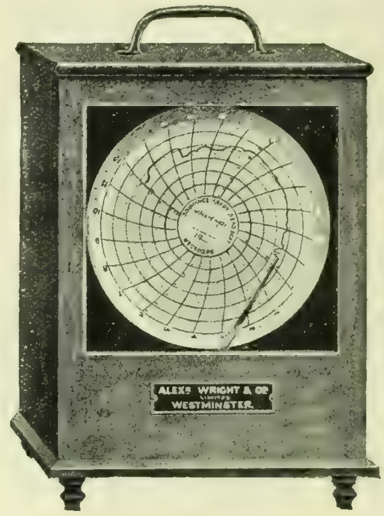


Interior View of Works Employed in the Manufacture of
WELDED STEEL MAINS
for WATERWORKS Etc.



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PATENT
PORTABLE RECORDER.

No Liquid.
No Corrosion.

Very Sensitive.
Weighs 8 lbs.

Alex. Wright & Co., Ltd.,
WESTMINSTER.

TO GAS ENGINEERS
NAPHTHALENE SOLVENT.

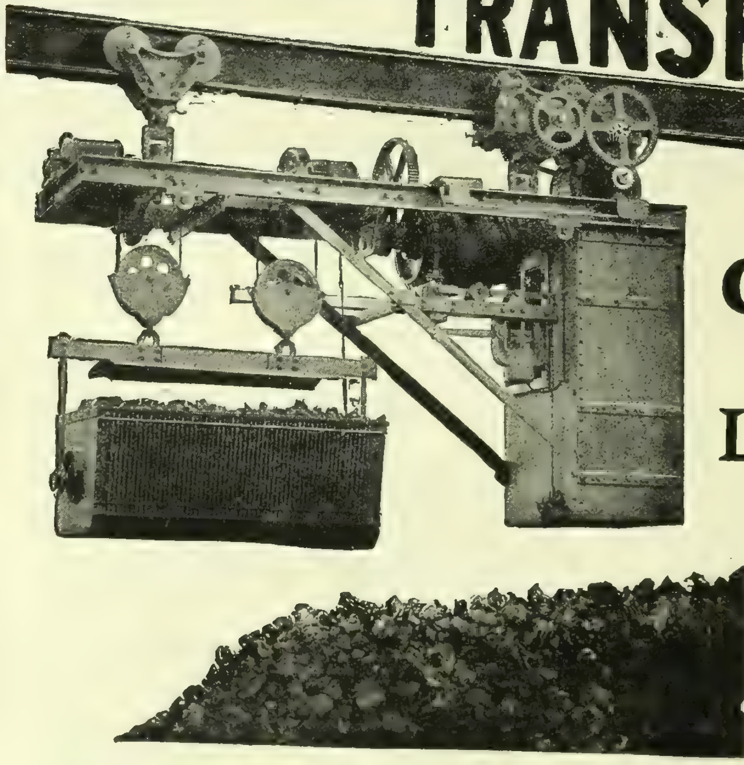
Are you troubled with **NAPHTHALENE** in your **MAINS?** If so, try our special

"SOLVENE."

THE FINEST NAPHTHALENE SOLVENT.
ENQUIRIES SOLICITED.

BROTHERTON & Co., Ltd.,
CITY CHAMBERS, LEEDS.

TRANSPORTERS
FOR



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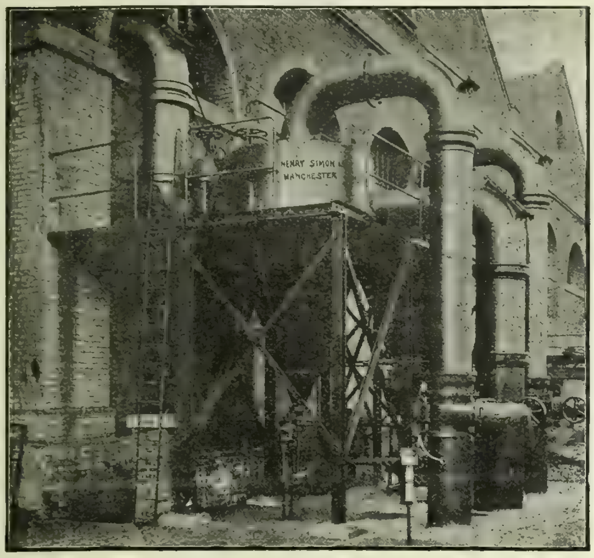

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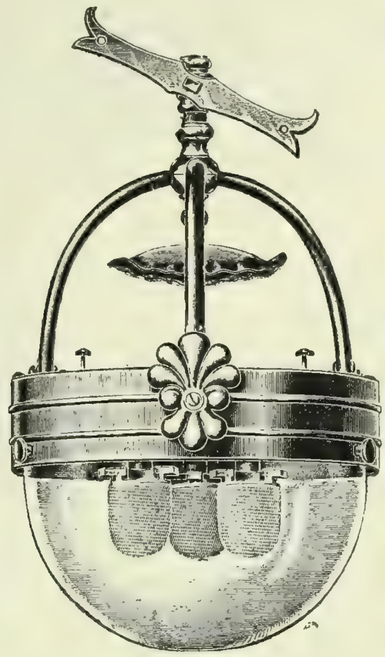

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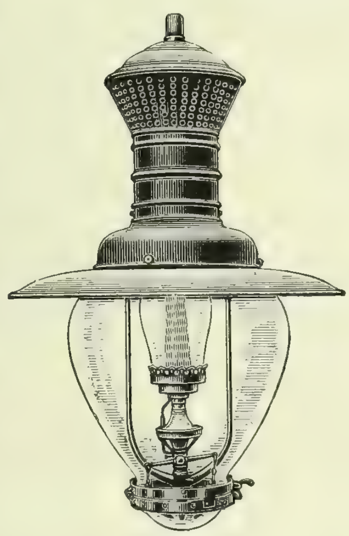

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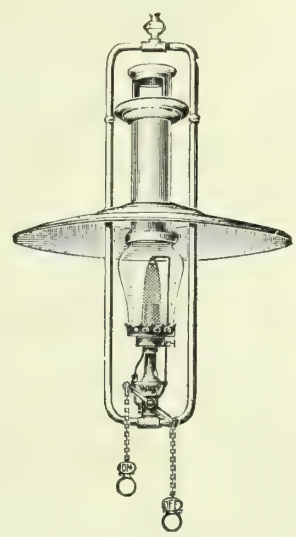

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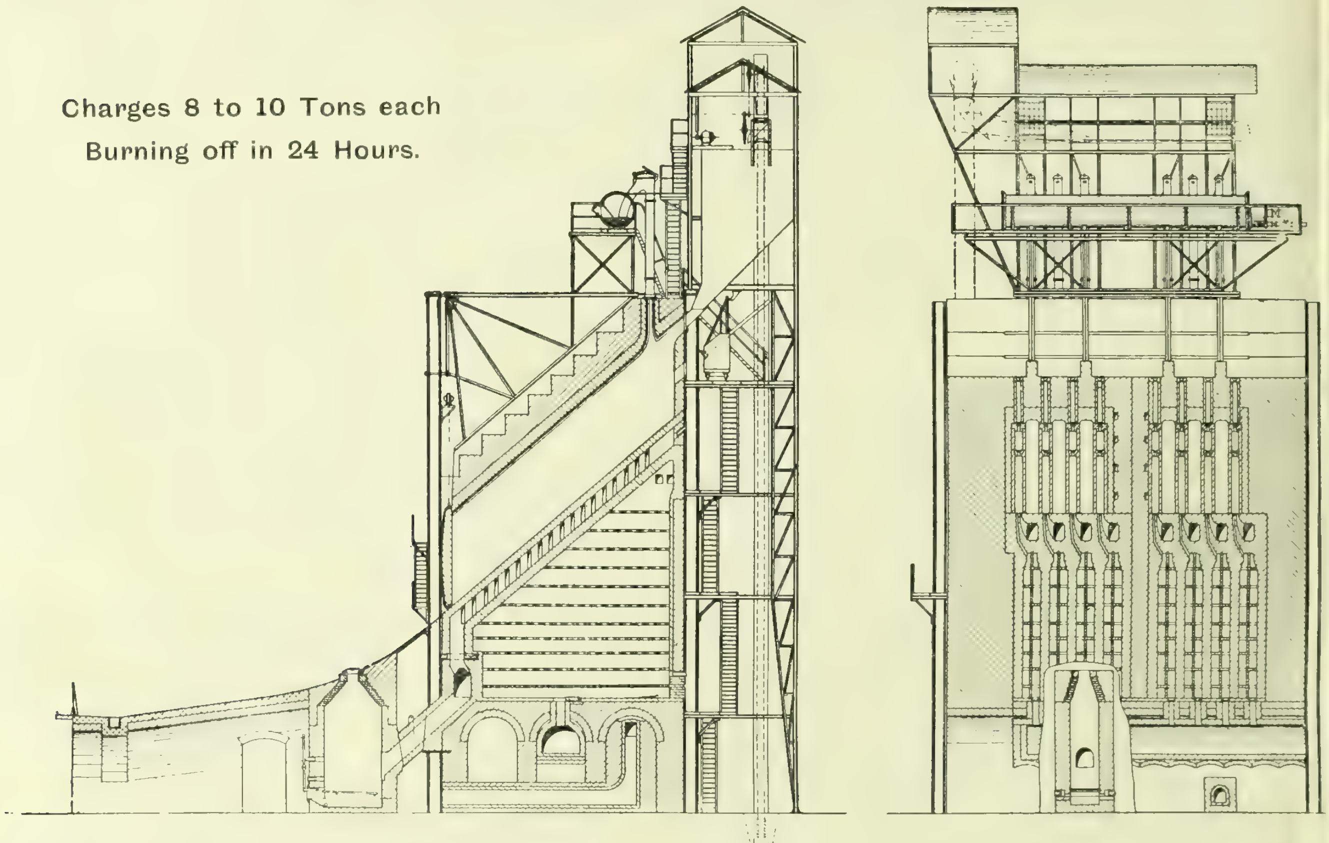

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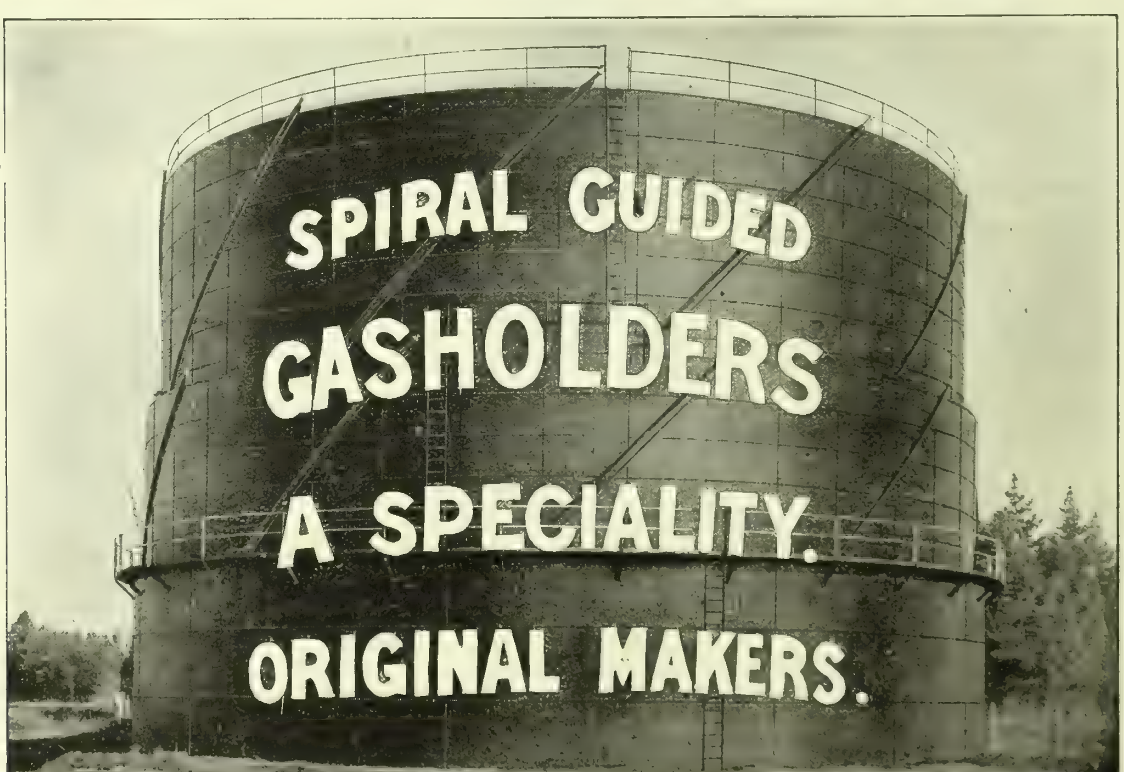

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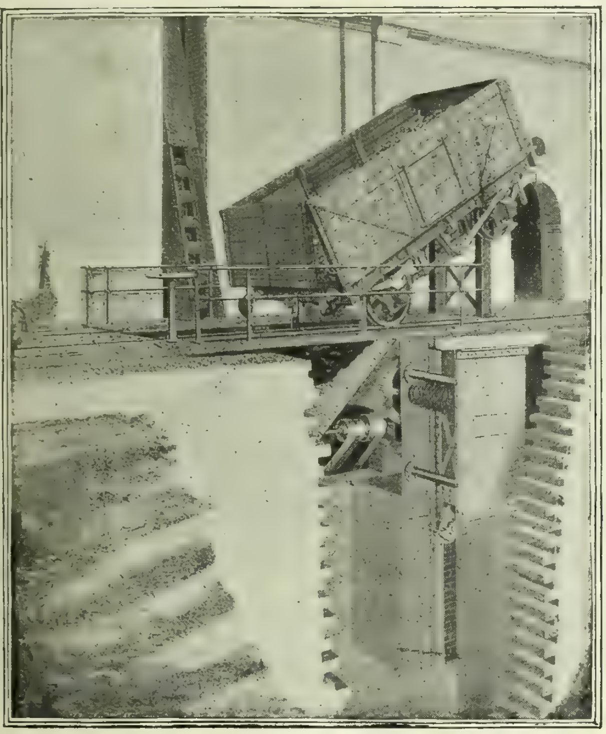

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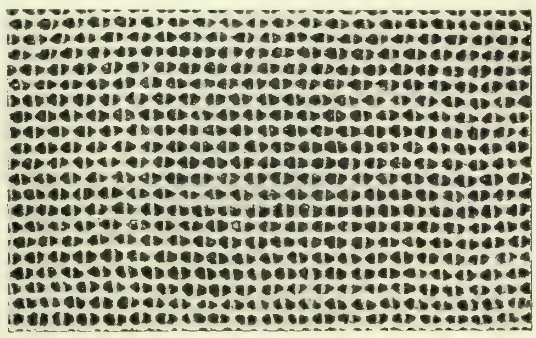
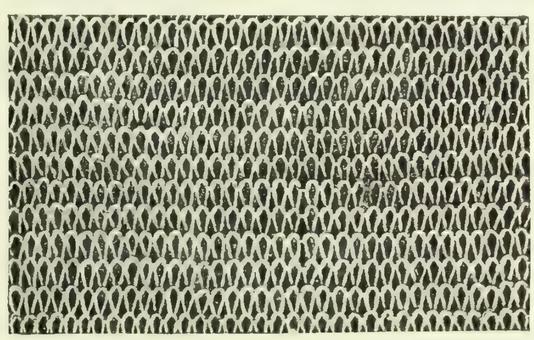
The following illustration shows clearly that the threads run in straight lines, and that no part displays an angular structure.



Loom-Woven Mantle.

In order to emphasize the increased strength of a loom-woven mantle over a knitted mantle, the following illustration gives a representation of the mesh of an ordinary knitted mantle, as usually supplied to the trade. The marked difference in the increased strength of the mesh of the loom-woven mantle must be apparent to the most casual observer.



Knitted Mantle.

We understand that a number of engineers connected with leading gas companies, after giving these mantles a prolonged test, have pronounced emphatically in their favour; and the mantles should certainly prove of great interest to all engaged in street lighting and maintenance work—*Journal of Gas Lighting, Nov. 29, 1910, p. 632.*

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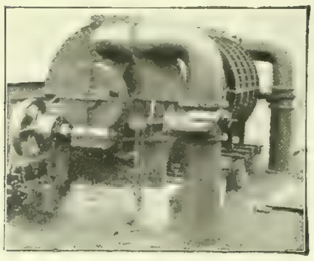

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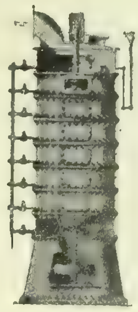

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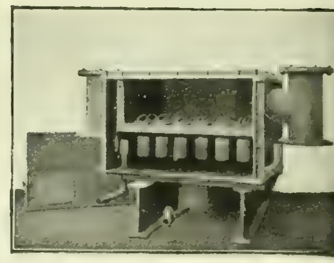

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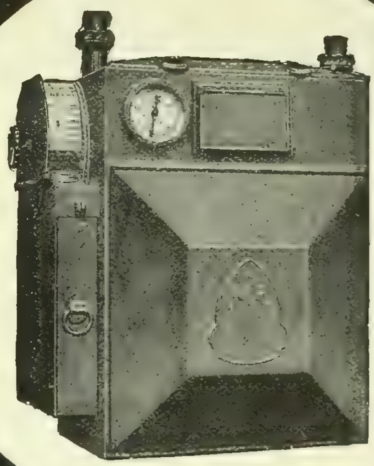

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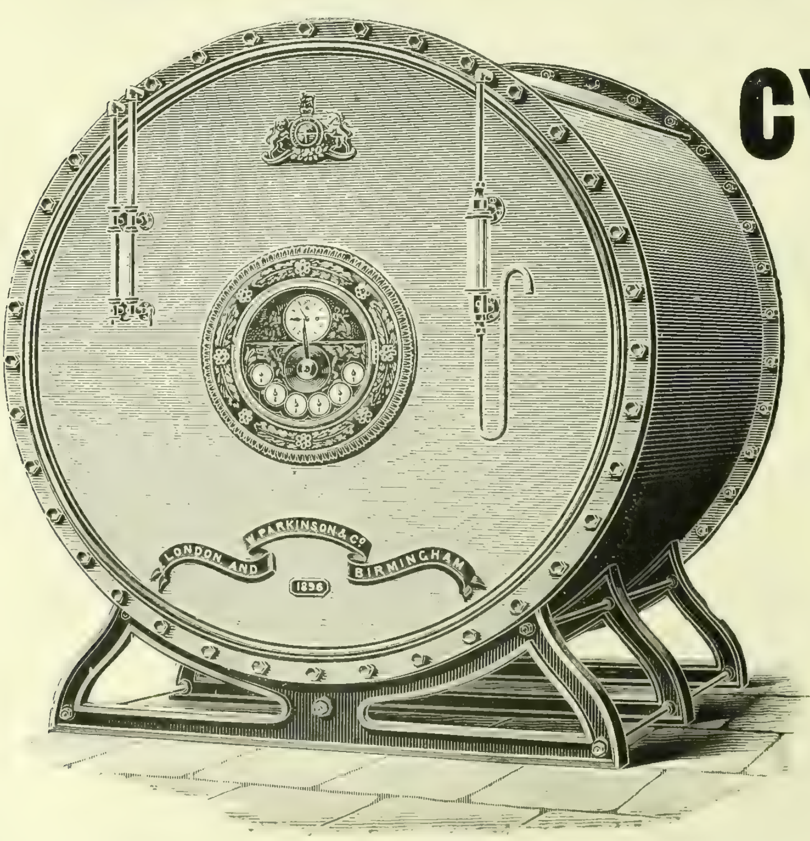

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2483 —— TUESDAY, DECEMBER 13, 1910.

EDITORIAL NOTES—GAS, &c.

The Undegenerate Gas Industry.

The Effects of Increased Make of Gas per Ton.

THE commercial rivals of the gas industry are prone at times to a little mental aberration anent the wasting away of the gas industry through their competitive exertions; and the terrible state to which (in imagination) the industry is being reduced is occasionally set forth with undisguised pleasure in the electrical press, to the amusement of those of the gas industry who see these fantastical performances. It entirely passes our understanding why concrete facts so easily procurable in this instance should be set on one side in favour of unrealities. The Board of Trade returns relating to statutory gas undertakings are as available year by year to our electrical contemporaries as to anyone else; and they can learn from them, if they so desire, the history of a progressive development. The newly issued ones (from which some figures were reproduced in our columns last week) bring the information in the case of statutory gas companies up to December last year, and in the case of municipally owned gas concerns to the end of March last; and, as we expected they would be, the figures are of greater importance than ever in their disclosure of a conspicuous enhancing of the stability of the industry through working economy development and business expansion. It is altogether a good tale the statistics have to tell, in both their technical and commercial sense.

There are only this year four additional undertakings included in the returns (taking company and local authority ones together); these making the total 794. The capital employed by them amounts to £132,123,284, which is an increase, in comparison with the previous year, of £1,414,591. The total capital employed (including the amounts added by conversion and premiums) represents a few shillings under £744 per million cubic feet of gas sold, which is less by about £8 per million than in the preceding year; while the added capital introduced is the equivalent of £379 per million on the year's gas-sale increment. There is not much value attaching to the latter figure, excepting that it assists in pointing to capital economy, notwithstanding the huge demands of the distribution departments of gas undertakings in these times. Passing onward, the total receipts for the year amounted to £30,350,042, which was a reduction of £169,597. The year covered was one in which there were many reductions in the price of gas; and it was one, too, in which the market values of residual products were not on the best levels of their recent records—coke and tar being particularly disappointing features. When it is brought to notice that 1d. reduction per 1000 cubic feet on the total sale of gas of the country last year would represent more than three-quarters of a million of money—actually £740,362—and considering the causes already referred to affecting revenue in the year, a diminution of only £169,597 on an aggregate revenue of £30,350,042 is not a matter claiming much consideration. But to set against this reduction of revenue, we have a saving in expenditure amounting to £666,066; the total outlay of the twelvemonth having been £22,808,643. Taking the reduction of revenue from the reduction of expenditure, we have to the good a sum of £496,469; and this is the amount by which the revenue balance of the statutory gas industry—£7,541,399—is better than in the preceding year.

It is not difficult, surveying the conditions of 1909-10, to place the finger on the causes for the remarkable financial improvement. Against the indifferent markets for coke and tar, there has to be set an increase in the amount of gas sold of 3,729,548,000 cubic feet—the total sale having been 177,686,943,000 cubic feet, from a total production of coal and water gas of 193,547,394,000 cubic feet, which was an increase of 3,628,657,000 cubic feet. This is the point at which we arrive at what must, technically and financially, be regarded as the most significant feature of the whole of the returns, and that is the economy that has been effected internally, and which has left a marked and gratifying impression on the finances of the industry. We were showing not long since that in the year 1908-9, deducting the water gas produced, an extra 63,066,000 cubic feet of coal gas was made, though the aggregate consumption of coal was 12,446 tons less. But these figures are wholly dwarfed by the revelations of the returns before us; for last year the consumption of coal by the statutorily controlled gas industry (15,225,320 tons) was no less than 168,987 tons below the figure for the previous year, while the coal gas made (again omitting all water-gas production) was 1,632,331,000 cubic feet more—the total make of coal gas having been 169,922,207,000 cubic feet, compared with 168,289,876,000 cubic feet. Let us emphasize the figures by repetition: Less coal used, 168,987 tons; more coal gas made, 1,632,331,000 cubic feet. This is the most remarkable disclosure of the present returns; and needless to say it is the most gratifying. That the industry has, with common consent, set its face steadfastly towards the realization of the fullest economy in working through the modern carbonization practices, is seen by the fact that (taking the aggregate figures) the make of coal gas divided by tons of coal indicates an average production of no less than 11,160 cubic feet of gas per ton. This is good, taking works from large to small included in the returns, and considering the variety of coal from good to comparatively poor in gas-yielding quality that is consumed according to geographical position in the industry. Still, considering all things, we shall look for the average being still further heightened, for from some of the coals that were formerly accounted as being comparatively poor in their gas-yielding property, we have seen figures, working under modern conditions, better than the average one quoted above.

Among the miscellaneous items of interest representing progress and expansion are these: The mileage of distribution mains of 35,230 is an increase of 740; the number of consumers (6,164,066) represents an augmentation of no less than 247,946; and the number of public lamps lighted (712,903) is an enlargement by 12,207.

Statistical reflections on the returns are highly satisfactory and encouraging; and, on this occasion, the satisfaction is intensified by the notable economies that have been achieved in the manufacturing department. An industry that is developing economy in its working results, expanding its connections, and pushing out its distribution system into new fields, and whose business during the daylight hours is growing so rapidly, as is the case with the gas industry, exhibits no trace of that degeneracy of which rivals occasionally talk and write with tongues and pens more ready than wisely directed and controlled.

Low-Temperature Carbonization Again.

SINCE the early part of 1908, many things have happened in connection with the production of more profitable results in the carbonizing operations of gas undertakings; and having all that has transpired in view, we should now like to ask our friend Professor Vivian B. Lewes whether he still adheres to the advice he gave gas engineers, at the Society of Arts, in the spring of the year named, to transfer their affections from high temperature to low temperature carbonization, and also whether at Hythe and Plymouth the financial predictions he then made, on a suppositious basis, have worked out in practice? The reason we now ask if latter-day experiences in the new gas-works practices have altered Professor Lewes's view, is because the lecture relating to smoke abatement that he delivered at the London Institution the other evening leaves us uncertain as to whether or not he considers the aerial flights he allowed his imagination to make in 1908 in his recommendations to gas engineers have been at all curtailed. If he does not reply, we must take it that there has been a modification of view; for the London Institution lecture is entirely silent

regarding the abandonment of high-temperature carbonization and the adoption of low-temperature carbonization by gas undertakings.

But Professor Lewes does not completely abandon his position, because he says that—while admitting that the Coalite Company are at present labouring under difficulties—he is as convinced now as he was when he first examined the process (remember the metamorphosis it has undergone!) that, when its manufacture is properly handled, coalite will be the "ideal fuel," and will not only solve the smoke problem in the easiest possible way, but will also be an economical advance in the treatment of coal. But what have the British Coalite Company and their technical advisers been doing if, after three years' experimenting—for different periods at Wednesfield, Barking, Plymouth, and Hythe—they are not even yet properly handling the manufacture of coalite? We have grounds for fearing that the Company are still floundering about in an attempt to learn how to properly "handle" the manufacture. A letter to-day in our "Correspondence" columns supplies some curious information concerning the plant at the Plymouth Gas-Works, about which there has been a fair amount of secrecy as to how it has been behaving, or (shall we say?) misbehaving, itself. We know, too, of the eviction of the plant from the Hythe Gas-Works, and a certain old-iron transaction. In no one instance has there been, after all that has been done, any of the promised proof (it would have been a miraculous thing if there had been) that low-temperature carbonization is technically and commercially superior to high-temperature carbonization to the gas maker—more so high-temperature carbonization as now practised. Professor Lewes is as well aware as we are that the newer carbonizing practices of the gas maker have distinctly further widened the gulf between low-temperature and high-temperature carbonization from the point of view of economical and of commercial gas production. He partially confesses it in admitting that economies have been found in gas making in larger charges than ever before attempted, and that the introduction of the vertical and oven retorts is a step in the direction of making coke which is more fitted for domestic fuel than "the over-heated "product made in horizontal retorts of late years."

This is a point upon which we should also like to learn something more of the views of our friend—as to whether or not he considers the heavier charges in horizontal retorts have not done something "of late years" to remove the degradation with which he covers the coke produced in them. At the present time, whatever the character of the coke (and we know it to have been improved), reports from gas-works assure us that the coke market is in a highly flourishing condition. Prices are good; and there are several cases within our knowledge where stocks have been cleared out, and contracts can only be executed as the retorts yield their spent material. There is acquaintance with at least one instance in which a gas-works has had to refrain from booking further coke orders; and another case in which there has had to be purchase of coke by one gas-works from another in order to meet pressing needs. Such experiences are not isolated. But is this the coke of which Professor Lewes speaks in his lecture? There is a further charge levelled in the lecture against high-temperature carbonization. It is asserted that the gas manager has ruined the tar market by overheating his retorts, and "so loading his tar with free carbon and naph-"thalene as to make it nearly worthless." The tar produced under the current practice of heavy charges contains less free carbon and naphthalene than in the days of high temperatures and lighter charges; so that Professor Lewes, if he made the attempt, would have some difficulty in substantiating his charge. The fact is that his indictment of high temperatures has lost the little supporting substance it had. It would, therefore, be a considerable satisfaction to the gas industry if he would take the changed circumstances of operation in gas-works as stepping-stones over which to cross from his advocacy of low-temperature carbonization for the purposes of gas manufacture to the high-temperature process, and rank himself with those who have, in the selection of their methods, to give due weight to commercial interests and current requirements, as well as to chemical considerations.

There is the point, too, as to coalite being the "ideal" fuel. There again the gas industry crosses swords with the lecturer. The ideal fuel is the one that, in addition to being smokeless, goes the farthest in removing labour from the household; and that fuel is gas of reasonable calorific value. It does all that coalite can do, except that it is not "poker-"able," and the structure in which it is used for producing heat has a strong objection to being made the final receptacle for cigar stumps—one of the advantages that Professor Lewes sees (we recognize here the lecturer's jocular habit) in maintaining the solid-fuel stove. Pleased enough as we should be—inasmuch as it would afford a market for two gas-works products—to see Siemens's idea of thirty years ago adopted, of using swing atmospheric gas-burners for lighting up coke fires, and occasionally using the burners for reanimating the coke, this can only be looked upon as a cumbrous expedient in comparison with the gas-fire, as it still involves labour, and would not look particularly æsthetic in any room. The only place, perhaps, in which it might be suitable would be the kitchen range; and there householders are finding out that the excellent local heat supplied by a good coke fire is extremely serviceable for heating in connection with hot-water circulating systems, for clothes airing, and so forth. However, though in low-temperature carbonization, and the production of a semi-carbonized material in which some of the volatile constituents of the coal are allowed to remain, Professor Lewes holds that there is the most economical method of using coal, the fact remains that the manner of the use has to comply with the best means of serving certain definite ends; and, realizing this, the gas-supply industry conducts its technical operations accordingly.

Singular Case of the Continental Union.

Flooded gas-works, a huge and expensive strike, and an earthquake make a combination of evil circumstances that must be without parallel as forming the subject-matter of any single speech from the Chairman of a Gas Company to the proprietors. But it is a fact that these (in the order mentioned) composed the main themes—not so much the actual occurrences, as the effects financial and otherwise—of the address of the Chairman of the Continental Union Gas Company (Mr. J. H. Birchenough, C.M.G.), at their meeting last Tuesday. Four-fifths, in round figures, of the capital of the Company represents their investment in the Union des Gaz; so that, when speaking of the affairs of the one Company, to all intents and purposes the affairs of the other are also involved. The floods near Paris, by which the whole area of the Nanterre works of the Union des Gaz was submerged, the strikes of gas-workers of the latter at the Italian stations, and the earthquake that reduced Messina to ruins, and has caused the works there of the Continental Union Company to remain ever since practically derelict and lifeless, are matters that—being extraordinary in their character—are fully in the memory of our readers, and therefore we will not iterate the facts concerning them. But there is another side to these matters to which attention may now be directed, as bearing on the effects and the future. The Company have had trouble in the past beyond compare among gas undertakings; and the ugly and costly series of events occurring in such a short space of time has been a tremendous strain on both the administration and the executive officers. In the cases of the strike and floods, the only effects from which the Company are temporarily suffering now are of financial character; but in regard to the strike there is financial and other value in the fact that at the Italian stations the conditions have never been more peaceful, nor the working so good, as at the present time. As to Messina, the fate of the Company's administration of the gas supply there has not yet been decided, and matters hang in a balance for the time being.

But in all these respects, the Board have, and are, facing the position that has been created by the destruction of assets and by necessary expenditure of money with a boldness and tact that will hasten the time when the financial effects of this perfect avalanche of trouble will be completely effaced; and the concern it is hoped—there is, indeed, every prospect, for we cannot point to any single reason to the contrary, other than those incidental and contingent to all trading enterprises—will have a brighter future than ever. Under these circumstances, we have no sympathy with the one or two shareholders who urge the Directors—in fact, it was not politic to publicly do so at the present time—to consider the advisability of getting the capital in hand in hard cash by letting the stock gradually flow on to, and be absorbed by, the French market. The bold and prudent course adopted by the Board, in quickly clearing away the financial encumbrances produced by the troubles of the recent past, has involved the shareholders' dividends. Clip down dividends

even temporarily, and there are almost bound to be stockholders who will at once fall into pessimistic mood, and be prepared to tender advice that, put into execution, might be most unwise and irretrievably disastrous. To do what was suggested by a proprietor when there is a break in the cloud of trouble through which one sees, so far as it is humanly possible to see, fair hope for the future, would, in our judgment, be the height of folly. The stockholder who made the suggestion unconsciously displayed a fair amount of ignorance when he spoke in disparaging terms of the administration from this country of gas concerns carrying on their operations abroad. We look at the position of the Imperial Continental Gas Association, of the European Gas Company, and of concerns carrying on their operations in India and South America, and the conclusion arrived at is that the stockholder in question must have had, upon which to base his judgment, some exceptionally bad experience with concerns that have suffered not through their administration in this country, but through local conditions, the consequences of which a managing body immediately on the spot could not have possibly averted.

It is sincerely hoped that the end of the chapter of difficulty has been reached for the Continental Union Company; and that in the time before them the Directors and the officers will not have falling to their lot more than the normal troubles attending a gas enterprise. Out of evil good may come; and we are looking forward to this being a case in point.

"Progress" of Electric Lighting.

The members of the Illuminating Engineering Society on Friday evening last assembled to hear of the "progress" of electric lighting; but the paper by Dr. E. W. Marchant and the discussion were largely directed to defects of the most modern lamps with which the electricity supply industry is out to do business. There is absolutely nothing new in the several points that were largely talked about; but the occasion concentrates them once more. Let us run over some of them. The author of the paper commented upon the fact that flame arc lamps give off a good deal of fume and vapour, and are therefore unsuitable for indoor lighting; so that the developments have been more in the direction of increasing their serviceability for street lighting. In addition to the fumes and vapour, the flickering is against this form of lamp for indoor purposes for which a steady light is essential. As to the outdoor use of flame arcs, Professor Morris mentioned that consideration is now being given, by the authorities of certain docks on the Thames, to the question of the abandonment of that type of lamp in favour of high-pressure gas lighting, on account of the better penetrating power of the latter during the prevalence of white mists, which are the most frequent form of "fogs" on the river. Experience goes farther than all the talk of rival advocates.

On the other hand, there is no question about the steadiness of the light of metallic filament lamps in comparison with that of flame arc lamps. But relative to the metallic filament lamps, two points are now freely admitted: The glare is so great, and the diffusion of the light so bad, that it is necessary to use dioptric globes to tone down the former, and to direct the light where it is required, instead of wasting it in other directions. On the subject of glare, we have Dr. Marchant saying that it is becoming increasingly acknowledged that it is necessary to screen the direct image of the lamp filament from the eye. The intrinsic brilliancy of such an image is very high; and the image formed on the retina is now recognized as producing undue stimulus; and, if often repeated, this may prove most injurious. This implies the necessity of using either a frosted or refracting globe. Then we have Mr. A. H. Seabrook admitting (it was not always so) that some consumers find the use of metallic filament lamps too expensive; and the only means we can discover of producing greater satisfaction is the use of Holophane globes or shades, whereby the rays of light are brought into the required direction, and fewer lamps are necessary to produce the light necessary. But all these defect-curing accessories cause added expense and labour. They require cleaning; and there is the fragility of the filaments when cold to be considered. In paper and discussion, this was a prominent point; and the private user has to be educated up to switching-on his lamps before he ventures to brighten up the glassware. The laboratory long life of these lamps, or the long life obtained in the careful hands of the expert, can only be realized by the private user by considerable nursing, and the avoidance of shocks. Professor Howe introduced another defect of the metallic filament lamp, in describing an interesting investigation into the cause of the blackening of their globes.

These are among the several points that were debated on this evening when the members of the Society assembled to hear of the "progress" of electric lighting. The electricians deserve to be complimented on acknowledging that they are conscious of serious shortcomings in the field of illumination, and that in making progress in one direction they retrogress in others.

An Experiment with German Coal.

No doubt several of our readers saw an announcement last week in the Daily Press that a collier had arrived in the Thames with a cargo of German coal for the Gaslight and Coke Company; and the intelligence will have raised an amount of interest in the gas industry. As a matter of fact, we learn, on inquiry from the General Manager of the Company (Mr. D. Milne Watson), that this cargo is only one of three or four—amounting in the aggregate to something like 10,000 tons—that the Company have purchased. There is no immediate significance about these purchases; inasmuch as the Company's contract prices are not such that, under reigning circumstances, they can complain of them. But, at the moment, the purchases of German coals are solely for the purpose of obtaining information. The purchases have established the feasibility of bringing German coals up the Thames for delivery at the Company's works; and the relationship between cost on the works and the value of the coal to the Company as makers of gas, coke, tar, and other products is now a matter of trial. In short, the purchases represent a pure experiment on their part.

Results obtained from the native coals under German conditions, in which little or no notice is taken of illuminating power, have of late years been frequently published in our columns, in connection with the development of carbonization systems in that country; and our German friends are also fully cognizant of what British coal will do working under German conditions. But in this country—we suppose the shortcoming must be added to the shoal of other things ascribed to our insularity—there is little or no knowledge as to what German coal will do under our home circumstances; and the circumstances of the Gaslight and Coke Company include penal testing for both illuminating and calorific power. But the relaxation of the illuminating power conditions of the gas industry—relaxation that is year by year being applied to more and more undertakings—has extended the fields from which coal supplies for gas making may be drawn, and therefore the opportunities for bargaining on the part of gas manufacturers. And while it is not at all likely that recourse will be had by gas undertakings in this country to the German coal-fields for their requirements while supply conditions at home are favourable to them, it is as well to be prepared with experimental information as to what can be done here with the coal. That, too, is the view of the Governor (Mr. Corbet Woodall) and the Board of the Gaslight and Coke Company.

A Specification for Street Lighting.

It will be remembered that, at the recent meeting of the Institution of Electrical Engineers, when Mr. Haydn Harrison's paper was under discussion (*ante*, p. 713), the question was raised as to the absence of any proper specification for street lighting; and it was considered that such a specification should be framed by a Committee representing the various lighting interests and those responsible officials of local authorities who have to advise on the subject of street lighting. The suggestion shows that the specifications for the Westminster and the Calcutta street lighting contracts are not universally considered as fully meeting requirements, though Mr. J. W. Bradley, the City Engineer of Westminster, describes (in a communication to the "Contract Journal") the one he has prepared as, in his experience, "a most convenient and workable one." The main parts of both the Westminster and Calcutta specifications were included in Mr. Jacques Abady's paper read before the Institution of Gas Engineers last June. The interesting announcement was made by the President (Dr. Silvanus P. Thompson), at a meeting of the Illuminating Engineering Society last Friday, that the Council have decided to appoint

a Committee from its own members, with power to consult with others, to draw up, in a preliminary form, an actual model specification for street illumination—something which will serve quite irrespective of any particular interest. In other words, it is proposed that the model specification shall be framed to show borough surveyors and others concerned the proper way to specify how a street is to be lighted, so that it will be known exactly what has to be tendered for. With one or two exceptions, the President pointed out, there have been no proper specifications. The Council of the Society have taken the first step in this matter; but, as the adoption of the model specification will be entirely a voluntary matter, it will be necessary for it to be made as acceptable as possible to all parties. To this end, there should be a fair balance of the interests concerned represented on the Committee; and the representatives should be men fully competent to effectively assist in composing the specification. The model must also be one which will not bring any undue influence to bear upon the responsible officials of local authorities. All that is wanted by the gas industry is a fair field and no favour.

A Bad Failure.

Even the best regulated electricity supply system is subject to failure. No one can deny the thoroughness of the technical management of the Glasgow Corporation Electricity Department. But, thorough as it is, a trunk high-tension feeder in its distribu-[illegible] failed last Tuesday evening; and all private houses, [illegible] remises, streets, places of entertainment, meeting halls, and railway stations depending solely on electricity were thrown into darkness, and this continued for fully half an hour, at the very busiest part of the evening. Confusion reigned wherever reliance had been placed on the electricity supply; but the dangerous side of such an occurrence as this is the sudden plunging into darkness of streets, railway stations, and places where the public assemble. That is a serious aspect that is all too often overlooked by the authorities responsible for selecting the system of lighting for these places; whereas the protection of the public ought to be one of the first points for consideration. We notice that at the City Hall where a social function was proceeding, at one of the halls where political matters were under discussion, and at a polling-station where a local authority election was taking place at the time, the convenience of gas as a stand-by was proved. They were cautious and thoughtful Scots who retained the means of gas illumination in the places. We notice similar retention in many buildings in London where electric lighting is adopted; the instances of repeated electricity supply failure having undermined the confidence of those who have changed over. In connection with stand-by gas supply for lighting, it will have been noticed that the Swansea Gas Company will seek next session the right to levy a minimum charge.

The Duties of Auditors.

Some weeks ago, Mr. Charles Duguid, a City writer on financial subjects, gave an address at the London Institution, before the Incorporated Accountants Students' Society of London, in which he dealt with the position and duties of auditors in connection with the certification of accounts of public companies. A few of the points made by the lecturer were referred to in the "Journal" at the time (*ante*, p. 182); and one of these was the need for plain speaking on the part of auditors, whose certificate, he contended, ought to say what it meant, and not merely give hints. Auditors, he urged, existed in a great measure to see that the directors rendered to the shareholders a faithful account of their stewardship—to see that the shareholders were aware of the true position of the business which belonged to them. Turning to another aspect of the question, he expressed the opinion that at the root of any shortcomings there might be in our system of audit, lay the apathy of the shareholder. One suggested change was that auditors should be rendered more independent of both directors and shareholders—that was, that they should be appointed nominally by the shareholders, but not be removable without application to the Board of Trade—and another was that they should receive higher fees. The discussion was postponed; and when it came on recently, the case for the auditors was fully presented. It was argued that any assertion that auditors fell short in their duties to shareholders was, in the main, based on exceptional cases, and that to take a few instances out of the 43,000 companies in this country was not quite fair; while as to speaking out, there was a great responsibility resting on the auditor, as to do so in some cases might endanger the company concerned. "Wise words, well considered and tactfully delivered," it was remarked, "should be the relation between the auditor and the directors; and only when these failed to take effect was it his duty to inform the shareholders." One speaker admitted that the Act of 1900 had done a very great deal to strengthen the position of the auditor; but he agreed with Mr. Duguid that still more remained to be done, and that the auditor's position was now not sufficiently strong. It was right to urge, he added, that the certificate must be frank and full, and that the auditor was paid to state that which he knew, and not to construct such a certificate as, in his opinion, should protect himself. There may in many cases be substantial ground for the complaint of another member that where auditors had done their best to put a concern on a better footing, and to show the shareholders what the position of the company was, they would find the shareholders never supported them. But whether or not there be any serious shortcomings in the existing system, Mr. Duguid's hearers must have taken heart at a statement made by him in the course of his reply to the discussion. This was to the effect that soon after he delivered his lecture he received a communication from the Consul-General of Germany asking for some advice, as the Germans were desirous of modelling their system of accountancy on that in vogue in this country.

Representation in Parliament.

Following up the information given in the paragraph under this heading last week, we have to congratulate Sir J. Fortescue Flannery, one of the Directors of the South Suburban Gas Company, and a warm friend of co-partnership in the gas industry, upon retaining his seat, as a Unionist, for the Maldon division of Essex. Mr. H. W. Helme, the Chairman of the Lancaster Corporation Gas Committee, continues the representation, in the Liberal interest, of the Lancashire North (Lancaster) division. Sir Henry Kimber, who presided over the Standard Burner Bills Committee of the House of Commons last session, and is a thorough-going Unionist, has increased his majority in Wandsworth (by upwards of 200 votes) to 4439. Sir Philip Magnus, of the City and Guilds of London Institute, returns to Parliament as representative of the London University. He had a strong Liberal opponent in Sir Victor Horsley; but he polled 722 more votes than the latter. Sir Alfred Mond goes back, with an increased majority, for Swansea as a Liberal; and Mr. J. F. L. Brunner, also on the same side, continues to hold the Cheshire (Northwich) division. We sincerely regret that Mr. A. P. Main was unsuccessful in winning the Tradeston division of Glasgow. Sir W. J. Crossley, in the Cheshire (Altrincham) division, has suffered defeat at the hands of his Unionist opponent, but only by 119 votes. By 186 votes, too, Mr. E. A. Brotherton (Unionist) has lost his seat at Wakefield.

A Fire Canard.

We were afraid, on reading the London papers last Thursday evening and Friday morning, that a disastrous fire at York, on Thursday morning at a large drapery stores, would have to be entered up against an unprotected gas-jet. The building in which the fire occurred was that of Messrs. Boyes and Co.; and it was stocked with highly inflammable Christmas goods. The London version of the story ran that some coloured paper was blown against an unprotected gas-jet, and so a fire was started which gutted the building, and caused an estimated loss of £20,000. Willingly, had there been any proof as to the cause assigned by the London papers being the correct one, we should at once have accepted it, with a feeling of thankfulness that the terrible loss of life of the electrically originated fires at Clapham and Accrington had not been repeated in this instance. But we read in both the "Leeds Mercury" and the "Yorkshire Observer" that, in conversation with their representatives, Mr. Boyes stated that steps had been taken to find out the origin of the fire, but there had been absolute failure. He added, however, "there is no truth in the rumour that the blaze was caused by some Christmas decoration paper being blown against an unprotected gas-jet." It is satisfactory to have such a correcting statement from the principal member of the firm.

On the invitation of Mr. John Bond, the Manchester and District Junior Gas Association will visit the Southport Gas-Works next Saturday.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 805.)

The Stock Exchange last week was decidedly less cheerful than it was the week before. Business was very quiet; but that is to be expected at the approach of Christmas. Apart from this, the depressing factors were the elections and the weather. The former seemed to be considerably overdone as a motive power; and a seat gained by a Radical was a lever strong enough to mark Consols down a fraction. Railways had to contend against an almost incessant rainfall and a terrible accident; and they stood up against these influences very well considering. The opening on Monday was not promising. "Majorities" was the chief line of interest, and over-sanguine backers of the Unionist cause were plunged in despondency. Consols were put down $\frac{1}{2}$. Rails were weak in sympathy. The tone on Tuesday was much the same, with dulness and depression. Consols fell another $\frac{3}{8}$; and the general tendency in most departments was adverse. On Wednesday, after some nervousness, markets began to recover their calm, and prices mended a little. Consols were $\frac{1}{8}$ better, and Rails were firmer. The restored cheerfulness brightened Thursday's business, what little there was. Government issues were strong, Consols rose $\frac{1}{4}$ for money and $\frac{1}{8}$ for the account, and Rails made several moderate advances. Business was very slack on Friday, and the tendency was dullish, with some realizations. Disappointment was expressed at the Bank rate not being lowered. Saturday was as quiet as could well be, with little movement; but Consols were $\frac{1}{8}$ lower. In the Money Market, the supply was very abundant on easy terms; but discount rates hardened towards the close. Business in the Gas Market showed reanimation in point of activity; and several issues were freely dealt in. Unvaried firmness was the general characteristic. There were only two or three changes in quotation; and they were for the better. In Gaslight and Coke issues, the ordinary was pretty active and quite firm—all transactions lying within the limits of $105\frac{3}{4}$ and $106\frac{1}{2}$. In the secured issues, the maximum changed hands at $87\frac{1}{4}$ and 88, the preference at from $103\frac{1}{4}$ free to 104, and the debenture at from $80\frac{1}{4}$ to $81\frac{1}{2}$. South Metropolitan was unchanged at the old figures of $121\frac{1}{2}$ to $122\frac{1}{2}$, with $81\frac{1}{2}$ for the debenture. In Commercials, there was one bargain in the $3\frac{1}{2}$ per cent. at $101\frac{3}{4}$. Among the Suburban and Provincial group, Brentford old was done at 249, Brighton ordinary at 161, British at from 44 special to $44\frac{3}{4}$, and Tottenham "B" at $113\frac{1}{2}$. Ilford "B" rose 2, without business marked. In the Continental companies, Imperial marked from $185\frac{1}{2}$ to $186\frac{1}{2}$, ditto debenture $94\frac{7}{8}$ and $95\frac{1}{2}$, Union 88 and 89, European fully-paid $23\frac{3}{4}$ and $23\frac{15}{16}$, and ditto part-paid $17\frac{5}{8}$ special and 18. Among the undertakings of the remoter world, Melbourne $4\frac{1}{2}$ per cent. changed hands at $100\frac{1}{8}$, Primitiva at from $7\frac{1}{4}$ to $7\frac{13}{32}$, ditto preference at from $5\frac{3}{16}$ to $5\frac{3}{8}$, and ditto debenture at $96\frac{1}{2}$.

ELECTRICITY SUPPLY MEMORANDA.

Critics of the Lighting at the Institution of Electrical Engineers—Glare and Excessive Local Illumination—Where is the Joint Wiring and Fittings Bill?—Electric Supply Proposals for Next Session—Animation Produced by Modern Gas Lighting—A Lesson for Gas Companies.

Among places in which there should be model electrical illumination right away from the start, the new home of the Institution of Electrical Engineers should assuredly stand first. But from what we read, the electrical experts who have had this matter in hand have not been successful in pleasing everybody. That is often the case in electric lighting—the counsellors, as a rule, being very strongly addicted to under-estimating the quantity of light that is really required. That is the sort of thing that has grown on them through the pinch, which they feel most acutely, of the economy of incandescent gas lighting. The difference between us is that electricians prescribe as sufficient as little light as possible where it is a question of competition, in order to cut down cost, while the gas industry offers an abundant light at a low expenditure. They seem to have been letting custom dominate plans in fitting up the new home of the Institution of Electrical Engineers; and there is not, as observed already, universal approval of what has been done. Therefore at the present time the place is not at all exemplary in the matter of lighting; and there is a prospect of alterations being made. After this, there will be need for caution in putting faith in the advice of electricians who have failed, at the outset, to put their own house in order in respect of illumination.

There is in the last number of "The Illuminating Engineer" a criticism of the lighting in the form of a hypothetical conversation between an electrical engineer, a philosopher, a man of sense, and a lighting expert. The man of sense seems to have much gratification in finding that, in the lecture theatre, "the beastly glaring metallic filaments have been kept out of sight." This is Limehousing with a vengeance; but the electrical engineer does not, in print, appear to take the "whip lash" at all amiss. On the contrary, he seems to consider the recognition of the act of hiding the lamps along the cornice, and reflecting the light, as a compliment completely outweighing the uncomplimentary description of the lamps themselves. Then there is a square centre illuminated by outside mercury lamps, which is intended to serve "to break up the ceiling, and prevent monotony." The general effect is described by the critics as "spectacular—not to say theatrical." It is also considered that the place looks "empty, depressing, sombre, and dismal." It may be believed that "the impression of 'something wanting' springs from the fact that there is no one point to which attention is involuntarily directed. The President's chair ought to be such a point; and it ought also to be possible to give special local lighting to diagrams." Passing into the Common Room, the philosopher complained of the obvious solidity and the low position of the fixtures there. In the Library, there are pendant lights above the gangways; and both the man of sense and the philosopher complained that they had not enough light at the centre table by which to read. This demonstration of the art of illumination as pursued by electrical engineers will no doubt undergo a little revision so as to fine-down the opportunities for critics.

But electrical engineers are in the habit of practising the "art" of illumination to suit their own special conditions and convenience rather than stick to the letter of correct principles. They have agreed that, for their own lecture theatre, the proper thing is to keep the "beastly, glaring metallic filaments out of sight." They would probably recommend the same system of reflected illumination in Belgravia, or for mansions elsewhere, where expense is no great object. To other patrons who would perhaps object to the constant greater expense of reflected lighting, electrical engineers would recommend some of the prismatic globes to break down the glare. But where they want to do business, and economy is an object, the question of the glare of metallic filaments, and the injurious effect on the eyes, do not disturb their consciences. The same in shop lighting. Tradesmen may have three or four flame arcs along a ten or twelve feet frontage, a couple of feet or so above the eyes of pedestrians and almost horizontal with the eyes of travellers on passing omnibuses; but never a word of protest from the electrical engineer as to this being opposed to the canons of correct illumination, and as to it causing physical discomfort to people using the footways and passengers on the tops of popular means of locomotion. The commercial influence is stronger than scientific rule or propriety. In street lighting, too, there is now a disposition, in order to obtain the full strength of the flame arc in meeting the competition of high-pressure gas lighting, to use plain globes. This is not right; and local authorities should not tolerate it, any more than they should tolerate excessive local illumination, with all around on a considerably lower scale. We were protesting just recently against the proposal of the crest-fallen St. James' and Pall Mall Electric Company to put in Piccadilly Circus—free of all cost to the ratepayers for five years—three groups of four 3000-candle power flame arc lamps on high standards above the high-pressure inverted gas-lamps that are being supplied by the Gaslight and Coke Company, each of which is on a single column. The electrical proposal—the issue of fright and reproach—is, to say the least, a ludicrous one. To have such an amount of light concentrated in one position would be harmful, and would create an altogether false impression as to the illumination of streets in the vicinity. An extreme of illumination in one place gives an idea of insufficiency in the surrounding parts; whereas it is the excess that is in fault. Besides, there is danger in what is proposed. "There is," as we were saying recently, "danger in having too much light in one place where there is a lot of vehicular traffic;" and if the Electric Company are allowed to carry out their project for overpowering the gas-lamps by sheer force of light concentration from a number of high-power units in excess of the gas-lamps, "Piccadilly Circus may find itself overdone with illumination."

On our contention, this is the brilliant and philosophic comment of "Meteor" in the "Electrical Times": "As to the surfeit of illumination, if too much light is dangerous, even when 30 feet above the observer's eyes, there should be grievous accidents on those rare days when the sun shines. Yet we recollect no placards announcing 'Bright Sunshine in Piccadilly Circus; Horrible Accidents.'" The St. James' and Pall Mall Company are not proposing to do what Old Sol does. He gives light without favour; and he does not concentrate a powerful amount on Piccadilly Circus, with a smaller allowance for the streets converging upon it. "Meteor" has already forgotten some of the contents of the recent special outdoor lighting number of the "Electrical Times," over the preparation of which he groaned on account of the hard labour involved. It is convenient sometimes to have a short memory. Nor can we think it possible that he has yet been received into membership of the Society for the spread of the doctrine of illuminating chastity, or he would never support such a piece of illuminating barbarity as is projected by the St. James' and Pall Mall Company. On the contrary, he would endorse these words from one of the leading articles in the December issue of "The Illuminating Engineer": "For our part, we are convinced that in the near future the discussion of what constitutes good lighting will turn more and more on this question of avoiding badly-placed and inconveniently brilliant lights. The tendency in this direction is accentuated still further by the change in the nature of traffic and the increased speed of mechanically-driven vehicles. Conditions of lighting which dazzle the eyes of drivers and bewilder pedestrians might have been tolerated a few years ago, but are too dangerous to be acquiesced in now. It may therefore be anticipated that authorities concerned with traffic regulation will pay an increased amount of attention to street lighting." Enough is said.

Has that long-talked-of promotion by the Incorporated Electrical Municipal Association, to confer freedom upon municipal authorities in the matter of wiring and fittings speculation, gone astray? We have not seen any notice of it among the projected electrical legislation for next session; so that it looks very much as though it has been dropped for the present. There would be no surprise if it had been. It has had a mixed reception; not the least distinguished feature about it being the liberal manner in which sympathy, instead of hard cash, has been voted towards the support of the measure. Nothing short of a substantial guarantee fund is required for a Bill of this kind, which is bound to be strongly opposed at every stage of its career; for there is no telling at the inception of such a measure what will be the total amount ultimately standing at the foot of the bill of costs. Some of the local authorities who entered into joint opposition to the Standard Burner Bills last session have been "staggered" by the sums they have been called upon to pay for appearing at Westminster, and dancing to the tune chosen by Liverpool. The caution that has been displayed over the matter of promises of financial support for the electric wiring and fittings measure indicates a curious twist in the minds of local authorities in regard to the matter. They are apparently not willing to speculate heavily over the obtaining of parliamentary sanction; but they are quite prepared to speculate freely in wiring and fittings when sanction is obtained.

The applications for electric lighting powers of which notice has been given for next session are not striking in their character. There is intimation as to 33 Provisional Orders—thirteen by local authorities and twenty by companies; while the notices of Bills of four local authorities and two companies foretell clauses bearing upon electric lighting. In most cases, however, these are extensions of existing powers. There are at least three projected transfers. Callender's Construction and Cable Company are willing to take possession of the ill-fated Uxbridge concern; the Metropolitan Electric Supply Company are prepared to lift from the shoulders of the harassed District Council of Acton their electricity supply undertaking; and the Winchester Corporation are desirous of becoming possessed of the local Electric Light and Power Company's property and business. The fever of electrical speculation has so got hold of the Bermondsey Borough Council that they now desire to include in their area of supply certain portions of the borough at present served by Companies. This means competition. The Corporation of Gloucester desire their generating station and refuse destructor to be exempt from proceedings for nuisance. That is a remarkably brilliant idea. Several promoters are asking for wiring and fittings powers. Among gas undertakings, the Sidmouth Company are requesting electricity supply powers; the Ashbourne and Chapel-en-le-Frith Companies are desirous of authorization to make application for Electric Lighting Orders; and the Swansea Gas Company are requiring the right to make a minimum charge for the provision of a gas supply to a consumer using electricity for lighting purposes. From this projected legislation, there will not arise an inordinate amount of excitement.

The future historian of the electricity supply industry, looking back at these times, will have something to say, perhaps a little sarcastically, about the schemes of electrical tariff reform that most central station engineers of this period indulge in at some time or other of their career. To have a pet scheme has grown almost a mania in the industry's professional ranks; and there is in the fact the testimony to their difficulty of extending (at ordinary prices) business in heating, cooking, and so forth through the poor thermal duty of electricity. Mr. Lackie, the Electrical Engineer of the Glasgow Corporation, has reported on the need for a supply of energy for domestic use other than lighting, with a view of saving the cost involved in the separate wiring and meter; and he believes that the lower charge necessary may easily be arranged by an adaptation of the maximum demand method of charging. As the result of looking into the matter, he supplies a useful maximum demand hours' figure. From an examination of a large number of accounts of domestic consumers covering the past three years, he finds that these accounts are practically stable from year to year, and even in the corresponding two-monthly account periods of different years. The examination shows that the maximum demand quantity of domestic consumers averages 800 hours' use of the maximum demand per annum. The present charge to domestic consumers is a flat-rate of 3d. per unit; and he suggests that they be charged a maximum demand rate of 3d. per unit for 800 hours' use of the maximum demand—all current consumed over this quantity being charged out at 1d. per unit. Further, he proposes that the initial charge for the first 800 hours' use of the maximum demand should be on the principle of a proportionate number of 3d. units in each two-monthly account period; all the units consumed over this fixed quantity in the period being charged at 1d. This would let the consumer see in every account that, as a result of using energy for other than lighting purposes, so many units were charged at 1d. The division of the 800 hours' use of a maximum demand over the six periods into which the year is divided would be as follows: June-July, 40 hours' use of maximum demand at 3d. per unit; Aug.-Sept., 60; Oct.-Nov., 200; Dec.-Jan., 300; Feb.-March, 160; and April-May, 40—total 800 hours. All above would be at 1d. per unit. The idea is, of course, to save the expense of duplicate wiring and meter, and to regard the 800 hours' maximum demand as representing the lighting, and all over that the cooking and heating consumption.

Still further evidence of how keenly alive our electrical friends are as to the necessity—being face to face with demonstrations of latter-day street lighting by means of high and low pressure inverted gas-lamps—of scrapping old type electric lamps, and having nothing but the very best of flame arc lamps or high-power metallic filaments in the effort to match gas lighting. Mr. Leon Gaster and "Meteor" in the "Electrical Times" have just been aiming point-blank at the ghostly open-type arcs that are still doing duty on the Embankment, and urging their removal. The "Electrician" also says there can be no two opinions as to the advisability of electric supply authorities replacing the old types of arc lamps. But it suggests that possibly some of the authorities are undecided as to whether to instal flame arc lamps, or to change over to metallic filament lamps. We hope the state of indecision will continue; the longer, the better for the gas industry, as it will intensify the reasons for changing to incandescent gas lighting *à la mode*, which has had a peculiarly animating effect upon some of our electrical friends. On the point of the uncertainty as to whether to change over to flame arcs or metallic filaments, we have recently had an opportunity of inspecting a main road in which electric arc lamps have been superseded by lamps each containing a cluster of three metallic filaments. The lighting of the road is about as disgraceful as the "lighting" can be of a main road with trams running through it. The density of the shade between the lamps would send a shiver up the backs of illuminating engineers with electrical inclination who preach the doctrine of a minimum candle-foot allowance of light, and the reduction to the finest possible degree of the margin between maximum and minimum. But we have not heard quite so much about this sort of thing lately, since it does not fit in very well with the best of the lamps on offer by the electrical industry. On the contrary, the beauty of spot intensity and the restfulness of a little shade, instead of a monotonous uniformity, is now being talked about. We have failed to find any monotony about a road lighted in a fairly uniform manner; and we have regarded such a road as offering considerable safety to the public.

However, it is not only the electric supply authorities who have to wake up. There was an article recently in our Editorial columns which showed that there is not a little that is antiquated in existing street gas lighting; and we ventured to exhort gas companies to wake up in this matter, and to show the lighting authorities what can be done by new gas-lamps. We are reminded of this by a paragraph referring to the lighting of Ashstead. The local authority, it is understood, have transferred their business in this direction to an Electric Lighting Company supplying in the district; it being alleged that the Gas Company concerned have done absolutely nothing until the Electric Lighting Company sent in a tender. We do not know whether or not this is true; but exhibiting an interest in the question after an electric lighting company have been stirring things up appears to us to indicate a miscalculation as to the proper time for action. In these matters, it is better to be first in the field. It creates a good impression.

Glover-West Vertical Retorts at Manchester.

The installation of the Glover-West vertical retorts erected at the Droylsden Gas-Works of the Manchester Corporation has now been in continuous operation for more than five months; and we learn from the Chief Engineer, Mr. J. G. Newbigging, M.Inst.C.E., that from the date the plant was started the old retort-house has been put out of operation, and the vertical retort plant has supplied the whole of the gas to the Droylsden district without any assistance from the main supply. A number of tests have been carried out on local and well-known coals, and excellent results have been obtained with a fuel consumption varying from slightly over 9 lbs. to well under 11 lbs. of coke per 100 lbs. of coal carbonized. The alterations in details which have been introduced into the plant, as the outcome of the experience in connection with the first plant at St. Helens, have conduced to improved carbonizing results in every respect, compared with those produced in the several tests carried out at St. Helens—especially in respect to the fuel consumption, calorific value, and illuminating power.

Institution of Civil Engineers.—At the ordinary meeting of the Institution last Tuesday, Mr. Samuel Glover, Gas Engineer to the St. Helens Corporation, and Mr. J. W. Morrison, Engineer of the Sheffield Gas Company, were elected members.

Concrete Supports for Water-Pipes.—The Water Committee of the Birmingham Corporation report that the works undertaken last year for the strengthening of certain sections of the Severn syphon by filling in concrete under the pipes, have proved entirely successful; no bursts having taken place on any of the sections. The total number of bursts during the past summer showed a large reduction. The Directors of the Great Western Railway Company have called attention to two short lengths of pipes at present unprotected by concrete on the steep ground to the east of the Severn Valley Railway; pointing out that any serious burst on this section of the aqueduct might be attended with grave consequences. In view of the experience of the effective protection afforded by the concreting carried out last year, the Water Committee have resolved to undertake the concreting of these lengths by way of precaution.

PERSONAL.

JUBILEE OF MR. WILLIAM W. DRORY AT FRANKFORT.

In October, 1903, we had the pleasure to chronicle the celebration by Mr. William Wolverley Drory, the Manager of the Frankfort station of the Imperial Continental Gas Association, of the fiftieth anniversary of his entry into the service of the Association. Since that date, the Frankfort branch has been amalgamated with the local Frankfort Gas Company, and Mr. Drory has remained in harness as one of the Joint Managers of the new Company. It falls to the lot of few men to celebrate the completion of fifty years of active service, and to fewer still to celebrate fifty years' tenure of the responsible post of Manager in one and the same town. Mr. Drory, however, is now in the happy position of being able to do so, for he completed yesterday fifty years' service as Manager of the Frankfort Gas-Works, having been appointed to this position on Dec. 12, 1860, at the age of twenty-five. The gas engineers of those days had not the advantages of technical colleges and other aids to the acquirement of a knowledge of their profession, but had to grow up with their business, and gain their knowledge and experience while carrying it on. There are, we think, not many men of the present day who can boast of being appointed as manager of the gas-works in so important a city as Frankfort at so early an age. As an indication of the changes which have occurred during Mr. Drory's fifty years' managership, we may mention that in 1860 the annual quantity of coal carbonized at Frankfort was about 5200 tons, while it is now in the region of 125,000 tons.

Though Mr. Drory can look back on an unbroken service of fifty-seven years, which must constitute almost, if not quite, a record in the gas profession, he does not regard his career as closed, for he is now engaged on the task—by no means a light one—of constructing a large modern gas-works in the Osthafen district of Frankfort. We feel sure his many friends will join with us in congratulating him on this occasion, and in wishing him continued good health in order that he may have the satisfaction of being able to remain at the helm until the completion and putting in action of the new works he has in hand.

We are pleased to learn that Mr. Frank H. Robinson, whose papers on the new tank and gasholder at Manchester—the former given in the "Journal" for Nov. 30, 1909, and the latter elsewhere in the present issue—have furnished evidence of considerable ability, was on Friday appointed Manager of the Knutsford Gas and Water Works, and will enter upon his duties next Monday. He was educated at the Manchester Grammar School, and received his professional training in the office of Messrs. Thomas Newbigging and Son, with whom he was for three years. During the past seven-and-a-half years, he has been Engineering Assistant to Mr. J. G. Newbigging, M.Inst.C.E., the Gas Engineer to the Manchester Corporation; and in this capacity he has had charge of work costing about £75,000. Mr. Robinson, who is twenty-six years of age, is an associate member of the Institution of Civil Engineers. We cordially wish him success in his new sphere.

OBITUARY.

News has only just reached the German Technical Press of the death, on Oct. 23, of Herr Ernst Buhe, the Manager of the Duisburg Corporation Gas, Water, and Electricity Works.

We regret to learn, from the "Journal für Gasbeleuchtung," of the death, on the 1st inst., through an apoplectic seizure, of Herr Richard Bremer, the Engineer and Superintendent of Public Lighting to the City of Berlin. Deceased had attained his 57th year.

The last number to hand of "Het Gas" reports that Heer F. C. Steigerwald, formerly Chief Inspector of the Rotterdam Gas-Works, died on the 3rd ult. Deceased (born in 1836), after some years' work in a sugar refinery, entered the Rotterdam Gas-Works in 1860, to take charge of the steam-engines, &c., and was subsequently promoted to the position of Manager of the Oost-Zeedijk station. He retired, on pension, in 1907, after 47 years in the service of the gas undertaking. He was greatly esteemed and respected by his colleagues in the gas industry in Holland.

Mr. James Cox, aged 57, who was connected with the Gosberton Gas-Works, met with his death under sad circumstances some days ago; being scalded as the result of hot clinker falling out of the furnace into water below. After the accident, he was removed to the Spalding Infirmary, where death took place. An inquest was subsequently held, when evidence was given that deceased had made the following statement: "Before cleansing the fires, the fire-bars had to be removed. A clinker fell into the water in the pit beneath the bars, exploding. The steam was considerable." Medical evidence was to the effect that Mr. Cox was very severely scalded; and the cause of death was shock, due to the injuries. A verdict of "Accidental death" was returned.

The death is recorded, after a brief illness, of Mr. Francis Russell Hartley, Deputy-Engineer at the Salford Corporation Gas-Works, at his residence in Pendlebury. Mr. Hartley was at the works as usual on Friday, the 2nd inst., appearing to be in perfect health. On reaching home in the evening of that day, however, he had a seizure, from which he never rallied; dying just two days later. He had been in the service of the Salford Corporation Gas Department for 22 years; and the news of his sudden demise was received with much regret by his colleagues at the works and a large circle of private friends. The late Mr. Hartley was the eldest son of Mr. Charles James Hartley, Chartered Accountant, of Birmingham, and served his apprenticeship at the Atlas Foundry in that city. Subsequently he went to New York to fill an appointment with Messrs. Hoe and Co. On returning to England, he took up duty at the Saltley and Windsor Street Gas-Works, Birmingham, and later entered the service of the Manchester Corporation Gas Committee. Then he was engaged with the Lancashire and Yorkshire Railway Company, and afterwards went to Reading. Subsequently he joined the Salford Corporation gas-works staff, under Mr. S. Y. Shoubridge; and when Mr. W. W. Woodward was appointed Engineer to the Gas Department, Mr. Hartley was made Deputy Engineer. The funeral took place last Wednesday afternoon at St. John's Church, Pendlebury, and was attended by a number of officials of the Salford Corporation, including Mr. Woodward, the Engineer, the foreman and workmen at the carbonizing department of the Bloom Street works, and members of the staffs at Liverpool Street and Albion Street.

WILLIAM YOUNG MEMORIAL LECTURE FUND.

Final List of Contributions.

We learn from Mr. Alexander Bell, of Peebles, the Hon. Secretary and Treasurer of this fund, that the preliminaries in connection with the memorial are completed, and that the deed of trust has been executed and duly registered. The following is the

Final Subscription List.

Total of second list (see "Journal" for July 19)	£422	19	0
North British Association of Gas Managers	105	0	0
Dr. George Beilby, F.R.S., LL.D. (second donation)	47	10	0
John Dennis, Bonnyrigg (second donation.)	5	8	0
Alder and Mackay, Edinburgh	5	5	0
W. R. Herring, London	5	5	0
Selkirk Gas Company	5	5	0
John Hammond, Eastbourne	5	5	0
Peebles Town Council (second donation)	5	5	0
R. M. Sutherland, Falkirk	5	0	0
R. Forbes Carpenter, London	3	3	0
G. R. Hislop, Paisley	3	0	0
Lawrence Hislop, Uddingston	2	2	0
Lochgelly Gas Company, Limited	2	2	0
S. B. Langlands, Glasgow	1	1	3
David Easson, Selkirk	1	1	0
J. W. Broadhead, Elland	1	1	0
John Young, Glasgow	1	1	0
Alexander Ross, Burntisland	1	1	0
J. G. M'Geachin, Dumbarton	1	1	0
R. & G. Hislop, Paisley	1	1	0
Bo'ness Gas Company, Limited	1	1	0
James Bell, Kirkintilloch	1	1	0
John Barker, Nairn	1	1	0
Stonehaven Gas Company	1	1	0
Executor of the late Alex. Bell, Sen.	1	1	0
George Hands, London	1	1	0
William Taylor, Forres	1	0	0
P. R. Chalmers, Kelso	1	0	0
Archibald Leitch, Baillieston	1	0	0
Thomas Lindsay, Gourock	0	15	0
F. H. Lamb, Manchester	0	10	0
Forbes Waddell, South Queensferry	0	10	0
H. G. Ritchie, Fraserburgh	0	10	0
Alexander Munn, Glasgow	0	10	0
Andrew Taylor, Glasgow	0	7	6
Alexander Bishop, Newtongrange	0	5	0
Frank Carlow, Renton	0	5	0
Samuel Glover, St. Helens (extra)	0	5	0
Total	£642	19	9

A sum of £650 has been invested in the 3 per cent. debenture stock of the North British Railway Company, and the income will be devoted to the Memorial Lectures, which will be delivered every alternate year.

The marriage was lately solemnized in Paris of Mr. Charles W. Bland, Managing-Director of the Bland Light Syndicate, with Miss Retta Pavey, only daughter of Mr. J. Pavey, of 8, Boulevard Flandrin, Paris.

In the course of a paper, entitled "The Working of the Road Development Act, 1909," read at the meeting of the Society of Engineers, on Monday of last week, by Mr. Reginald Brown, the author pointed out that to tar macadamize the whole of the urban roads in England and Wales would cost very little more than at present if highway expenditure were equalized. If this cannot be done, then a contribution of £30,000 per annum would ensure the provision of dustless roads so far as urban main roads are concerned. Rural main roads at present need only be tar-dressed.

STATISTICS OF WORKMEN'S COMPENSATION.

Some of the principal points from the first part of the Home Office Blue-Book for 1909 upon the Workmen's Compensation and Employers' Liability Acts were noticed in the "Journal" a short time ago (*ante*, p. 556); but these dealt only with statistics of compensation under the 1906 Act—that last passed—in cases occurring in certain specified industries. There is furnished in Part II. of the Blue-Book the customary information with regard to the general administration of the 1906 Compensation Act and the Employers' Liability Act of 1880; and from this portion some of the figures may now be given. The matters referred to in this portion of the returns are: Cases coming for arbitration before the County (in Scotland, the Sheriff) Courts; those in which memoranda recording agreements or awards by committees or private arbitrators under the Workmen's Compensation Acts are registered in the County or Sheriff Courts; those under the Employers' Liability Act; those taken to the Appeal Courts; and the use made of the services of Medical Referees. The "contracting-out" schemes certified by the Chief Registrar of Friendly Societies are, of course, set forth separately, in the annual report dealing with these organizations. The portion of the Home Office statistics now under notice is divided into three sections, covering respectively England and Wales, Scotland, and Ireland.

Referring first of all to England and Wales, it is seen that in the year 1909 the number of cases actually dealt with under the Workmen's Compensation Act of 1906 by County Court Judges and by County Court Arbitrators was 4390; and of these 4201 were decided by Judges, and 42 by Special Arbitrators, while 147 were settled by the acceptance of money paid into Court. In addition to the cases adjudicated on, there were 1798 that were withdrawn, settled out of Court, or otherwise disposed of in such a way as not to enable the officials of the Court to state definitely the results. This makes the total number of cases taken into Court, under the 1906 Act, 6188—as against 5358 in the previous year. Besides the cases under the 1906 Act, there were, however, a small number outstanding under the earlier Acts which were also dealt with. In 129 of the cases last year, compensation was claimed for incapacity due to industrial disease. With reference to the decisions come to, it may be remarked that of the claims settled within the cognizance of the Courts, the decision in 2427 cases was in favour of the applicant, and in 660 in favour of the respondent. Thus the proportion of successful claims was 79 per cent., which compares with 82 per cent. in 1908, 84 per cent. in 1907, and 83 per cent. in 1906. The number of cases in which compensation was awarded (under the 1906 Act) on account of the death of workmen was 750; and in all except nine of them the deceased had left dependants. Excluding these nine, the total amount of compensation awarded in the 741 cases was £117,844, or an average of £159 per case. These figures compare with 772 cases in 1908, with a total award of £128,340, or an average of £166 per case. In addition, compensation was awarded last year on account of death, under the earlier Acts, in four cases, to the total amount of £535, or an average of £134 per case. In the previous year there were 30 such cases, with a total award of £4004, or an average of £133 per case. The average figures for the last five complete years under the earlier Acts (exclusive of the few cases in which the deceased left no dependants) were: Number of cases, 426; total compensation, £78,097; average compensation, £183. Of the 741 cases in 1909 in which compensation was awarded to dependants under the Act of 1906, there were 303 in which sums of less than £150 were awarded—namely, cases of partial dependency; the total amount being £19,543, or an average of £64 10s. per case.

With regard to the cases of injury, the assignment of a weekly sum was again the most general method of compensation adopted; there having been, under the 1906 Act, 1244 cases in which a weekly payment was fixed, as compared with 433 in which the compensation was returned as consisting of a lump sum. In 88 of the cases in which a lump sum was paid, the claimants accepted amounts paid into Court; while in the majority of the remaining instances, a lump sum appears to have been awarded by consent of the parties. The average amount of the compensation was £25 18s. 9d.; whereas the average figures for the last five complete years under the earlier Acts were: Number of cases, 113; average amount of compensation, £34. In the instances last year in which a weekly payment was awarded, the average compensation was for cases of total incapacity, 12s. per week; and partial incapacity, 9s. 6d. The cases taken into Court last year are classified under seventeen heads; the list and the number of cases under each head being as follows: Professional employments, 29; commercial occupations, 12; shop assistants, 118; domestic servants, 432; seamen, 359; fishermen, 19; agriculture, 265; building, 637; factories and workshops, 1820; docks, wharves, and quays, 315; mines, 1255; quarries, 87; constructional work (excluding buildings), 177; railways, 176; inland transport by road, 379; inland transport by water, 48; miscellaneous, 60. As compared with the preceding year, these figures show an increase of about 400 under factories and workshops, and 200 under mines; and there were also smaller increases in most of the other classes.

Instances in which memoranda were registered in County Courts, having reference to cases settled by agreement, by committees, or by arbitrators, are set forth in the next table. It is, however, pointed out that these cases represent only a small proportion of those in which compensation is settled by agreement. According to the table, the registrations under the 1906 Act of cases settled were: By agreement, 18,073; by committee of employers and employed, 124; and by an arbitrator, none. The corresponding figures for the last complete year under the earlier Acts were: 5096, 68, and 7. In these agreed cases in 1909, the average compensation to dependants in connection with fatal accidents was £175; and the average weekly payment in cases of incapacity, 13s. 5d. For the last five complete years under the earlier Acts, the average payment in the event of death was £160; and in cases of incapacity, 13s. 1d. per week. The number of cases of incapacity last year under the Act of 1906 in which the memorandum registered was for a lump sum and not a weekly payment, was 5321, as against 5668 in which a weekly payment was agreed upon. The remaining cases were in connection with various points (mainly the agreement of a lump sum in redemption of weekly payments) which do not fall to be included under either of the two headings named. The average lump sum payment over the 5321 cases was £28 0s. 7d. The figures under the different classes of employment, however, vary widely. Docks, wharves, and quays once more show the lowest average lump sum payments for accidents in connection therewith (£11 19s. 2d.); while mines are at the top of the list (£57 2s. 2d.), and next come commercial occupations (£47 6s. 1d.). In practically every class the average lump sum payment is higher on the present occasion than was the case twelve months ago. Factories and workshops, under which are included 1570 of the cases of commutation, have an average of £29 18s. 1d., as against £19 7s. 6d. in 1908.

Turning now to the Employers' Liability Act, which is dealt with in the report upon as nearly as possible the same lines as the Compensation Act, but in a simpler manner—firstly, because all cases except those removed to the High Court are decided by the County Court (there are no arbitrators), and, secondly, because the damages awarded can always be stated as a lump sum. The number of actions brought under the Employers' Liability Act has since the passing of the first Compensation Act shown a continuous falling off; and this decline has been very marked during the last two years. In 1897, there were 688 cases; in 1907, 393; in 1908, 260; and in 1909, 204. Of last year's actions, 67 resulted in judgment for the plaintiff, 26 in favour of the defendant, and 111, or more than 50 per cent., were "otherwise disposed of." The total amount of damages awarded was £4997. Of the 67 cases in which judgment was given for the plaintiff, only three were in connection with fatal accidents; the total compensation awarded being £489. There were 40 cases of total incapacity, with compensation of £3174, or an average of £79 per case; and 24 of partial incapacity, with compensation of £1334, or an average of £56 per case. In about 10 per cent. of the total cases in 1909, though the proceedings were originally taken under the Employers' Liability Act, the question of compensation was actually determined under the Compensation Acts. The average amount of damages recovered last year under the Employers' Liability Act in the three cases of death was about £163, as compared with £159 under the Compensation Acts. The average amount of solicitor's costs under the former Act was, however, £25 18s., as against £11 17s. 10d. under the latter.

The number of cases that were last year carried to the Court of Appeal in England under the Compensation Acts was 135, or just over 2 per cent. of the cases that came before the County Courts. Of these, 68 were appeals by workmen, and 67 by employers. On each side, 23 were successful; while 25 appeals were abandoned, withdrawn, or settled out of Court before the hearing. There were two appeals to the House of Lords, one of which was by a workman. Neither was successful. The number of appeals under the Employers' Liability Act was four, of which two (by employers) were successful. Out of 110 cases in which the point on which the appeal arose is known, no less than 33 turned on the meaning of the words "accident arising out of and in the course of the employment." In four actions, the definition of the term "dependants" was at issue; and in two others, the meaning of the words "wholly or in part dependant." Six cases turned on the definition of the word "workman." Another case had reference to a contract by a domiciled and resident Englishman to work abroad for an English company; the point being whether the Act was operative outside the confines of the United Kingdom. The employers appealed; and their appeal was allowed.

Dealing with the Scottish returns, it is stated in the report that during 1909 the number of cases taken into Court under the Compensation Acts was 1205 (compared with 1026 the previous year); and under the Employers' Liability Act, 92. The average amount of compensation paid in case of death where dependants were left was £137 0s. 2d. in cases decided in Sheriffs' Courts under the Compensation Acts, and £185 10s. 6d. where memoranda were registered. In cases of incapacity, the lump-sum figures were respectively £9 0s. 1d. and £14 12s. 1d.; and the weekly payments were 12s. 11d. and 13s. 5d.

In Ireland last year there were 920 cases taken into Court under the Workmen's Compensation Acts, and two under the Employers' Liability Act. The average amount of compensation in cases of death where dependants were left was £130 2s. 8d. when decided in the County Courts under the Compensation Acts, and £132 19s. where memoranda were registered. In connection with claims for accidents causing incapacity, the lump-sum figures that were awarded were respectively £17 7s. 10d. and £22 17s. 1d.; and the weekly payments, 8s. 6d. and 10s. 5d.

THE LATEST GAS UNDERTAKINGS RETURNS.

Particulars as to Water Gas and Other Gas-Making Materials.

In the last number of the "Journal," we gave some of the principal figures from the latest published returns as to the gas undertakings of the United Kingdom—viz., for the year ended Dec. 31, 1909, in the case of Companies, and to March 31 last for the Local Authorities.

As usual, the returns contain particulars in regard to the proportion of water gas used, and also indicate the undertakings in which materials other than coal are employed in the manufacture of gas. The following is a list of the Companies and Local Authorities making water gas; the figures in parentheses showing the maximum proportions (except where averages are stated) of its admixture with coal gas.

Companies.

Aldershot (not stated).
Alliance and Dublin (47).
Aylesbury (30).
Barking (30).
Bath (50).
Bexhill (33·51).
Bilston (10).
Bish. Stortford (35·95).
Bognor (30).
Bournemouth (37·8).
Brentford (38·5).
Bridgwater (33⅓, aver. 20).
Bridlington (33).
Brighton (42·51).
Bromley and Crays (25).
Bromsgrove (20, meth. hydrogen).
Cardiff (25).
Chigwell (38).
Cleethorpes (20).
Colchester (27).
Commercial (42·25).
Croydon (41·6, av. 29).
Dartford (20, one day only).
Dorking (25).
Durham (20 estimated).
Eastbourne (40).
Epsom (33).
Falmouth (20).
Felixstowe (20·85).
Folkestone (33⅓).
Gaslight and Coke (*).
Gosport (25, av. 2·51).
Gravesend (45, av. 30·8).
Guildford (25 to 33⅓).
Hampton Court (36·2).
Harrow (43 calculated over one week).
Hartlepool (abt. 20, av. 16).
Hastings (37·95†).
Hornsey (33).
Horsham (25).
Hull—British (29).
Hythe and Sandgate (40).
Ilford (19·84).
Ilfracombe (16·7, av. 8·58)
Ipswich (24).
Kingston-on-Thames (25).
Liverpool (50).
Lea Bridge (50, av. 43·7).
Londonderry (15, av. 10).
Maidenhead (34).
Maidstone (20).
Malton (33).
Marlborough (30).
Merthyr Tydfil (30).
Mitcham (35·7).
Newcastle (7·96 one wk.).
Newport, Mon. (23).
North Middlesex (50·58).
Norwich—British (42·8).
Plymouth (41·94).
Portsea Island (30·2).
Prescot (35).
Preston (46·8, av. for one week).
Ramsbottom (5).
Reading (40).
Redhill (35).
Rhymney (15).
Rochester (36).
Romford (38, av. 29·1).
Rushden and Higham Ferrers (17·03, av. 14·71).
St. Albans (aver. 30).
Scarborough (25·6).
Southampton (35).
Southend (47·06).
Southgate and District (56·7).
South Shields (30·86)
Staines and Egham (25).
Stretford (35·54).
Swansea (25).
Swindon United (39).
Taunton (35).
Tonbridge (25).
Torquay (45·5, av. 27·4).
Tottenham (33).
Truro (50).
Tunbridge Wells (25 to 30).
Uxbridge (26).
Waltham Abbey (3·5).
Wandsworth (48, aver. 29).
Watford (31·9).
West Ham (48).
Weston-super-Mare (30).
Wexford (25).
Winchester (30).
Wolverhampton (not stated).
York (30·16).

*Of the total quantity of gas sent out by the Company, 11 per cent. was unmixed with water gas. As regards the remainder, 9 per cent. contained a maximum proportion of 26 per cent. of carburetted water gas; 59 per cent., a maximum proportion of 27 per cent.; 12 per cent., a maximum proportion of 38 per cent.; 9 per cent., a maximum proportion of 40 per cent.; and 11 per cent. a maximum proportion of 41 per cent. † Average for the year, 30·15 per cent.

Local Authorities.

Aberdeen (25).
Accrington (25).
Ashford (32·1, av. 15·75).
Barrow-in-Furness (19·34).
Belfast (not stated).
Birkenhead (33·33).
Birmingham (25).
Blackburn (25).
Burnley (40).
Carlisle (32·6).
Chorley (16).
Coventry (34·74 one day).
Devizes (35).
Devonport (52·6).
Dundee (25).
Edinburgh (6).
Halifax (9).
Hebden Bridge (about 20).
Leeds (15).
Leigh (15).
Lincoln (33·33*).
Longton (about 30).
Loughborough (25).
Manchester (18·94 on the total output).
Middlesbrough (no limit).
Nottingham (12·95).
Oldbury (about 20).
Oldham (40†).
Paisley (1·18 oil gas).
Pontypridd (38).
Rochdale (25).
Smethwick (20).
Southport (34·33).
Stafford (36).
Stockport (25).
Stockton-on-Tees (23·7).
Tipton (1).
Todmorden (16).
West Bromwich (28·4).
Wigan (11·78).

* In the daytime; none at night. † At one station, and on one day only.

Five new Companies appear in this list: Aldershot, Bilston, Bromley and Crays, Felixstowe, and Rhymney and Aber Valleys; and one (Nuneaton) drops out. Among the Local Authorities, Aberdeen appears.

The extent to which oil, petroleum spirit, carburine, or "other material" is being utilized for the production of gas will be seen from the following list of the Companies and Local Authorities making returns.

Companies.

Aldershot.
Alliance and Dublin.
Alton.
Aylesbury.
Barking.
Bath.
Bexhill.
Bilston.
Bishop's Stortford.
Bognor.
Boston.
Bournemouth.
Brentford.
Bridgwater.
Bridlington.
Brighton and Hove.
Bristol.
Broadstairs.
Bromley and Crays.
Bromsgrove.
Bude.
Canterbury.
Cardiff.
Chigwell.
Cleethorpes.
Coatbridge.
Colchester.
Commercial.
Croydon.
Dartford.
Derby.
Dorking.
Dover.
Durham.
Eastbourne.
Epsom and Ewell.
Exeter.
Falmouth.
Fareham.
Felixstowe.
Folkestone.
Gaslight and Coke.
Gosport.
Grantham.
Gravesend.
Guildford.
Hampton Court.
Harrow and Stanmore.
Hartlepool.
Hastings.
Hornsey.
Horsham.
Hull (British Co.).
Hythe and Sandgate.
Ilford.
Ilfracombe.
Ipswich.
Isle of Thanet.
Kingston-on-Thames.
Lea Bridge.
Littleborough.
Liverpool.
Londonderry.
Maidenhead.
Maidstone.
Malton.
Marlborough.
Merthyr Tydfil.
Mitcham and Wimbledon.
Newcastle-upon-Tyne.
Newport (Mon.).
Northfleet.
North Middlesex.
Norwich (British Co.).
Plymouth.
Portsea Island.
Prescot.
Preston.
Ramsbottom.
Reading.
Redhill.
Rhymney & Aber Valleys.
Rochester.
Romford.
St. Albans.
Scarborough.
Shrewsbury.
Southampton.
Southend.
Southgate and District.
South Shields.
Staines and Egham.
Stirling.
Stretford.
Sutton and Hooton.
Swansea.
Swindon.
Taunton.
Tonbridge.
Torquay.
Tottenham.
Truro.
Tunbridge Wells.
Tynemouth.
Uxbridge.
Waltham Abbey and Cheshunt.
Wandsworth and Putney.
Watford.
West Ham.
Weston-super-Mare.
Wexford.
Winchester.
York.

Local Authorities.

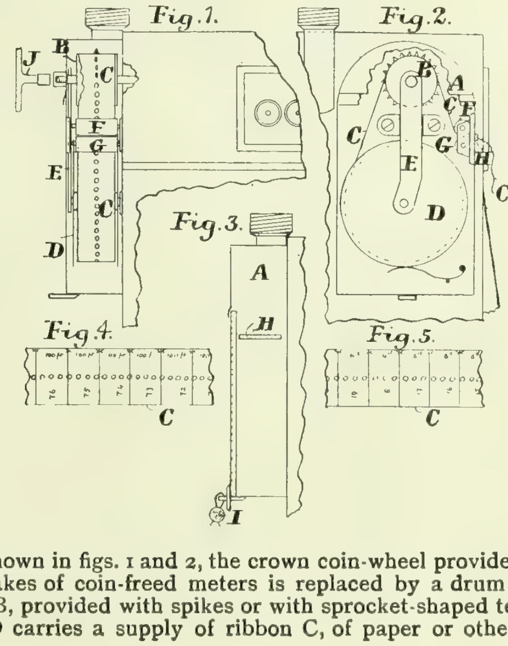
Aberdeen.
Abergavenny.
Accrington.
Airdrie.
Alloa.
Alva.
Arbroath.
Ashford.
Barrow-in-Furness.
Belfast.
Birkenhead.
Birmingham.
Blackburn.
Blackpool.
Burnley.
Carlisle.
Chorley.
Coventry.
Darlington.
Dalton-in-Furness.
Darwen.
Devizes.
Devonport.
Dumfries.
Dundee.
Dunfermline.
Edinburgh and Leith.
Ellon (gas oil only).
Greenock.
Halifax.
Hebden Bridge.
Helensburgh.
Heywood.
Hamilton.
Ilkeston.
Kirkintilloch.
Leeds.
Leek.
Leigh.
Lincoln.
Liverpool (Fazakerley).
Llandudno
Longton.
Loughborough.
Manchester.
Market Harborough.
Middlesbrough.
Middleton.
Mossley.
Nottingham.
Oldbury.
Oldham.
Oswaldtwistle.
Paisley.
Perth.
Pontypridd.
Portsoy (acetylene gas).
Rochdale.
St. Helens.
Smethwick.
Southport.
Stafford.
Stratford-on-Avon.
Stockport.
Stockton-on-Tees.
Tipton.
Todmorden.
Torquay (St. Mary Ch.).
Walsall.
Warrington.
West Bromwich.
Wigan.

The new names in the above lists are the Aldershot, Bilston, Bromley and Crays, and Felixstowe Gas Companies, and the Aberdeen, Kirkintilloch, and Liverpool Corporations—the last named appearing in respect of their Fazakerley undertaking. The Huyton and Roby, Nuneaton, Quorndon and Mountsorrel, and Richmond Companies, and the Ashburton, Ballinasloe, Bury, and Glastonbury Local Authorities drop out.

The Gas Commissioners of Portsoy used 11 tons of carbide of calcium in the manufacture of 99,792 cubic feet of acetylene gas, of which 72,520 cubic feet were employed for private and 24,637 feet for public lighting—together, 97,157 cubic feet, at the price of 5s. per 100 cubic feet. At the date to which the returns were made up (March 31 last), there were 68 consumers, about four miles of mains, and 72 public lamps.

CONSUMERS' METERS AND THEIR ACCOUNTS.

The following communication from Mr. G. J. Cox, the Chief Meter Inspector to the Metropolitan Gas Company of Melbourne, has reference to matters that come within the experience of all who have to deal with details incidental to gas consumers and their accounts. Prior communications from the same source on this subject have been published in our columns; but the devices and methods now proposed to be employed are put forward as a new means of dealing with consumers and the problem of their accounts.



As shown in figs. 1 and 2, the crown coin-wheel provided in certain makes of coin-freed meters is replaced by a drum or band wheel B, provided with spikes or with sprocket-shaped teeth. A spool D carries a supply of ribbon C, of paper or other fabric.

The ribbon is pierced along its length with a line of holes, spaced apart to register with the pitch of the teeth carried on the wheel B. The ribbon, as it is used, passes off the spool D, over the drum B (engaging the teeth thereon), under the tension roller F, and out of the chamber A by the aperture H.

In fig. 3, it will be seen that, with the ribbon so arranged, no portion of it can be withdrawn from the chamber A without the drum B is revolved to some extent; and as a meter to which this device is proposed to be applied is presumed to contain all the devices usually pertaining to coin-freed meters, or stop meters (except such portions as would be necessary for holding or dealing with a coin), it follows that the action of revolving the drum-wheel B, by hauling at the ribbon C, will have precisely the same effect upon the valve, &c., as provided within the meter crown for coin-freed purposes, as though the original crown-wheel had been turned through the medium of a coin. It will also be understood that in this arrangement, in order to keep the supply of gas uninterrupted, a ribbon drawing movement is necessarily made from time to time, to re-open the valve as it is automatically brought to the closing point by the meter action.

In one modification of the apparatus, a small portion of the ribbon is simply drawn out by hand as a consumer wishes to provide a continuation of his supply. In the arrangement provided as shown, however, the drum and its shaft is intended to be so braked that the friction set up is greater than the tensile strength of the ribbon; so that a persistent attempt to revolve the drum by pulling at the ribbon would break the ribbon. This provision is made in cases where the exposed end of the ribbon is not otherwise protected from improper interference, and where it is desired to keep the supply under control. In such cases, the drum B can only be revolved by means of a detachable key, such as J in fig. 1. In operating with such a key, it is still intended that a slight tension be put on the ribbon end by the operator's spare hand.

The ribbon C is marked off by transverse lines into divisions of equal length; and each such division represents a commercial unit—say, 100 feet of gas, or the cash value of any unit (say 6d.). It would be preferable to show both the volume and cash value on each unit. It will be obvious that the diameter of the drum B, the length of the ribbon units, and the gearing connections between the drum and the correlative apparatus within the meter must bear consistent relations one to the other. The diagrams originally represented portions of a certain five-light shilling slot meter, the crown coin-wheel of which provides for about 600 cubic feet of gas per revolution. Figs. 4 and 5 are not to the same scale as the other portions.

It will be understood that the limitation regarding the supply made available will be the same as in a coin-action meter, and that only a certain quantity of gas, governed by the range of the valve movement, can be made available for measurement and consumption in the one movement, but that any definite quantity within the maximum can be provided for in the one movement. The consumer operating the apparatus may also have the assistance of the indicator usually provided in slot meters.

As to the usefulness of a meter equipped as described, the first claim made for it is that, for the first time in the history of the gas-meter (so it is believed), means are provided whereby consumers more or less dependent on domestics and others are enabled to determine and allot the maximum amount of gas they desire to be used within a defined period of time, or for a specific purpose, and can set the apparatus accordingly, and leave the meter to complete their arrangements. So far as this goes, it is evident that the use of a prepayment or stop meter would answer the same purpose. But if a customer did not object to prepaying, such meters do not provide what may be considered the central feature of this conception—viz., a cumulative record and easily understood statement of the amount of gas consumed, or in process of consumption, during the usual account-covering period. Something that is capable of keeping a consumer's liability for gas supplied well before his notice would go a long way towards making him quite content when the day of reckoning came.

In connection with an ordinary meter index, there is nothing that obtrudes on a consumer's notice as does the accumulating charge for gas supplied. If a householder discharges his ordinary domestic liabilities monthly, he usually gets a statement concerning them weekly, and is made aware, at short intervals, of his accruing liabilities. But so far as his gas account is concerned, there are few accounts that are paid less gracefully and with less satisfaction, simply because the consumer has had nothing calling his attention in this direction during the whole period covered by the account. By making it necessary for the consumer to go to the meter at intervals, the consumer, without any effort worth considering, takes the record of his liability to date in his hand each time he goes to make provision for maintaining his supply.

The device under notice goes far to solve the problem how to make consumers' accounts for gas supplied to be concurrently determined, on a prearranged date, whereby such accounts would be all for the same length of time, and under similar atmospheric conditions, and provide data that would enable definite comparison to be made between works' output and consumers' meters. The arrangement is workable in two ways; but in either case the co-operation of the consumer is essential, and would probably have to be paid for by a rebate on the account.

(1) The consumers would all have to be coached to take action on a prearranged date to mark the exposed portion of ribbon in connection with their respective meters at the division nearest the aperture. Subsequently, an officer of the supply body inspects the meter, records the index reading then showing on the meter, cuts off the ribbon at the specially marked division, endorses it for office purposes, and returns the detached slip and the present index reading to the office; and if the two records be reasonably consistent, a conventional account for gas supplied, based upon the ribbon record, could issue as a matter of form, as the consumer would, in the prior marking transaction, be fully cognizant of the amount he would be charged in due course.

(2) As a means of enabling a rebate on accounts to be paid for the joint action of recording the consumption and promptly paying the amount due by a consumer, without rendering an account for same, the consumer concerned could be coached to cut off the ribbon ends exposed on a prearranged date, instead of marking them, and present the slips at the supply office and have them accepted as inferential evidence of the amount consumed during an understood period; and provisional receipts could be given for any payments tendered in connection with such slips. As in the prior case, a visit from an inspector, to record the index reading of the meter, is necessary at some time during the account-covering period. Beyond this periodical inspection, however, it will be seen that if it were made attractive so to do, the device provided gives a consumer an interest in dealing with his gas account, and makes it practicable for the supplier to get prompt returns for all the gas sold, with a minimum staff employed. It would also make it an easy matter to substitute monthly accounts for the present quarterly accounts for gas; and although concurrent action on the part of consumers would provide valuable statistical data for comparison purposes, there is nothing dependent otherwise on the concurrent action of consumers.

The arrangement last described, reduced to a weekly system, with a monthly check-reading of the meter indices, would enable coin-meters, and all their vexations to property owners and to both suppliers and consumers, and the cumbersome cash burden, to be dispensed with; the onus of presenting the detached slips, and cash represented thereby, at a convenient receiving depôt, being placed on the consumers, together with such penalties as may be necessary in order to ensure compliance with the scheme agreed upon. The amount of trouble thus thrown on the consumer once a week would be far less than that now placed on him to obtain the necessary supply of coppers, and to operate the meter for each pennyworth he requires. Years ago, the writer advocated, through the "JOURNAL," that weekly accounts for small consumers' supplies would be preferable to prepayment meters. It will be seen, however, that with the system set forth prepayment is not necessarily abandoned, as consumers might be encouraged, by a special discount, to withdraw an amount of ribbon as would probably cover their week's requirements ahead; and thus pay for it in advance.

Provision is made in connection with the ribbon system whereby early intimation would be given to the consumer that the spool is becoming exhausted; and easy access is provided so that a responsible officer can replace the spool when necessary. As a means of more positively identifying the detached slips, apart from hand endorsement, the roller G may be provided, and be engraved for printing purposes with the meter number, and an inking pad be attached—all in such a manner that the meter number would appear at intervals along the back of a slip to be detached from that particular meter.

THE BIRMINGHAM UNIVERSITY.

Professor F. W. Burstall's Inventions.

LAST Saturday afternoon, members of the Midland Junior Gas Engineering Association paid their second visit of inspection to the New Birmingham University—their first having taken place in March, 1906, at a time when a portion of the buildings was still incomplete. On this occasion, therefore, there was a good deal to be seen that had not been seen before; and an enjoyable and instructive afternoon was the result. The work of showing the members round was undertaken by Professor F. W. Burstall, who was assisted by Mr. Riley and Mr. F. J. Broscomb; while, when they entered the civil engineering department, they were fortunate in finding there Professor Dixon, the Professor of Civil Engineering at the University.

After an inspection of the Great Hall (which is said to be the largest hall under one roof outside London), the metallurgical department was an object of interest. In the mining department, there is a complete plant for dealing with gold, silver, lead, and tin; and it takes about 100 H.P. to run the whole of this. In the mining rescue room, there is being undertaken work for the Home Office, in the way of experimenting with safety apparatus for rescue purposes. A complete mine on a small scale has been made, and so arranged that it can be filled with poisonous gases; and in this the testing is carried out. There is a well-equipped electrical laboratory, where the students are mainly occupied in making efficiency tests. In the civil engineering department also various machines were seen, and were explained by Professor Dixon. In the smithy, students are instructed in the work of the blacksmith, and also in making small forgings, and such things; and adjoining is a foundry. The students in the general engineering course make their patterns in the pattern-shop, cast the articles in the foundry, and then take them to the machine shop.

The first two years are occupied in a general engineering course; and in the third year they specialize in the civil, mechanical, or electrical branch. All the general repairs about the University are carried out by their own staff; and special apparatus for research work is made by the students, assisted by the staff.

At the power station, which is some distance from the main building, the members, of course, saw much to interest them—the Mond producer gas plant, steam and gas engines of various types, and last, but not least, Professor Burstall's inventions. In the autumn of last year—to be precise, in the number for Sept. 28, pp. 818-820—an illustrated description was given in the "Journal" of Professor Burstall's tar-extracting appliances; and to these he has since added a screen washer, to supplement his rotary tar machine. He explained that when the gas has passed through the centrifugal fan, there is a considerable quantity of suspended water and tar that goes along with it and would ultimately settle in the pipe. But in order to remove this quickly, a sheet of water is provided in the pipe, through which the whole of the gas has to bubble; and this sheet of water abstracts all the suspended water and tar from the gas. Then the Professor's "Static" gas-washer, which was described and illustrated by Mr. W. H. Johns in the paper he read a few weeks ago before the Association (*ante*, p. 495), was seen at work extracting the tar and cooling the gas from the producer plant. One other point may here be mentioned. At the present moment, Professor Burstall is experimenting with an adaptation of the rotary principle which was worked out by the tar-extractor, to the direct recovery of ammonia from the gas. That is to say, the ammonia is taken out while the gas is still hot, and the sulphate formed, without liquors or any means of that kind, by washing with dilute sulphuric acid in a lead-lined chamber, in which rotate a large number of lead-covered wires. The acid falls from the top to the bottom, and the gas rises from the bottom to the top. The resulting liquor is evaporated; and the sulphate is obtained direct. The idea is that the apparatus should be placed in the hydraulic main. Messrs. W. C. Holmes and Co., of Huddersfield, it may be remarked, are the makers of the whole of Professor Burstall's apparatus.

The visit was brought to a close in the handsomely equipped library which has been given to the University by the family of the late Mr. Charles Harding. It was, however, announced that, if, at the termination of the proceedings, any members wished to make a journey to the top of the large tower, Professor Burstall would arrange for them to be taken up by the lift.

The President (Mr. R. S. Ramsden, Burton-on-Trent) proposed a hearty vote of thanks to the Senate of the University, and particularly to Professor Burstall, for having given the party such an interesting afternoon. Certainly, they had seen a great deal that was of special interest to those connected with gas. Unfortunately, he was not one of the party when the Association paid their previous visit to the University, some four-and-a-half years ago; but he understood that there had been a great many additions made since then.

Mr. R. J. Rogers (Birmingham), in seconding the proposition, remarked that it had been a very instructive visit. On the present occasion they had seen a good deal that was new; and if they went there once a year, he thought they would see something fresh every time, because in a University like this there were always changes going on. The thanks of the members were also due to Professor Dixon, for showing them the Engineering Section. To turn for a moment to another matter, most of those present were aware that at the Leeds University and the Manchester University, under the auspices of the Junior Associations in those districts, arrangements had been made for courses of lectures to be delivered by the Professors of the Universities and by other well-known gentlemen on various subjects; and it might not be out of place for them to hope now that something of the same kind might be arranged for the Midland Junior Gas Association in Birmingham. ("Hear, hear.") He did not know exactly what Professor Burstall himself might think of this suggestion; but he could, without hesitation, say that the members would highly appreciate it if Professor Burstall saw his way to give them some promise that he would deliver a lecture (say) on gas-engine efficiencies—because they would always remember him, so far as gas-engines were concerned, in connection with his researches on gas-engine efficiencies. No doubt, the suggestion he had put forward was one that would require careful consideration; but he hoped that if the Association approached the Senate of the University, the proposal would be received favourably.

The vote of thanks having been carried by acclamation,

Professor Burstall said he appreciated it very highly, as he knew other members of the staff would also do. As members of the Association and all Birmingham persons knew, those at the University were only too glad to welcome every section, every class, and every sort of people there. It was a People's University; and it existed for this purpose. He was, of course, specially glad to welcome the members of the Association, because they were connected with an industry in which he himself was particularly interested. If they came there again in another four years' time, he could promise them that they would see a good many more new things, as they had done on the present occasion. With regard to the important question of the University doing something for the gas industry generally, it had been in his mind many times that they ought to do something in this direction; and he thought there was no sort of doubt whatever that, if the Association approached the University authorities, they would endeavour to arrange most probably some course—because one lecture was rather hard on the lecturer, and rather hard on the students—of lectures on the gas industry. He did not think there was any doubt that such a proposal would be received in the most favourable manner.

BLAND BURNERS FOR CHURCH LIGHTING.

We have on several occasions referred to the excellence of Bland inverted burners for the lighting of churches; and a photograph which has just reached us of the interior of All Saints' Church, Leighton Buzzard, fully justifies our remarks. It was taken at night, with an exposure of 45 minutes; and all the architectural and other details come out remarkably clearly. The church was

formerly lighted by means of 149 flat-flame burners; but they have been replaced by 50 of the new type of Bland burners, which have proved a great success—every part of the church being beautifully lighted. The Churchwardens say the advantage of the new lighting is greatly enhanced by the reduction effected in the cost of gas; for in the quarter to Michaelmas last there was a saving of more than 68 per cent. compared with the corresponding period of 1909. The actual figures were 16s. 8d., against £2 15s. 3d. The work was carried out by the Leighton Buzzard Gas Company; and the Secretary and Manager (Mr. C. F. Ruggles) states that it has proved so satisfactory that they have received an order to light St. Andrew's Church in a similar way. The Bland Light Syndicate may be heartily congratulated upon the result here recorded.

REQUIREMENTS OF ILLUMINATION AND THE STATUS OF GAS LIGHTING.

At the Meeting of the Graduates' Association of the Institution of Mechanical Engineers last night, under the presidency of Mr. H. E. Jones, a paper on the above subject was submitted by Mr. John C. Briggs, of Workington. We have been furnished by the Secretary (Mr. Edgar Worthington) with an abridgment of the paper, and make the following extracts from it.

The principal object of any lighting engineer in practising the theory of illumination is, of course, to enable the eye to perceive comfortably the objects illuminated. Hence there are two predominant factors—that physiological organ the eye, upon which the effect is produced, and the medium producing the effect. It is necessary, therefore, to eliminate extreme contrasts or objectionably located shadows which tend to produce this effect by a proper distribution of the light sources, and to decrease the shadow contrasts by the adoption of smaller units placed in closer proximity. This will, of course, necessitate an increase in the initial and operating cost of the installation, but a superior distribution of light and greater uniformity of illumination will be attained; and where it is necessary to discern objects at a glance, and rapid movement is general, this is essential. A satisfactory system of illumination should, therefore, possess a complete graduation of light units to meet the exigencies of the various conditions.

Let us now examine the medium producing the effect, and from a few experimental observations it may easily be demonstrated that the intrinsic brilliance of these radiants, or light-reflecting surfaces per square inch of luminous area, exceed by far the natural light to which we are so accustomed. Certainly the antiquated candle and flat-flame burner have intrinsic brilliancies approaching that of daylight; but each further stage of development is marked by a prepondering increase, raising this factor far beyond physiological requirements. Various authorities have therefore advocated a maximum permissible intrinsic brilliance from a hygienic point of view for all light sources. Dr. Stockhausen, in giving 4-candle power, appears to have taken sky brightness as a maximum. Dr. Bell gives 5-candle power; while other authorities have advocated a maximum as low as 0·1 to 0·2 candle power.

It would, however, appear that if all radiants of high intrinsic brilliance are placed at a sufficient distance to prevent side lighting of the eye, and rigorously precluded from the field of vision by being kept invisible from the most frequented or ordinary points of view, and while being high enough to prevent inconvenience or distress are low enough to give a maximum of lighting effect per unit of cost, all danger in this respect would be obviated. When the conditions are unavoidably transgressed, and the source of light protrudes the field of vision, suitable artificial equipment must be employed to reduce the factor to within physiological limits. The application of these mediums results in considerable reduction in physical efficiency of the light source, so that high intrinsic brilliance is not a desirable constituent in an illuminant. The whole question resolves itself into one of relative contrasts of luminous areas of widely different intensities; and it is this fact that makes a source of light which is harmless in broad daylight unendurable at night.

It is evident from the foregoing considerations that sheer intensity of illumination is not wholly responsible for the production of glare, from the fact that glare is exhibited in cases of illumination where the brilliance is less than full daylight. On the contrary, high brilliancy is a source of health, safety, and pleasure, and does not deserve the adverse criticism which has been levied. Defective vision is more the outcome of an ill-regulated supply than a prepondering flood of light. The author has found that a very good effect may be produced, where the ceilings and surrounding walls are light in character, by providing 1-candle power per 2 to 3 square feet of floor area—or, expressed in terms of cubical capacity, 50 candles per 1000 cubic feet—increasing this factor according to the colour of the walls and ceilings, and the degree and nature of obstructions. The amount of light will, however, obviously depend upon the local conditions, the exigencies of work, and the pursuits of the worker. These considerations must alone dictate and prescribe the correct treatment and be solved for each individual case.

Colour.

From the physiological aspect, the author need only refer to the desirability of guarding against a short wave and invisible ultra-violet rays which produce such a deleterious effect upon the faculty of vision by inflaming the anterior structure and injuring the human lens. The wearisome effect produced by artificial lights has been also ascribed by various authorities to the presence and the tendency towards increasing this undesirable constituent in the spectra of the various illuminants. Fortunately, however, the glass accessories or enclosing mediums have the effect of absorbing a portion of these; thus considerably minimizing the danger from this source. When the daylight balance of colours is not maintained, the light ceases to be white; the excess or absence of some particular colour being noticeable in the resultant colour effect. It might be asserted that the efficiency of the source of light is dependent to a great extent upon its colour. In practical illumination, it is impossible to dissociate it from the colour of the ceilings and the surrounding walls, the influence of which must also be considered as an important feature in this respect.

Glassware.

The author has dealt with the intrinsic brilliance of the illuminant. He will now examine the medium employed to balance the physiological factor, and the methods in vogue for securing extraneously a superior distribution of light. Such equipment may be divided into three general classes—globes, shades, and reflectors. The usual object in employing globes or shades is, in the first place, to effect a greater diffusion of light, and to protect the eyes by decreasing the intrinsic brilliance of the illuminant. The disadvantage to their adoption, however, lies in the fact that they offer a certain amount of obstruction to the passage of light; the proportion of the light obstructed varying according to the shape and the character of the material composing it. Thus Mr. William King found that, when using a No. 3 fishtail burner, the various descriptions of globes mentioned below obstructed the passage of light in the following proportions:—

	Percentage Loss of Light.
Clear-glass globe	10·57
Ground-glass globe	29·48
Smooth opal	52·83
Ground opal	55·85
Ground opal with painted figures	73·98

This clearly amplifies the necessity, while fulfilling the desired object, of preventing waste by using globes or shades restricting the least possible percentage of light. It also explains the great loss in physical efficiency where dense globes have to be utilized in order to reduce brilliant high-power light resources to within physiological limits previously referred to. Reflectors, as their name implies, change the distribution of light by dissipating those rays which would otherwise be wasted into the area to be illuminated.

Ventilation.

The interference with the hygienic conditions of workshops and factories through contamination of the air supply for human functions would be disastrous to the adoption of any particular illuminant. A few moments' deliberation might be helpful in an attempt to solve the prejudices attributable to different systems. In order to form a clear conception of the subject, the various systems may be divided into two general classes—those which evolve light with the production of heat, and those which also produce heat with the evolution of carbonic acid and sulphur compounds, and depend upon the surrounding atmosphere for the supply of oxygen for combustion. In selecting gas and electric light for consideration, not only are the more general methods opened for discussion, but the chief representative of each class chosen.

Gas lighting, in the first place, is accredited by electrical engineers with the production of stuffy and uncomfortable rooms, with the accompaniment of headaches, lassitude, and ill-health generally, not to consider the devouring of the oxygen from the atmosphere. On the other hand comes the ready response reciting gas as a boon, by the injector action of its ventilating properties, revivifying the atmosphere by a continuous gentle current of uncontaminated air, and preventing those objectionable down-draughts characteristic of a system of electric light, due to the descending currents of human respiration being cooled through contact with the ceilings, windows, and walls, being displaced by the heated upward current, accelerated by the specific gravity of the cooled carbonic acid.

Observations go to show that carbonic acid has not the harmful effect attributed to it, but that it is the bad company in which it finds itself in the form of poisonous organic substances from the exhalations of the human organism. These to a certain extent become incinerated by the action of the gas-flame and sterilized by the sulphur compounds. If the function of a gaslight installation is properly understood and correctly applied, it may also be utilized to serve the useful purpose of assisting defective natural ventilation by removing the vitiated air and establishing efficient ventilation.

Dangers.

With the development of the various systems of lighting, the attitude of the fire insurance officials may well be studied as a fair criterion of the dangers and hazards to which property and life are submitted by the use of gas and electricity respectively. With the birth of electric light, many suggestions were forthcoming in order to obtain certain concessions and privileges over users of gaslight; but the extended experience of the offices has only resulted in the depleting of certain original restrictions in favour of gaslight, and placing the systems under equal obligations. The advent of the high-pressure system of gas lighting may also have raised doubts in the minds of some people; but, after strict inquiries, the insurance officials have found no additional risk to necessitate the differentiating of premiums. Certainly, in exceptional cases of extreme danger—such as trades where celluloid is used, or where fine inflammable dust is present in large quantities—the companies prefer electric light; but it is necessary to employ only the enclosed types. Cases are indeed isolated where accidents occur through defective gas installations or the deterioration of the system. They are due rather to stupidity, forgetfulness of simple rules, and disobedience.

HIGH-PRESSURE GAS LIGHTING.

The high scientific knowledge and technical skill expended in the development of gas and electric light are worthy of the fullest admiration; and the evolution of the high-pressure inverted gas-burner and the electric metallic filament lamp commands the highest appreciation. The incandescent burner is in reality a heat-light engine of rather low efficiency, approximating that of the ordinary slide-valve steam-engine; and therefore the energy delivered as light must bear some relationship to the energy put into it as heat per unit of time. This transformation of energy, which is shown in the following table by Professor Lewes, indicates the enormous proportion still dissipated and lost in the form of heat.

Coal Gas.	Heat.	Light.	*Electric Light.*	Heat.	Light.
Flat-flame and argand	98	2	Geissler tube	97	3
Regenerative	93	6	Arc	90	10
Incandescent	88	12	Incandescent	95	5

The bunsen burner, in one or other of its modifications, is the one adopted in incandescent gas-light. The imperfections of the earlier forms of burners were manifest in the incomplete mixtures of gas and air attainable, with consequent low flame temperatures; and as light-emitting power is synonymous with high-flame temperatures, low efficiencies only were obtainable. The protracted consideration of this question, however, has evolved burners capable of attaining remarkable efficiencies; 30 candle power per cubic foot being comfortably attained under the low-pressure system, while the use of higher pressures has added a new impetus to the industry by still further raising this factor to between 60 and 70 candle power per cubic foot.

The improvements wrought in mantle production have in no small measure contributed to the high efficiencies and reduced maintenance costs now prevailing in gas lighting. The web base of the mantle is in reality a structure of thoria and ceria in the proportions of 99 per cent. of the former and 1 per cent. of the latter. Thoria is an extremely bad radiator of heat, and therefore capable of attaining a very high temperature. It, however, possesses only poor light-emitting properties; but with the aid of the "excitant," the mass is raised to a high state of incandescence, producing a beautiful white light.

The question of distance lighting has always been considered a great deficiency in the system of gas lighting; but the numerous descriptions of appliances now available for this purpose have entirely removed this objection. Where the use of a bye-pass is also considered a disadvantage, electric ignition can be substituted, where a momentary current operates an electrical control-valve on each lamp, and simultaneously ignites the gas.

The author gave a table showing the cost of 1000 candles for one hour with gas and electric current.

ASSOCIATION OF WATER ENGINEERS.

The Winter Meeting of the Association was held last Friday and Saturday at the Rooms of the Geological Society, Burlington House, W.—the PRESIDENT (Mr. W. H. Humphreys, of York) in the chair.

The SECRETARY (Mr. Percy Griffith) read the minutes of the annual meeting held at York on June 2 and 3 last; and they were confirmed.

PAPERS AND DISCUSSIONS.

During the two sittings, the papers considered were as follows:

"The Wellingborough Water-Works and Softening Plant," by E. YOUNG HARRISON, Assoc.M.Inst.C.E., of Wellingborough.

"Gauging and Recording the Flow of Streams," by S. C. CHAPMAN, Assoc.M.Inst.C.E., of Torquay.

"The Eliminating Effect of Chlorine on the Bacteria of a River Water," by LESLIE C. WALKER, of Reading.

"The Advantages of Co-operation in Rural Water Supplies," by F. GRAHAM FAIRBANK, M.Inst.C.E., of York.

Extracts from the papers and indications of the points of the discussion will be published in future issues of the "JOURNAL."

WATER SUPPLIES PROTECTION BILL.

Mr. EASTON DEVONSHIRE (London), the Chairman of the Water Areas and Statistics Committee of the Association, presented reports (from which the following extracts are given) on the question of the Water Supplies Protection Bill, 1910, and the Government action arising thereon.

In the interval since our last report relative to the above Bill, the Joint Select Committee have issued a report upon the Bill, which is of such importance that your Committee have reproduced it as an appendix to this report.* It will be seen that the Joint Select Committee indicate their opinion that the provisions of the Bill do not adequately meet the circumstances or overcome the difficulties to which their attention was drawn by the various witnesses, nor even those which the promoters of the Bill presumably had in mind when drafting the clauses thereof.

Having dealt with the more important provisions of the Bill, the Joint Committee draw attention to the larger question raised by the evidence, and, after commenting on the absence of trustworthy information as to the water supply available in any particular district, and as to the effect of rainfall on the water-levels in various parts of the country, state that:

> They consider that a remedy for this state of things is urgently called for; and they think that it may be found by creating an organization empowered to inquire into the whole question of surface and underground water supplies from a comprehensive standpoint; to supervise the future allocation of supplies; and to serve as an authoritative adviser to Parliament in the consideration of particular schemes.

In the concluding paragraph of their report, the Joint Committee strongly recommend:

> (1) The establishment (within the Local Government Board, or independently, as may seem best to the Government) of such a Central Administrative Authority as is contemplated in paragraph 356 of the fifth Report of the Royal Commission on Sewage Disposal. And (2) the division of the country into watershed areas, and the appointment for those areas of local Representative Boards, who, subject to the guidance and control of the Central Authority, should prosecute systematic and continuous inquiries into the water supply of their jurisdiction; take all measures to husband such supplies, both surface and subsoil; secure their preservation from pollution; and advise on their allocation for sanitary, industrial, and other purposes.

The above recommendations so nearly accord with those which have been made by our Association from time to time during the last ten years, that we feel perfectly justified in claiming that the Joint Committee in drafting their report were materially influenced by the evidence put before them on behalf of our Association.

[The report of the Association Committee then proceeds to state the steps taken by them to bring before the Joint Committee the views of the Association on points raised by the Bill.]

Your Committee ask for the Council's sanction to the steps they have taken, and suggest, in regard to the expenditure incurred, that the various water authorities whose views on the Bill were represented by the Association should be invited to contribute towards such expenditure on some reasonable scale.

Your Committee ask the authority of the Council to take such further action as may from time to time seem desirable to give effect to the recommendations of the Joint Committee, and to further the views of the Association.

In the course of a further report, the Committee remarked:

Since the presentation of our last report, further action has been taken by Parliament in connection with this matter. On July 27, Mr. J. G. Butcher asked the Prime Minister the following question in the House of Commons:

> Whether, in view of the grave difficulties arising in connection with the abstraction of underground water by water authorities and others, and of the demand for an alteration in the law as regards compensation for injury caused by such abstraction, he will favourably consider the recommendation of the Select Committee to the effect that a comprehensive inquiry into the whole subject of surface and underground water supplies should be held.

To this question, the Prime Minister replied:

> I understand that, prior to the appointment of the Joint Select Committee, my Right Hon. friend, the President of the Local Government Board, had decided to introduce a Bill to give effect to the recommendations of the Royal Commission on Sewage Disposal, endorsed recently by the Joint Select Committee. The recommendations of the Select Committee will be carefully considered by the Government in connection with the Bill in question.

On Nov. 24, on the motion of Mr. Herbert Lewis, Parliamentary Secretary of the Local Government Board, the House of Commons made the following Order for a return:

> Showing, as regards every water undertaking in England and Wales—
> (a) The powers, if any, under which the undertakers are authorized to supply water.
> (b) The limits within which the undertakers are authorized to supply water.
> (c) The places actually supplied.
> (d) The sources of supply, their nature, and sufficiency.
> (e) Particulars as to the works, the quantity and quality of the water supplied.
>
> And also as regards every district in England and Wales—
> (a) The area and population of the district, and the number of houses therein.
> (b) The number of houses supplied with water from a piped service.
> (c) The names of the undertakers providing a supply of water.
> (d) The source, nature, and sufficiency of the supply where there is no piped service.

As regards the Order made by the House of Commons for an inquiry into the facts as to the water supplies of England and Wales, their distribution and sufficiency, this is, in principle, in accord with the recommendations made by this Committee as long ago as Nov. 5, 1900, which recommendations were endorsed by evidence put forward by the Association and other witnesses in opposition to Lord Desborough's Bill. In the absence of knowledge as to the form of the questions which may have to be answered as a result of this Order, it is impossible to offer any detailed criticism; but your Committee are of opinion that the Association should express satisfaction that the preliminary step taken accords in principle with the recommendations advanced by the Association from time to time.

The question of the consolidation of existing water-works legislation was not touched upon in the report of the Joint Committee on Lord Desborough's Bill; and your Committee think that, in view of the expressed intention of the Government to introduce a Bill, the Association should take the initiative in formulating in outline suggestions on the various points in water legislation requiring amendment or consolidation with the view of creating uniformity in practice.

To give practical effect to the recommendations of the Committee, Mr. Devonshire moved:

(1) That the Association of Water-Works Engineers note with satisfaction the passing by the House of Commons of an order for a return to be made by the Local Government Board of statistics as to the powers, limits, nature, source, and sufficiency of supply of authorized water undertakings, as well as particulars as to the population, number

* The report was published in the "JOURNAL" for July 26, p. 280.

of houses, source, and sufficiency of supply, whether piped or not, in every district in England and Wales; an inquiry to this end being in accord with the recommendations made by the Association.

(2) That in view of the probable introduction of a Bill dealing with matters affecting the national water supply, the Council be requested to take steps to protect the interests of water undertakings so as to secure the amendment, consolidation, and uniformity of legislation.

Mr. W. MATTHEWS, in seconding, said he thought the time had arrived when the Association should pass such resolutions, because they would strengthen the position of the Committee who had been acting in this matter, and that of the Council who had adopted their reports. The Bill was sprung upon the Association suddenly; and its provisions appeared at once so absolutely dangerous to every water authority and undertaking in the country, that very prompt action had to be taken. The Committee did their best under the circumstances; and he hoped that what was done would meet with the general approval of those interested in the matter. He thought the Association might congratulate themselves that, in the opposition to the Bill, they appeared in the very forefront; and that their position and their status were thoroughly well recognized by everybody engaged in the inquiry. The Committee were anxious the Association should not be allowed to go back from this position, but that they should maintain it, as it had undoubtedly acquired for them an influence for good in the future. They thought that, in the interests of everybody concerned, they should take steps now to be (what he might term) just a little bit in front of the Government Bill. The Committee had every reason to think that, if they put suggestions before the Local Government Board, they were likely to get a very patient and proper hearing, and that the Board would welcome any suggestions from them.

Mr. E. J. SILCOCK (Leeds) congratulated the Committee upon the results of their labours, as indicated by the decisions to which the Parliamentary Committee had arrived. With regard to the resolutions before the meeting, no doubt the members would be involved in considerable trouble in getting out all the particulars required; but they would have the satisfaction of knowing they would be preparing statistics which would form the foundation of very useful work that would be of national value.

Mr. F. W. HODSON (Loughborough) agreed with the suggestion that the Council should ask the authorities who had benefited by the work of the Committee to assist in the payment of the expenses which had been, and would be, necessarily incurred in adequately dealing with this matter. It was a good idea, as many of the smaller authorities could not possibly individually oppose or promote any suggestions which might be brought before Parliament.

Mr. E. ANTONY LEES (Birmingham) said he took it, in view of the return that would have to be made to the Local Government Board, that the independent collection of statistics by the Association would be suspended for a time. Probably the returns that would have to be made to the Board would be available to the Association, and would supply the information they had sought to obtain. It had occurred to him that it would be a great pity to have the work duplicated.

Mr. R. ASKWITH (Weardale and Consett Water Company) did not agree with Mr. Lees. He thought the Association had better enter into the matter at once, and obtain information which would help to lead the Local Government Board, so as to keep things in the right course.

Mr. A. B. E. BLACKBURN (Sunderland) supported the action of the Council. He heard the evidence of both Mr. Matthews and Mr. Percy Griffith before the Committee; and he was fortunate enough to be called as a witness himself against the Bill. Therefore, he knew what had actually taken place. The members were to be heartily congratulated on the position the Association had taken in regard to the matter.

The resolutions of Mr. Devonshire were unanimously carried.

Mr. E. Y. HARRISON (Wellingborough) proposed a resolution recording the thanks of the members to the Committee for the way in which they had dealt with the matter.

Mr. J. F. CULLEN (Deal) seconded the motion.

The PRESIDENT observed that he had been anticipated. It had been his intention to express to Mr. Devonshire, Mr. Matthews, Mr. Bancroft, and the Secretary their appreciation of their services, because he knew what an immense amount of work they had done in connection with the Bill. Mr. Whitaker had also rendered a large amount of assistance.

The motion was heartily passed.

Mr. DEVONSHIRE, in reply, remarked that it was satisfactory to the Committee to know they had been able to earn the thanks of the members. The work had been hard; and they had had a great deal of information to assimilate to help them in preparing the evidence to lay before the Joint Select Committee. He did not like the suggestion made by Mr. Lees. If the Committee were to forestall any action which might be taken by the Government, they ought to know in advance the information the water authorities had been supplying to the Local Government Board.

Mr. LEES repudiated any desire to keep information from the Committee. But it seemed to him if the Committee were furnished with the details sent to the Local Government Board, that would suffice, and would save double work.

Mr. PERCY GRIFFITH remarked that the particulars furnished to the Association would probably prove to be additional to what would be asked for by the Local Government Board. The Committee had said in their report that they did not know the nature of the questions which would be sent out to the water authorities; and until they knew it, they could not say what more should be given to the Association. It would be a pity if the members considered the order of the House of Commons should in any way take the place of the returns asked for by the Association. At the present time, they were acquiring a valuable accumulation of maps at the office which would be of great service. The information would be valuable for reference, and no doubt for use in connection with any movement that might be made to protect the interests of water authorities.

ELECTION OF OFFICE-BEARERS.

The Scrutineers (Messrs. J. C. Hawkins and W. Shaw) reported the following elections to office:

President: Mr. Edward Sandeman (Derwent Valley).

Vice-Presidents: Mr. Joseph Spiers Pickering (Cheltenham), and Mr. Charles Clemesha Smith (Wakefield).

Ordinary Members of Council: Messrs. Easton Devonshire (London), G. Greenslade (South Hants), F. Griffith (Leicester), H. Ashton Hill (South Staffordshire), W. Matthews (Westminster), F. W. M'Cullough (Belfast), T. Molyneux (Stockport), R. H. Wyrill (Swansea), C. H. Priestley (Cardiff), and A. B. E. Blackburn (Sunderland).

Honorary Secretary and Treasurer: Mr. W. G. Peirce (Richmond).

PLACE AND DATE OF NEXT MEETING.

Mr. SANDEMAN, having thanked the members for the honour done him, said that he had been considering the question of the meeting next summer; and he suggested that Buxton would be a suitable place. The Buxton District Council had offered the use of the Town Hall; and his Water Board extended a cordial invitation to the Association to visit their works. The dates suggested for the meeting were May 25, 26, and 27. This was rather earlier than usual, as, if the meeting was held the first week in June, it would clash with the Whitsun holidays.

NEW MEMBERS.

The roll of membership was extended by the following names:

Members.—Mr. T. Booth, of Stamford; Mr. G. G. Bullmore, of Newquay; Mr. A. E. Cornewall-Walker, of Redhill, Surrey; and Mr. Walter Hunter, of Westminster.

Associate Members.—Mr. C. Boldry, of Chesterfield; Mr. P. N. Buchan, of Plymouth; Mr. H. Cottam, of Grizedale Lea Reservoir (Fylde Water Board); Mr. W. Criswell, of Eccles, Manchester; Mr. C. G. Kent, of Rochester; Mr. A. Murray-Smith, of Cheltenham; and Mr. G. K. Sutherland, of Cardiff.

Associates.—Mr. T. C. Pulman, of London; and Mr. W. P. Walker, of London.

Mr. T. Waddingham was transferred from the class of associate members to that of members.

INCORPORATION.

The PRESIDENT remarked that, at the summer meeting, he mentioned that the matter of the incorporation of the Association was in hand. The question had taken the Council more time and anxious consideration than they had anticipated; and it was still under discussion. They were giving careful attention to all proposals in connection with it. With one or two more meetings of the Council, however, they might be able to get the matter ready for the next summer meeting.

VOTES OF THANKS.

Votes of thanks were passed to the President and Council of the Geological Society for the use of their rooms for the meeting, to the authors of the papers, and to the Scrutineers.

This concluded the business before the meeting.

Glover-West Vertical Retorts for Bradford.—The Bradford City Council will have before them at their meeting to-day a recommendation by the Gas Committee to sanction the acceptance of the tender of West's Gas Improvement Company, Limited, for the erection of 64 Glover-West vertical retorts at the Thornton Road works. This will be a 2 million cubic feet per day plant, and the largest installation of vertical retorts ordered so far for this country.

Reduction in Price by the Gaslight and Coke Company.—It was mentioned in the "JOURNAL" for the 22nd ult. that at the meeting of the Directors of the Gaslight and Coke Company the previous Friday it was decided to reduce the price of gas 1d. per 1000 cubic feet as from the taking of the meter indices for the current quarter. The decision has now been announced in most of the newspapers. This is the fourth year in succession that a reduction has been made; and the latest will bring the figure down to 2s. 7d. per 1000 cubic feet.

Physical Society's Annual Exhibition.—The sixth annual exhibition of scientific apparatus will be held by the Physical Society of London on Tuesday next, at the Imperial College of Science, South Kensington. It will be open, as last year, in the afternoon from three till six, and in the evening from seven till ten. Among the firms who will exhibit, those in which readers of the "JOURNAL" are interested are the Cambridge Scientific Instrument Company, Messrs. J. J. Griffin and Sons, Messrs. Townson and Mercer, and Messrs. Alexander Wright and Co.

THE TEN MILLION CUBIC FEET GASHOLDER AT MANCHESTER.

By Frank H. Robinson, Assoc.M.Inst.C.E.

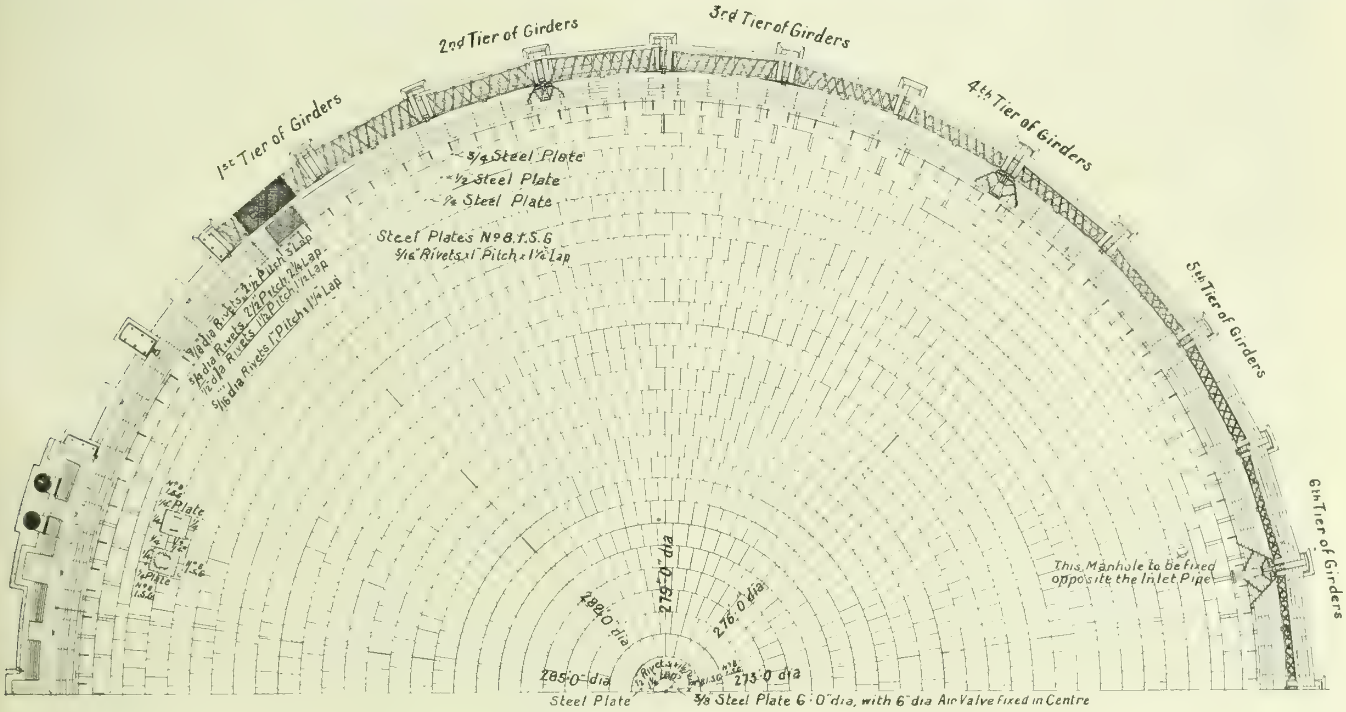
[A Paper read before the Manchester Association of Students of the Institution of Civil Engineers.]

This paper completes the description of the large structure now being erected at the Bradford Road Gas-Works, Manchester. The brick and puddle tank with its steel framing and inlet and outlet pipes was fully dealt with on the 24th of November last year, in a paper read by the author before the Association.* For the benefit of those who were not present on that occasion, he gave the following particulars.

The tank is 285 feet diameter and 43 feet deep to the top of the rest-stones from the coping. It is built in brick, set in cement mortar with a clay puddle backing; and the foundations and covering of the cone are in 5 to 1 portland cement concrete. The steel framing in the tank weighs 258 tons. The water required to fill the tank was 9,042,018 gallons. The inlet and outlet pipes are 42 inches inside diameter. The gasholder is a four-lift one. The outer lift is 282 feet diameter, the third lift 279 feet diameter, and the second lift 276 feet diameter—all these lifts being 42 ft. 6 in. deep. The inner lift is 273 feet in diameter and 43 feet deep, with its crown having a rise of 20 feet in the centre, forming a segment of a sphere with a radius of 476 feet. The guide-framing will extend the whole height of the holder when inflated, and consists of 32 lattice steel standards connected together by six tiers of horizontal lattice girders, and braced together diagonally. The total capacity of the holder when fully extended is 10,410,000 cubic feet. The height to the top of the crown will then be 182 feet; the standards reaching a height of 169 ft. 6 in. from the ground level. The floating weight of the holder itself is 1607 tons; and the total weight of steel and iron in the holder complete, but excluding the tank framing, is 3080 tons. The estimated cost of £52,600 includes the whole of the iron and steel work in the tank and holder complete.

The author then gave the following detailed description of the structure, and incidentally dealt with features which govern the design of gasholders.

The gasholder itself consists of a cylindrical vessel, in four sections, which rests in the tank of water like a closed telescope when the holder is empty, and appears like a huge extended telescope when fully inflated. Each lift slides in and out of the next larger lift as the holder falls and rises in exactly the same manner as tubes of an ordinary telescope. The water in the tank serves a threefold purpose: (1) To prevent the escape of gas from the holder; (2) to provide resistance to the gas as the holder rises; and (3) to expel the gas from the holder as the latter falls.



[Rise of Crown at Centre, 20 feet.]

Half-Plan of the New Holder at the Bradford Road (Manchester) Gas-Works.

In this holder there are four lifts or sections. The first or inner lift will now be described, followed by the others, and then the guide-framing.

Inner Lift.

The top curb is formed of an outer row of steel crown plates $\frac{3}{4}$-inch thick, a second row of plates $\frac{1}{2}$-inch thick, a ring of $\frac{3}{4}$-inch steel plates 16 inches wide, fixed at right angles to the crown underneath, and attached thereto by 4 inch by 4 inch by $\frac{3}{4}$ inch steel angles. In addition to the above, the top row of side plates, 3 feet deep and $\frac{5}{8}$ inch thick, together with a ring of 6 inch by 6 inch by $\frac{5}{8}$-inch splayed steel angle uniting these plates to the crown, complete the curb; the total sectional area being 115 square inches. All these curb plates are butt-jointed with planed joints, so that the whole cross area of the curb shall be effective. The crown plates are all correctly radiated, and cut to the proper curves. All the joints are covered with cover-plates $\frac{1}{8}$ inch thicker than the plates the joints of which they cover, and are secured with zigzag riveting. This curb is subjected to great compound stress, and must therefore be very rigid, so that no distortion may take place in a high wind when the holder is fully inflated.

The forces acting on the curb are as follows: (1) The pull of the top sheets caused by the pressure of the gas on the under side of the crown. (2) The wind pressure acting horizontally on the side sheets and transmitted to the curb. (3) The weight of the side sheets, outer lifts, &c., acting in a downward direction. (4) The pressure of gas on the side sheets from within acting in a horizontal direction.

The resultant of these forces is found to cause compression in the curb. The curb would therefore fail by buckling or else by compression. In this holder, the stress works out at 6 tons per square inch on the curb, which is a safe working stress. As there is always a certain tendency for a gasholder curb to buckle, it is as well to keep the stress low. Further, extra strength here relieves the guide-framing of a good deal of stress, and reduces very considerably any tendency in the latter to distort.

In connection with gasholders, Mr. F. Southwell Cripps, Assoc. M.Inst.C.E., has gone very fully into all the stresses and their solutions, and has deduced many formulæ for arriving at these stresses; one of these being used in the case given above. Too much time would be taken up if the author were to submit and explain all these formulæ, besides serving no useful purpose. There are 100 pages of diagrams and printed matter in Mr. Cripps's book on "The Guide Framing of Gasholders, &c.," in which only stresses are dealt with. It would be obviously too much for any audience to sit and listen to a recital of such an amount of theoretical matter, however interesting it might be. The author will therefore only point out the principal features of gasholder design.

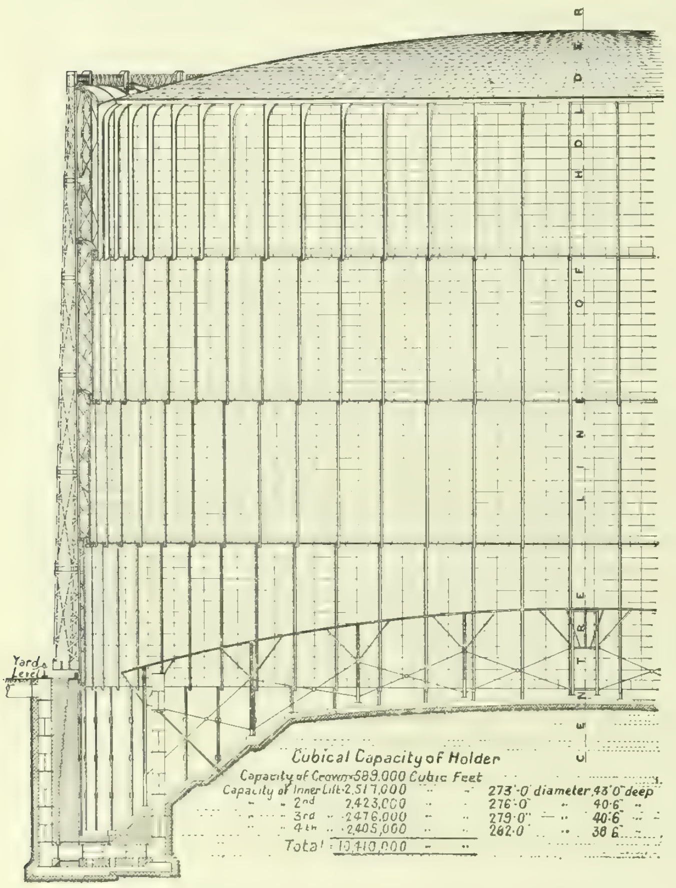
The hydraulic cup is on Piggott's system, $21\frac{1}{2}$ inches deep, $11\frac{1}{2}$ inches wide inside, and made of $\frac{1}{2}$-inch plate bent to the correct shape. On the inside edge of this cup, a stiffening bead of 3 inch by $\frac{3}{4}$ inch steel is riveted.

The "cup and grip" together form the water seal between the lifts, to prevent any escape of gas; the water being contained in the cup, which must be sufficiently deep to prevent any escape of gas when at maximum pressure.

* See "Journal," Vol. CVIII., p. 609. Reference may also be made to the paper containing particulars of the tank prepared by Mr. J. G. Newbigging for the Manchester District Institution of Gas Engineers—given in the "Journal" for March 2, 1909 (p. 618); and to the account of the inspection of the tank and holder by members of the City Council, contained in the issue for Sept. 27 last (p. 838).

The side sheets of the lift vary in thickness according to position. As previously mentioned, the top row forming part of the curb is ⅝-inch thick. The following row, and also the next to the cup are ¼-inch thick. The remaining intermediate rows of sheeting are of No. 9 imperial standard gauge thickness of steel, riveted with $\frac{5}{16}$-inch rivets, 1-inch pitch, and 1¼-inch laps. Opposite to each vertical stay, and riveted to it, is a vertical strip of ½-inch plate, 18 inches wide, extending from the ⅝-inch curb plates to the ½-inch cup plates, in two lengths, and butt-jointed at the centre. The side sheets are riveted to these vertical strips with ⅝-inch rivets, 2-inch pitch. For the purpose of stiffening the lift, there are 64 vertical stays, placed opposite to, and intermediate between, the standards. They consist of upright plate girders, 18 inches deep by 6⅝ inches wide, with shaped ends. Additional horizontal stays are fixed between the feet of the stays, and are left straight—not being bent to the curve of the holder.

As already mentioned, the two outer rows of crown plates at the curb are thicker than the others, as the principal stress comes on the curb. The next row—*i.e.*, the third—is ¼-inch thick. The centre plate is 6 feet in diameter by ⅜-inch thick; the row next to this being ¼-inch thick. All the intermediate rows are then of No. 8 imperial standard gauge thickness of steel. The whole of the sheets are correctly radiated and cut to the required curves on the circumferential edges. Two manholes are provided in the holder crown—one over the inlet pipe, the other over the



Sectional Elevation of the Standards, Holder, Tank, and Framing.

outlet pipe. They are of the Livesey type, and enable the pipes to be inspected without blowing out the gas from the crown of the holder when down on the rest-stones, a water seal being provided. There is also an ordinary manhole fixed to the crown on the opposite side to the inlet and outlet pipes, for access to the interior of the holder.

An air-valve, 6-inch bore, is provided in the centre crown plate for discharging the contents of the holder crown. Round the curb of this inner lift there is a hand-rail, composed of three tiers of 1¼-inch gas-tubing. Two landings are fixed to the lift. They consist of chequered plates hinged to the holder curb; the outer or free end being suspended by chains from the hand-railing. These landings are fixed near the ladders in the guide-framing, so that men may be able to get on to the crown of the holder whatever its position may be.

The top guide-carriages are each provided with three cast-iron rollers—one radial and two tangential. The radial rollers are 24 inch diameter, with 2¼-inches diameter steel axles, provided with forks and adjusting screws, so that the face of the rollers may be brought up to the guides or otherwise; slotted holes being provided in the sides of the carriages for this purpose. The tangential rollers are 18 inches diameter, mounted on 1¾-inch steel axles, and roll up and down the flanges of the H-steel guides. The carriages themselves are formed of steel plates and angles with additional steel angle wing stays from the rollers to the crown to counteract any side play. All rollers have turned rims, with bosses turned, faced, and bushed with ⅝-inch thick steel bushes. The total number of these carriages is 32—*i.e.*, one opposite each standard; and each weighs, without rollers, 26 cwt.

Attached to the cup at the bottom of the lift are 64 carriages and rollers; the carriages being formed of steel plates and angles. The rollers are 12 inches diameter; and they roll up and down the guides on the inside of the second lift. The axle holes are, as in the larger carriages above, slotted to allow for an adjustment being made. Steel wedges are also inserted behind the carriages to prevent any slipping back when once they have been adjusted. The ends and nuts of all the axles are drilled and then fitted with split pins.

The total weight of the lift is 672 tons, which will give a pressure of 4·9 inches of water when stationary. The friction of the rollers, snow, and wind, will, in a slight degree, add to, or take away from, the pressure given above as the lift rises or falls.

Second Lift.

We now come to the second lift, which is 3 feet greater in diameter and 6 inches less in depth than the first or inner lift. The cup and grip of this lift are exactly the same as the cup for the inner lift; the grip being provided with a number of cast-steel rest blocks, to receive the weight of the other lifts when the holder is extended. These blocks prevent any wearing on the plate. On the inside of the sheeting, and secured thereto by ¾-inch rivets, 6-inch pitch, are 64 guides, formed of 3¾ in. by 2½ in. by ½ in. bulb angles in pairs, up and down which the rollers of the bottom carriages on the inner lift travel. These guides also stiffen the sheets. They are attached to vertical strips of ½-inch plate similar to those for the inner lift. On the outside of these plates, and back to back with the inner bulb angle guides, are similar pairs of bulb angles running vertically from cup to grip, riveted through to the guides inside; these also acting as stiffeners. The rows of side sheets next to the cup and grip are ¼-inch thick and 2 ft. 11 in. deep, centre to centre of rivets; all the intermediate rows being No. 9 imperial standard gauge, and 3 ft. 2 in. deep, centre to centre of rivets.

The grip carriages are similar to those on the first lift, but smaller. The radial and tangential rollers are 18 inches and 15 inches diameter respectively. The cup carriages and rollers are exactly like those on the inner lift, and the same number. This lift weighs 321 tons, and will throw an extra pressure of about 2·3 inches of water.

Third Lift.

This is again 3 feet larger than the second lift, and the grip carriages are smaller; but in other respects it is identical with the second lift. Its weight is 307 tons, giving an extra pressure of about 2·16 inches of water.

Fourth or Outer Lift.

In this lift, which is 282 feet in diameter and 42 ft. 6 in. deep, there is a hydraulic grip formed out of the top row of plates exactly like those on the second and third lifts. The bottom curb is subjected to bending stresses and must therefore be stiff. This bottom curb is formed of a 10 in. by ⅜ in. steel plate fixed at right angles to the side sheets by a 4 in. by 4 in. by ⅜ in. steel angle, and also a ring of 8 in. by 3½ in. steel channel set edgeways to the side of the holder, 15 inches above the bottom plate. The bottom roller carriages are fixed between the channel and the bottom curb plate, thereby stiffening both. The curb plate is also stiffened by steel gusset brackets underneath; these brackets being attached to the channel steel guides inside—one opposite each of the 32 channel guides fixed to the side of the tank. In addition to these, and midway between the bottom curb carriages, additional steel brackets are fixed between the ring of channel steel and the curb plate. All this stiffening reduces to a minimum any tendency to buckle.

The bottom row of plates to this lift is ½ inch in thickness and 2 ft. 6 in. deep; the next row being ¼ inch thick and 2 ft. 11 in. deep; all the intermediate rows being of No. 9 imperial standard gauge and 3 ft. 2 in. deep—all rows being measured from centre to centre of the rivets. All seams are provided with linen tape of sufficient width, well smeared on both sides with red lead before riveting up. The guides and stiffeners to this lift are similar to those on the other lifts. The grip carriages are in this case fixed to the side of the grip, instead of the top. This allows the carriages to the other lifts to be brought lower down, and so save height and weight. There are only radial rollers to these carriages. They are 10½ inches in diameter by 5 inches wide, and have axle pins of hardened steel, 1½ inches diameter, reduced to 1¼ inches at the ends. All the carriages have slotted holes in the cheeks to allow for roller adjustment. Steel wedges are used for these carriages, as for the cup carriages previously described. The bottom curb carriages are practically the same as those on the grip. Their rollers work up and down the channel steel guides fixed to the tank wall.

The weight of this lift is about 307 tons, and gives an additional pressure of 2·1 inches of water. The total floating weight of the holder, when fully inflated, is about 1607 tons. To this must be added the weight of the water in the cups. A total of almost 12 inches of water is the pressure then obtained for the holder fully inflated. This will apply when the holder is stationary and free from snow or wind pressure. Either of these, and friction of rollers, will affect the actual pressure in some degree. A gale is often registered on the charts of the governors by a wavy line caused by the oscillations of the pencil; these oscillations being produced by pulsations in the mains corresponding to strong

gusts of wind on the holders—the gas in the mains being the medium by which these pulsations are conveyed.

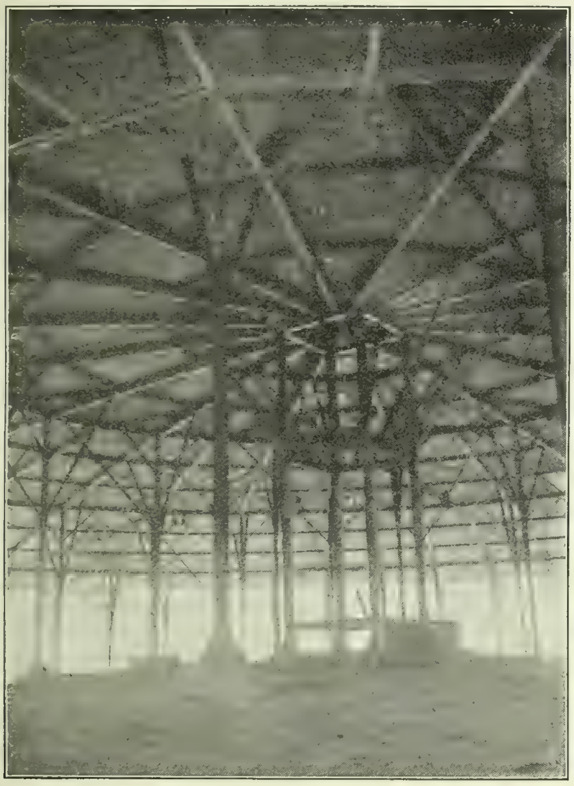
Factors Influencing Gasholder Design.

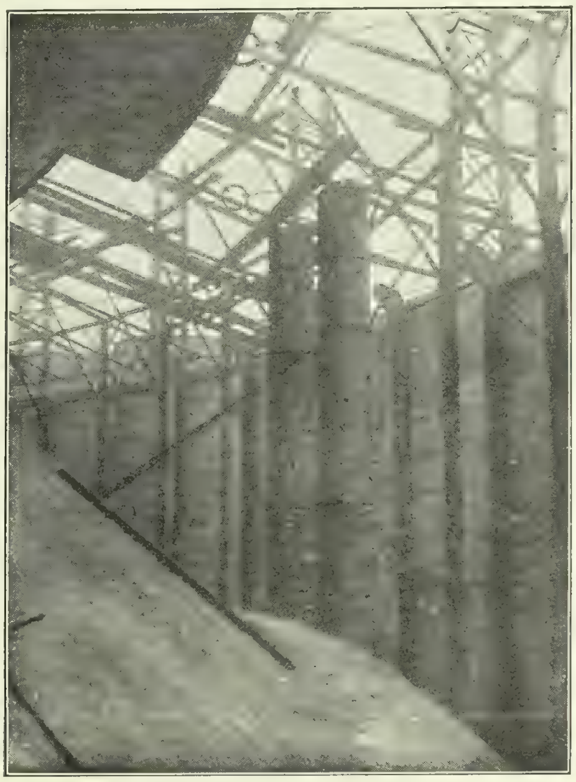
Before passing on to describe the guide-framing, a few of the factors influencing gasholder design will be dealt with. With gasholders, as with ships, there are centres of gravity and buoyancy. The centre of gravity is the point at which the whole weight of the gasholder is supposed to act vertically downwards. The centre of buoyancy is the point at which the whole of the upward pressure of the gas is supposed to act, and is generally below the centre of gravity; the only exception being when the first lift is but a few sheets out of the water. Therefore, there is almost always present a tendency to overturn. The overturning would take place with the slightest force acting sideways if some method of guiding the holder were not used; and the greater the tilt, the more unfavourable the conditions become for equilibrium. Guiding in some form or other is, therefore, absolutely necessary to maintain equilibrium. If guiding were not provided above the tank, and only one circle of rollers were used—viz., those rolling up the tank guides—the holder would revolve about two of the bottom rollers diametrically opposite, gas would escape from one side, and the other side would crash into the edge of the tank, and perhaps buckle up.

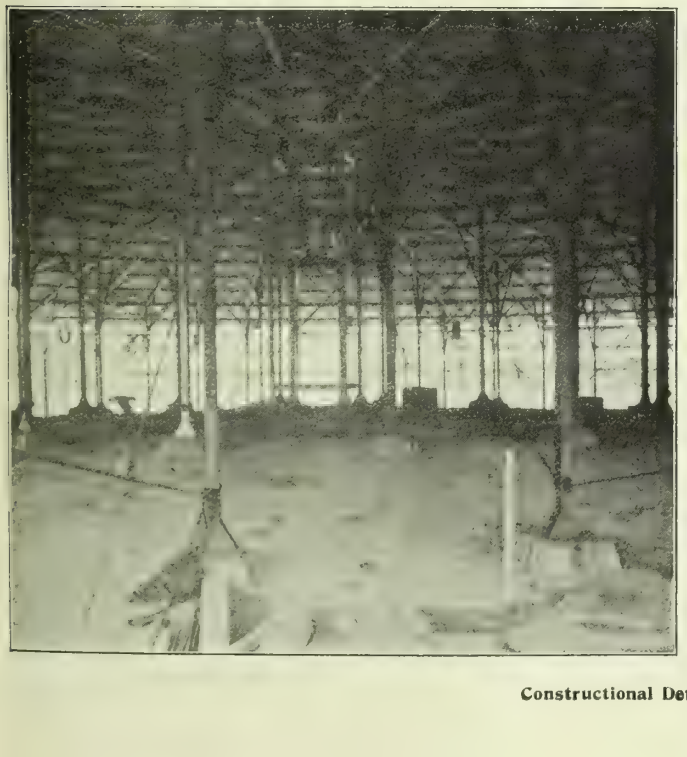
The forces tending to overturn a holder are snow and wind. The tendency of the wind is to produce a certain amount of wedge action and to flatten the holder into an ellipse. As stated previously, the curbs take up the stresses in the holder itself for the most part. The cups and grips, and even the sheets themselves, also come in for their share of the stresses. If the vertical stays and guides in each lift are well secured to the sheeting, as in this case, the spring and the racking are reduced to a minimum, and greater rigidity, with less tendency to distortion of the lifts, is obtained. In some holders the vertical stays are only secured top and bottom. Hence, there is very little in the way of a stiffened web to take up the shear except thin sheets, which are only kept straight by the weight suspended from them.

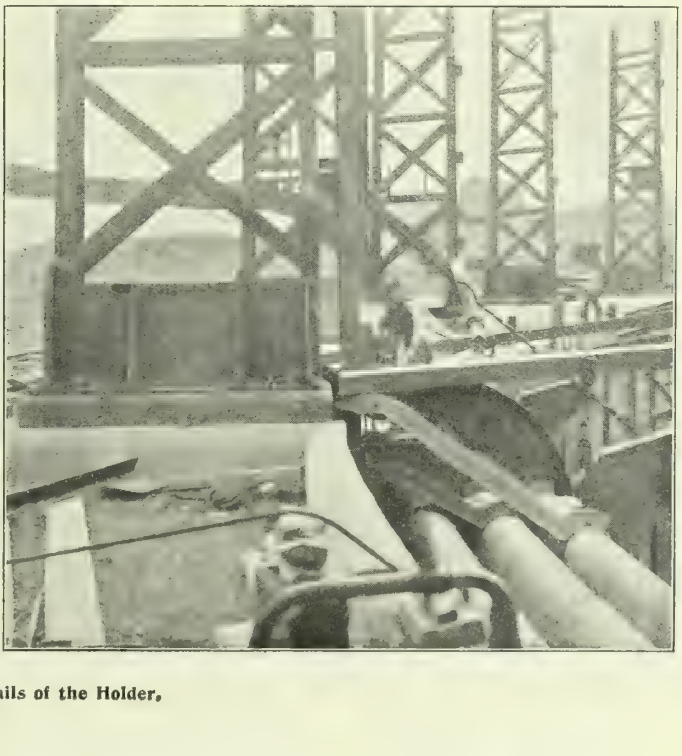
The tension in the crown sheets varies "directly as the radius of the sphere of which the top is a segment and as the pressure of the gas;" and it is the same in all directions. This is proved by Mr. Cripps in his book on the subject. It will be noticed that there is no trussing to the crown of the holder; the tank framing in this case supporting the crown sheets when the holder is empty. In smaller holders, trussing in the form of a huge umbrella frame is provided. It might be asked why such a trussing is not used in this case. In answer to this, I cannot do better than quote from Mr. Cripps's work. He says:

> It is easy to show that the advantage of an untrussed top is greater in a large gasholder than in a small one; for the separate frame built in the tank does not require to be much stronger, however large the gasholder may be made. In other words, the framing for carrying a 200 feet top need not be any stronger, area for area, than for a 100 feet









Constructional Details of the Holder.

top; the only difference being that there is four times as much area to support. But with a trussed top, a 200 feet gasholder not only requires four times as much trussing as a 100 feet holder, but (owing to the increase of span) it must also be made of much stronger sections in order to carry itself. It is, therefore, much heavier in proportion. It follows, then, that there must be a limit beyond which it is decidedly uneconomical to adopt a trussed top; and this limit can only be determined by comparing the cost of two plans of gasholders of the same size.

As a general practice, holders 150 feet in diameter and over have untrussed crowns. There is undoubtedly greater stress in the curb with an untrussed crown than with a trussed crown; but the extra metal required is very small compared with the saving in weight in the framing. Further, it is not desirable to have too great a pressure, as this pressure only throws more work on the exhausters, and is objectionable to a certain extent in other ways. In calculating the effective wind pressure on the holder, due allowance must, of course, be made for the circular shape of the holder, and for the fact that the wind pressure at the ground level is much less than at a great elevation. At the Forth Bridge, the pressure recorded at a height of 70 feet was 12 lbs. per square foot; at 210 feet, 11 to 15 lbs.; and at 375 feet, 15 to 24 lbs.

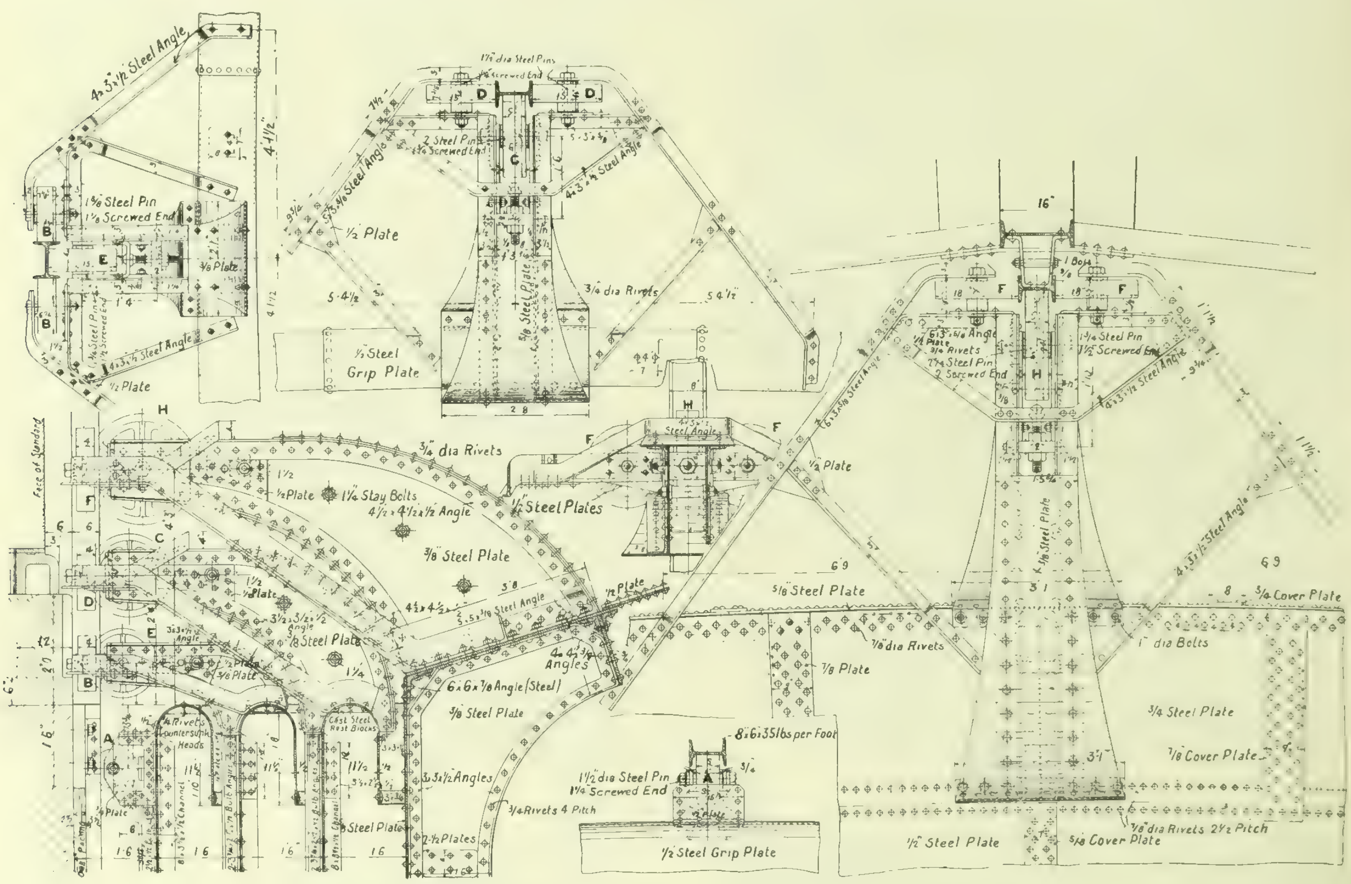
Guide-Framing.

Having now dealt with the gasholder itself, we will turn our attention to the guide-framing.

The guide-framing consists of 32 steel standards, each firmly bolted to a masonry pier of the tank with six 3 inch diameter bolts 13 ft. 3 in. long; the bottom ends being held together by a ⅞-inch steel plate built into the brickwork. The bracing between the standards consists of six tiers of horizontal lattice girders and diagonal bracing between. Each standard is 168 feet high over all, 7 feet deep at the base and 2 feet at the top, and is composed entirely of steel sections. The front and back members are of H section, 16-in. by 6-in. by 62 lbs., united by horizontal struts of 6-in. by 4-in by ½-in. tees, and diagonal flat bars ½-inch thick, varying in width from 6 inches at the foot of the standard to 3½ inches at the top. Side plates of ¾-inch are provided at the foot, further strengthened with gussets secured to the bottom plates. These bottom plates are 1 inch thick by 4 feet wide, and are secured to the side plates by steel angles; the rivets being countersunk below. The standards are erected on cast-iron base-plates 4 ft. 6 in. wide by 7 ft. 11½ in. long and 8¾ in. deep, of 2-inch metal. On the top of each standard are riveted two steel angles attached to the top plate of steel, 2 feet wide by ½ inch thick, and projecting over the front of the standard to cover the end of the guide—being attached by angle brackets.

At the junction of the girders with the standards, large junction plates are riveted to the back and front limbs of the standards for securing the girders and bracing. The plates on the back or outside on the first two tiers from the ground are ¾-inch thick, on the third and fourth tiers ⅝-inch thick, and on the two top tiers ½-inch thick. The plates on the front are all ½-inch thick. The overall sizes of these plates also vary according to position. To fill up the space between the plates and the web of the joists forming the standards, cast-iron blocks are provided.

Of the six tiers of girders, five are horizontal lattice girders



Details of the New Manchester Gasholder—Top Curb, Grips, Guide-Carriages, &c.

composed of steel channels and angles; and the sixth or top tier is box-shaped and latticed. The top girders are 4 feet deep by 2 feet wide, and are composed of four angles, 6 in. by 4 in. by ½ in., joined together by ½-inch flat steel lattice bars on all sides. The intermediate tiers are formed of two steel channels 12 in. by 3½ in., united top and bottom by steel angle lattice bars, the largest bars being on the lowest and widest girders. The width of the girders varies according to their position, and is slightly less than the standard at the place where they join the standard. These girders are attached to the standards by ½-inch steel plates riveted to the T-steel struts of the standards, and also attached to the junction plates back and front.

The diagonal bracing consists of flat bars. The first four tiers have bars ¾-inch thick and varying in width from 9 inches at the bottom to 6 inches at the fourth tier. The remaining tiers have bars ⅝-inch thick; those in the fifth tier being 5 inches wide and in the top tier 4 inches wide. All bars are in one length, and are riveted at crossings. The ends of the bracing bars are riveted to the junction plates by ⅞-inch rivets.

The guides forming the path for the carriage rollers are formed of H section steel, 8 in. by 6 in. by 35 lbs., secured to the back of the standards by brackets of ⅝-inch steel plate, 1 foot long, fixed 6 ft. 8½ in. centre to centre. The radial rollers of the carriages travel up and down the web, while the tangential rollers travel up and down the flanges. To illustrate the great pressure on the tangential rollers on a large holder, the flanges of similar guides on the existing 7 million cubic feet holder at Bradford Road have been bent ½ inch away from their true position; having received a permanent set of this amount.

For the purpose of reaching the crown of the holder when in any position, in two opposite bays are ladders and platforms, one platform on each tier of girders.

To prevent the freezing of the water in the cups in winter time, two complete sets of Cutler's anti-freezing apparatus are provided.

The total weight of the guide-framing and holder complete is about 3080 tons; each standard and its guide weighing 30 tons. The tank framing and inlet and outlet pipes are painted with three good coats of red-lead paint. All the external work is painted with two good coats of red-lead paint, and one finishing coat of William's "Viternus" paint. The whole of the work received one coat of paint before delivery. In our experience in gas-works, we find red lead to be the most satisfactory paint for steel work. To avoid discoloration from sulphuretted hydrogen, a finishing coat of some other paint free from lead, and possessing a similar rate of expansion, may be applied as in this case.

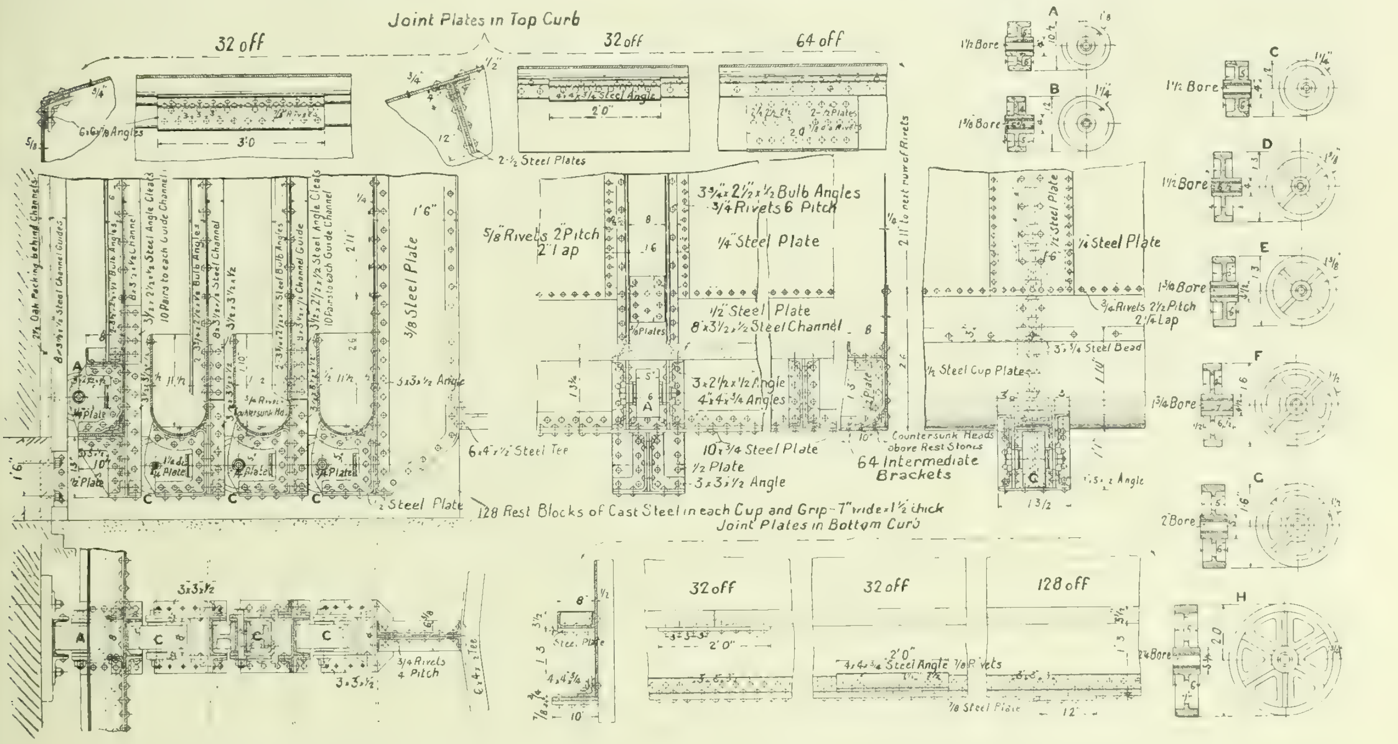
The stresses to which guide-faming may be subjected are somewhat complex, on account of the huge dimensions and the circular form of the structure. When a high wind is blowing, the effect produced is to drive the holder against the standards on the leeward side, and throw these into compression and those on the windward side into tension—the whole framing being con-

sidered as a vertical cantilever of circular form. The horizontal girders are therefore the struts and the diagonal bracing the ties. To find the true moment of inertia of this huge cantilever is a very complicated process if extreme accuracy is required, as the standards are not symmetrical, and each is at a different angle to the neutral axis. With circular columns, it would be simpler, but with built-up standards every standard requires different treatment. The question as to whether the framing should be treated as a vertical cantilever, or whether the standards should be considered as independent posts tied together, is dependent upon design. The greater the amount of the bracing, the truer the cantilever theory becomes. There is then very little stress on the standards; but owing to the elasticity of the steel, and the inevitable springiness of the structure as a whole, and the imperfect contact of bell with frame, it seems more likely that a light standard on the leeward side would collapse by buckling, although theoretically strong enough for purely compression stress, before any great tension could come on to the one on the opposite side. This being the case, it appears the safer plan to consider this particular guide-framing as coming between the multipost type and the cantilever type, and give the standards plenty of lateral support in the way of cross girders and ties, and plenty of depth from front to back. For these reasons, the cross girders are, with the exception of the top tier, fixed flat, and occupy the whole depth of the standards at the points where they join them.

The force tending to distort a gasholder out of the true circle, and thus produce a bending moment upon the standards, was assumed by the late Sir Benjamin Baker, on the Old Kent Road $8\frac{1}{2}$ million cubic feet gasholder, designed by the late Sir George Livesey, as being "equal to 14 lbs. pressure per square foot when distributed over a surface equal to about three-fourths the total depth of the holder multiplied by the distance between two columns or standards." This 14 lbs. is the figure obtained after allowing for the circular form of the structure, and for the assumption that the pressure is not the same over the whole of such a large surface at the same moment, and that the pressure varies according to the height. In addition to wind pressure, allowance must be made for the tilting effect of the snow on the leeward side of the crown, which will also cause an extra thrust on the carriages on this side, and so increase the bending moment on the standards. Also, the dead-weight per standard must be taken into account. In this case, it amounts to close upon 63 tons per standard, including the proportion of load due to bracing.

Summing up all these forces acting on the standards, and assuming the worst conditions, we get as a maximum compressive stress, $7\frac{3}{4}$ tons per square inch, using Cripps's formulæ for the whole cantilever. This may appear somewhat high; but it is assuming that the whole force of the wind and snow to be concentrated on one standard or point in the circle. As this is extremely unlikely with 16 carriages in the half circle on each lift available for taking up the wind pressure, the stress will be distributed, and therefore much less than $7\frac{3}{4}$ tons per square inch, and thus perfectly safe.

If the framing be considered as belonging to the independent column or multipost type, the stress becomes about $5\frac{1}{2}$ tons per square inch at the base of the standards. The stress on the bottom row of ties works out at $5\frac{1}{2}$ tons per square inch. On the bottom tier of girders or struts, the stress is about 2 tons per square inch; the safe working load for a strut of this section and length being about 3·6 tons per square inch. It will be seen that there is ample margin of safety. In the neighbourhood of the Bradford Road, the air is highly charged with acid and other corrosive agents from the chemical works in the vicinity. It is therefore imperative to have plenty of margin if the structure is to resist corrosion for any length of time. The sheeting is also, for this reason, made thicker than might be expected.



Details of the New Manchester Gasholder.—Bottom Curb, Cups, Curb and Cup Carriages, Guides, Cast-Iron Rollers, &c.

METHOD OF ERECTION.

The general design of the structure having now been dealt with, the method of erection will be briefly described. On completion of the tank, the steel framing inside and the tank-guides were fixed. These were followed by the fixing of the curb of the outer lift on the rest-stones. Then the vertical guides and the stiffeners, with their plates, were fixed to the curb, and the sheeting followed—being finished off with the grip. Six or eight sheets are sent from the shops riveted together, to save a great amount of handling on the site. This order was followed in the next two lifts; the only difference being that the cup in these cases took the place of the curb on the outer lift. The inner lift was run up in a similar manner, with the vertical stays all fixed; and the top curb was completed before the crown sheets were attached. The laying of the crown sheets was commenced at the centre, and will join up to the curb shortly.

The guide-framing may be erected any time. The standards are to be run up in sections, and braced by the cross-girders as they rise. Up to the present, the first tier of girders has been reached. The other sections will be erected as the holder rises during testing; the crown of the holder being used as a scaffold. The carriages and rollers may be put on at any time after the first tier of girders is fixed; final adjustments being made when the holder is inflated with air.

All the charges of plates and bars were inspected and tested at the steel works prior to dispatch, and marked with a stamp; the quality satisfying the specification of the British Standards Committee.

The $\frac{5}{16}$ inch rivets are put in cold. Those on the side sheets are put in from the outside, and hammered up flat on the inside. Those in the crown are put in from the inside and hammered up outside. All riveted joints are provided with broad, linen tape soaked in red-lead paint; the faces of the joints being also well painted before the tape is inserted.

When completed, the gasholder will be tested with air and raised to its full height; the guide rollers being carefully adjusted as it rises, and then fixed. It is to remain at its full height for not less than three days and any leakage stopped. It is then to be emptied of air and filled with gas, and must remain filled for 48 hours without leakage, and must work satisfactorily in every way before being taken over by the Corporation. It is expected that the holder will be ready for use next winter.

GENERAL CONCLUSION.

The holder is one of the largest in the world; coming third in point of cubical contents—only those at New York and at East Greenwich being larger. The New York gasholder is 15 million cubic feet capacity; that at East Greenwich is 12 millions.

The Contractors for the holder and guide-framing are Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees. They were also Contractors for the 7 million cubic feet holder at Bradford Road.

In conclusion, the author has again to express his great indebtedness to his Chief, Mr. J. G. Newbigging, M.Inst.C.E., who is

responsible for the design of this mammoth structure, for permission to read this paper and submit the original working drawings which accompany it.

The meeting was held last Wednesday at which the foregoing paper was read. Prior to the meeting, the members paid a visit to the site of the new holder, which, as readers may remember, is in course of erection at the Bradford Road station.

Mr. D. C. Rattray, who occupied the chair, remarked that there was no need for him to introduce Mr. Robinson, who was known to all, and had in hand a most interesting subject.

Mr. Robinson then read his paper.

Mr. R. Cotton, in opening a brief discussion, said he should like to know whether, in estimating the total stress thrown by the holder owing to various agents, the result was arrived at graphically or mathematically. The author of the paper had stated that there were 100 pages of matter in a certain book on the subject, and it would be interesting to know whether they used much of it when devising the structure described, or relied on first principles. He personally thought theory could be hopelessly overdone; practice was the great thing. He thanked Mr. Robinson for his observations on the subject of the centre of buoyancy and gravity. The remarks as to the pressure of the wind were particularly interesting to him, as he had had charge of the meteorological station at Glossop, and he then found that the higher the velocity was taken, the greater the force of the wind. It would about double its velocity in 1000 feet.

A Member asked if there was ever any trouble from leakage in the crown of the holder, and, if so, how it was detected.

Mr. A. Bowes said, as far as he could see, the details of the holder described were highly commendable; and if there was to be any criticism of them, it should come from a man who had carried out something bigger. The largest holder he had constructed was 100 feet in diameter, with three lifts; and the details were almost identically the same as in the one before them. One great difference he noted, however, in this was that the tops of the standards and guides finished at the top of the lifts; while the previous method was not to go so far. He would like to know the reason for this. In constructing so large a crown to spread over the area of an immense tank, he assumed that the work of trussing would be carried out in arithmetical ratio proportionate to its weight and the weight of gas the holder would contain.

Mr. Robinson, replying to the remarks made, referred to the question of whether the stress was estimated graphically or mathematically, and said they adopted Mr. Cripps's method of doing it both ways; but it was obvious that when they had a large structure they must rely mainly on a mathematical system, at the same time taking into consideration probable wind, snow, &c. The question of wind pressure was one of the most difficult to deal with. The weight of pressure was largely dependent on the weight of the holder. As to the method of finding a leak in the crown, the usual way was to wash it with thick soap and water; and if there was a leak of gas, it would cause a bubble to rise. Men were stationed on the top of the holder to look out for bubbles; and if one appeared, they immediately set to work to caulk up the hole. In reply to Mr. Bowes, he might explain that the reason the standards were carried so high was because it was considered that in constructing a holder of the magnitude of that described, with four lifts, it was necessary to increase the rigidity of the lifts.

A hearty vote of thanks was accorded to Mr. Robinson.

RECENT PROGRESS IN ELECTRIC LIGHTING.

At the Meeting of the Illuminating Engineering Society last Friday—Dr. Silvanus P. Thompson presiding—Dr. E. W. Marchant, Professor of Electrical Engineering at the Liverpool University, read a paper bearing the above title.

The author said the paper was an attempt to give some account of recent developments in electric lamps rather than one on recent developments in electric lighting. The most remarkable development within recent times is the production of an incandescent lamp with an efficiency approximating to 1-candle power per watt; and the most recent development in the construction of tungsten lamps is in the use of wire-drawn filaments. It is claimed that these filaments are mechanically stronger than those in which the thread is obtained by deposition of the metal, or by some process equivalent to it. One of the chief drawbacks to the use of tungsten filaments has been their great fragility; but in this connection it should be noticed that the filaments are not very fragile, except when cold. Metal filament lamps stand a great deal of vibration when they are in use; whereas the same lamps when cold are soon broken under similar conditions. Another point connected with the fragility of these lamps is the effect of switching off and on. In order to test a statement that has been frequently made as to the bad effect of switching off and on, a series of tests are now being carried out in the Electrical Engineering Laboratories at Liverpool. As far as these experiments have gone, the effect of switching does not appear to be serious; the lamps that have been burning continuously have given out to the same extent as those that have been subjected to continuous switching off and on.

It is very difficult to get definite information as to the effect of vibration on the life of metal filament lamps. There seems to be little doubt that vibration is injurious, though there is reason to think that its effect has been greatly exaggerated. A large number of lamps in the author's laboratory are hung from a light roof supported on an upright girder, on which countershafting is carried. These lamps have now been in place for over a year, and are lit on the average during the winter for from two to three hours every evening. So far, not a single lamp has given way. It is probable that metal filament lamps are much more injuriously affected by the sudden shocks they receive when their globes are being cleaned than by any ordinary vibration to which they may be subjected. At the same time, vibration must be injurious in certain cases.

One may sum up the position so far as metallic filament lamps are concerned by saying that at present there is no difficulty in obtaining a 230 volt metal filament lamp of about 25-candle power which will give 1 horizontal candle-power for 1·2 watts, and will burn near this efficiency for over 1000 hours—probably for a much longer period under ordinary conditions.

So far as improving the illumination given by lamps is concerned, as much may usually be done by using suitable shades as by improving the efficiency of the lamp. By using suitable reflecting shades, a great increase in illumination may be effected by reflecting light (which would otherwise be wasted) in the direction where it is wanted. In modern systems of lighting, it is now becoming increasingly recognized that it is necessary to screen the direct image of the lamp filament from the eye. The intrinsic brilliancy of such a filament is very high; and the image formed on the retina is now recognized as producing an unduly severe stimulus, which, if often repeated, may prove injurious. This point is now so well known that it is unnecessary to labour it further, except in so far as it implies the necessity of using either a frosted lamp or a reflecting globe. The latter may be used to divert any wasted light in the direction in which it will be most useful; and from this point of view the question of light distribution becomes less important to manufacturers of lamps.

The most notable advance in arc lighting, within recent years, is the flame arc; but these lamps have been used so extensively for a number of years that the flame arc itself is far from being a recent development. With one exception these lamps all give off a good deal of fume and vapour (which makes them unsuitable for indoor lighting), and developments have been mainly in the direction of making them suitable for street lighting.

The author proceeded to deal with these two points: (1) The improvements made in the distribution of light so as to give more uniform illumination over a large area; (2) The actual efficiency or flux of light emitted per watt consumed in a modern lamp. We will not follow him into this part of his subject; except to say that he emphasizes the necessity of distinguishing clearly between the two factors—light distribution and light efficiency. They are obviously quite distinct and different. However great the improvement in distribution of the light that can be effected by altering the globe, this improvement can never go beyond the point at which the whole of the light produced is used in the most economical way. If further increase in illumination is required for a given expenditure of power, it must be obtained by increasing the total flux of light from the source. Inverted arcs for interior lighting appear to be much less used than formerly, and those who have had trial of metal filament lamps for lighting drawing offices and other similar places have no great difficulty in understanding the reason for this. The best arc lamp cannot compare with metal filament lamps as regards steadiness of burning; and most arcs, from the flickering character of the light they emit, even when burning under the most favourable conditions, are quite unsuitable for drawing office lighting. Another point which has led to their abandonment for interior lighting is the labour involved in renewing carbons. When a large number of lamps are used, as for street lighting, this difficulty is not serious, since a special staff is employed to carry out the necessary renewal of carbons. Further, with inverted arcs, there is not a great gain in efficiency of lighting, as compared with direct—*i.e.*, non-reflector—metal filament lamps. The main field of utility for arc lamps is street lighting; and it is for this purpose that the greatest progress has been made in their design. It may be desirable to mention the magnetite lamp which is used so largely in America, and it is to be hoped that some further figures with regard to its efficiency may be forthcoming.

The production of light from an incandescent vapour is a method of lighting which has long been familiar, though the only practical examples of it are the mercury vapour lamp and the Moore tube. In the Quartzlite lamp, the tube in which the mercury and the mercury vapour are contained is, of course, of quartz. The main characteristic of this lamp is that it produces a large amount of ultra-violet light, to which quartz is transparent, and which is screened off from the exterior by a heavy lead glass cover. If the lamp is left burning without this cover for a few minutes, the smell of ozone produced is very strong. It is a matter for discussion whether this type of light containing these very strong lines only in the spectrum, will not ultimately prove injurious to the sight of those who are obliged to work in it. It would *à priori* seem to be bound to produce a fatigue of those parts of the retina which respond to the impulses given by the particular rays which the lamp emits. A lamp of this type has recently undergone test in the author's laboratory, with the result that the efficiency worked out at 1·73-candle power (mean hemi-

spherical) per watt. The lamp consumed 688 watts at 230 volts, and gave a mean hemispherical candle power of 1190. The chief drawback to all mercury vapour lamps is the remarkable colour effects they give with coloured objects. In this regard some reference may be made to the recent work of Mr. H. E. Ives. The interesting result was found that the Welsbach gas-mantle provided a very satisfactory complement to the light produced by the mercury vapour lamp when the resultant light of each source was in the ratio of 1-candle power mercury vapour to ·57 candle power of Welsbach gas-mantle; the mantle having ¾ per cent. cerium. The mixing of the mercury vapour light with that of the light from tungsten lamps has been tried at Liverpool with quite satisfactory results. The Moore tube has not been used very largely in this country for lighting purposes.

Professor G. W. O. Howe, in the course of a note, said: Three years ago a number of Osram lamps were installed in the lecture theatre of the Electrical Engineering Department of the Central Technical College. The supply pressure being 200 volts, the lamps were connected two in series. Three pairs consisted of 110-watt lamps. At their normal voltage they take 100 watts and give only 36 mean horizontal candle power after a life of well over 1500 hours. Their specific consumption is therefore 2·8 watts per candle. Before the lamps had been running long, it was noticed that some of them had blackened considerably; and, on examination, it was found that the upper part of the bulb—*i.e.*, the part near the cap—was heavily coated with brilliant copper-coloured deposit. When recently examining this deposit, a very peculiar thing was noticed. A relatively clear unblackened pattern had been made on the globe, indicating that the blackening had been caused by particles projected from a single joint. By careful examination, it can be seen that the point from which this bombardment proceeds is the joint where the filament is connected to one of the leading-in wires. This is the point at which two of the three broken lamps have given way. Pear-shaped Osram lamps of smaller candle power which were installed at the same time are not so blackened, and show no sign of a pattern. The question which naturally arises is: Of what is the deposit composed? Mr. Robertson, of the Central Technical College, has kindly examined it, and finds it to consist mainly, if not entirely, of copper. The leading-in wires are found upon analysis to contain a certain amount of copper. The small lamps must differ in some way from the large ones, or we should get the same phenomenon in them. If the methods or materials of manufacture have not been altered since these lamps were made, it is evidently possible for the makers, by excluding copper from the joints, to reduce the blackening to a large extent; and at the same time to reduce the probability of breakage. All the lamps which show this phenomenon bear the inscription: "Made in Germany."

In the course of the discussion, Mr. A. P. Trotter spoke of the amount of light that one really requires. He rather resents the metallic filament lamp, because he is on a 205-volt system; and he cannot have anything less than a 20-candle power lamp. In his office, he has the "luxury" of an old-fashioned carbon filament lamp. He much prefers it to the high-power metallic filaments. There was a reference in his remarks to the necessity of keeping voltages steady; and there was a little reminder as to his work in connection with dioptric globes when he said: "I have had to wait thirty years before my invention of dioptric shades has been again heard of." It was mentioned by Mr. Haydn Harrison that he has tested many thousands of high voltage metallic filament lamps on the photometer; and generally the average efficiency is about 1·37 watts per British candle. On the point of the fragility of these lamps, Mr. A. H. Seabrook said that he has found that, in cleaning street lamps, if they are lighted up, the life is greatly increased; and this applies, too, to domestic lighting. Speaking of Holophane reflectors and globes, he remarked that experience with them the last twelve months has produced some extraordinary effects. They have had in Marylebone consumers who were using (say) 50-candle power lamps who said the consumption was too great, and they could not afford it. Using Holophane globes, the wattage consumption has been cut down one-half, by directing the light where it is wanted and not wasting it on ceilings and the walls where it is not required. In shop lighting, they have also been able to effect considerable improvements the same way. He believes gas and electric lighting people realize the enormous amount of educational work there is to do in illumination better than anyone else, for every day they see the atrocious methods of illumination that are carried out. Against absolute uniformity in street lighting, Mr. Wilkinson spoke—for example, more illumination is required at street corners. The utility of the flame arc lamp for street lighting purposes only was contested by Mr. Justus Eck, who knows that it is being used for factory lighting. Professor Morris told of an experience he has had with some tantalum lamps in a kitchen and a passage. In the hot place, one lamp went about every four weeks, while in the passage outside, where the temperature was not so high, the lamps had a greater life. Tungsten lamps are now used in the kitchen, and they run about ten months. On the question of the proper lamp to be used in fogs, he stated that, in connection with one of our docks on the river, it is now being considered whether a series of flame arc lamps should not be taken out and high-pressure gas-lamps be put in, on account of the large amount of white mist fogs on the river.

Mr. Leon Gaster, Mr. Waldram, Mr. Rawlings, Mr. Dow, and others contributed to the discussion.

CONTROL OF THE WORKING OF GAS-WORKS.

At the Meeting of the Mid-Rhenish Association of Gas and Water Engineers at Gmünd in September last, a paper was read by Dr. Karl Bunte, of Carlsruhe, on the "Control of the Working of Gas-Works." The Mid-Rhenish Association decided at its meeting in 1908 to ask the Experimental and Instructional Gas-Works of the German Association of Gas and Water Engineers to undertake the regular control of the working of the moderate-sized and small gas-works in the Mid-Rhenish district. Dr. K. Bunte, in his paper, describes what has been done by the Instructional and Experimental Works in this direction in the course of the past year.

In most cases the work was confined to investigations made with the object of exercising control on the ordinary working of the gas-works; but in a few instances special difficulties were studied, and in other cases efficiency trials of new plant on its delivery were carried out. The tests for the control of working were made for the most part by simple methods applicable on any works; but the opportunity was taken to familiarize the engineers and foremen with such tests, and to indicate to them the significance of the results obtained. The object was to inculcate the practice of making regular tests for the control of the working; and the endeavour was made to utilize as far as possible existing apparatus and appliances on the works. Some details of the nature of the investigations carried out with this purpose in view may be quoted from the reprint of Dr. Bunte's paper in a recent number of the "Journal für Gasbeleuchtung."

The retort-settings are in the first instance tested to ascertain whether the combustion of producer gas is proceeding properly. An analysis of the flue gas at the entrance of the regenerative passages is made. The sample is taken midway between successive clinkerings of the producer, and not immediately after making-up the fire or recharging the retorts. If 18 per cent. or more of carbonic acid and a small excess of air are found, combustion is regarded as quite satisfactory. The main point is to make the examination at a time when the firing of the settings is proceeding in average conditions. In the second place, investigation is made as to whether the formation of the flame is taking place in the proper manner. In most cases, this is ascertained by means of temperature measurements with the Wanner pyrometer in different positions in the setting. The differences of temperature should not be more than about 145° Fahr. above or below the mean. Frequently a very high temperature, approaching the fusing point of the fire-brick, is found immediately above the nozzles or burners, while the outer retorts are only moderately hot. In this case, the flame produced is not sufficiently long. An analysis of the producer gas will then commonly show that there is too much carbonic acid in it, due to the reducing layer of the fuel being too shallow. As a consequence, but little secondary air is required and the flame is short. In this case, the producer should be charged more frequently.

In other instances, though the proportion of carbonic acid may be low, there is a comparatively small quantity of carbonic oxide because insufficient water vapour has been introduced. The result is that the temperature in the producer is too high, and there is rapid combustion where the producer gas mixes with the secondary air. This condition is rectified by increasing the supply of steam to the producer. Occasionally, also, a too short flame is due to constructive faults, as when the producer gas and the air meet at an obtuse angle and, mixing rapidly, burn locally. It is rarely possible for the experimental works to do more than indicate to the officials of the gas-works the fault in the procedure, and the subsequent regulation has generally to be left to the works' superintendent to carry out. It is considered very important that the experimental works should be advised of the success or failure of the measures which it has recommended.

A third point in the checking of the working of retort-settings is the investigation of the soundness of the regenerative passages. Where there are a large number of similar settings in a bench, the faulty setting may generally be located by observation of the draught at the outlet. If most of the settings require a draught of (say) 3-10ths, and one of them requires 5-10ths, unsoundness of the regenerative passages in the latter may be safely inferred. In the same way the defective side of the particular setting may often be ascertained, and the conclusion verified by analysis of samples of the flue gas taken at the inlet and outlet of the regenerator. An abnormal diminution in the draught or a considerable difference in the amount of carbon dioxide at the inlet and outlet of a regenerative passage will indicate that the latter is unsound and requires repair. In some cases where a proper temperature cannot be attained, though the combustion is good and the consumption of fuel ample, it will be appropriate to ascertain the quantity of undecomposed steam in the producer gas; and this may be done by aspirating some of the gas through a weighed tube containing calcium chloride. Attention may be called to the fact that many settings have too few sight holes (and these are often in the wrong positions); while no provision is made for taking samples of the gas from the setting.

The control of the condensation of the gas made is very important in its bearing on the subsequent purification of the gas and on the extraction of naphthalene. Condensation begins in the ascension pipes, which should not be regarded as connections

merely between the retort and hydraulic main. The gas leaves the retorts at a temperature of at least 570° Fahr., and has to pass through the water seal and deposit a portion of its contained aqueous vapour without evaporating the water in the hydraulic main. Consequently, the temperature in the bridge-pipe should remain below 212° Fahr. The more recently-formed coals contain the most water; and hence the temperature in the bridge-pipe would be higher with them than with the older coals. The condensing action of the ascension pipes is only secured when they are kept clean. Deposits on them diminish the transference of heat; and, if they are present, the gas will be too hot when it reaches the hydraulic main, and instead of depositing water will take it up, with the result that in extreme cases the dip-pipes become sealed with tar instead of with water. The light oils and naphthalene are then volatilized from the tar, and thick tar or pitch is produced in the hydraulic main, and naphthalene stoppages occur in the subsequent apparatus. The temperature in the hydraulic main should not exceed 140° to 150° Fahr.

Care must be taken in regard to two points in the subsequent condensation. In the first place, the gas must be cooled uniformly and not suddenly, so that the naphthalene and the tar oil may be separated as much as possible together; while, in the second place, it is very important that the naphthalene should be deposited on cooling surfaces which are washed by the condensed tar, and not separated in the free-way of the gas. If two streams of gas of very different temperatures are mixed, the naphthalene separates in the form of dust as it passes direct from the state of vapour into the solid state. It is well known that liquids absorb substances in the condition of dust imperfectly, as is well illustrated by the insolubility of the haze of ammonium chloride in washing bottles and of solid sulphuric anhydride in water. The washers can only extract the naphthalene which is in the form of vapour. At 104° Fahr., this amounts to 83·47 grains per cubic foot, but at 50° Fahr. to only 14·1 grains per cubic foot. If the first chamber of a naphthalene washer has removed this vapour, the solid naphthalene in the form of dust can be converted into the same quantity of vapour, which can then likewise be removed. But as the process proceeds by stages, if we assume that the naphthalene entering the first chamber of a washer amounts to 87·4 grains per cubic foot and that at 30° C. (86° Fahr.) about 39·33 grains are in the form of vapour, this amount will be removed in this chamber at that temperature. From the remaining 48·07 grains of naphthalene dust, 39·33 grains will again be vaporized on the way to the second chamber. But if the washer is working at 18° C. (64·5° Fahr.) instead of at 30° C., only about 21·85 grains of the total of 87·4 grains of naphthalene per cubic foot are directly washed out in the first chamber, and there passes on into the second chamber 43·7 grains of naphthalene dust, and into the third chamber 21·85 grains, and so on. These considerations disclose the reason why naphthalene washers are kept warm. Not only is advantage thereby taken of the greater solubility of naphthalene in the oil at the higher temperature, but also of the higher vapour tension of the naphthalene and, consequently, of the higher proportion of naphthalene in the form of vapour.

The purification of gas is generally limited to the washing out of ammonia and the removal of sulphuretted hydrogen. In a few of the small and moderate-sized gas-works, cyanogen washers are also employed. In regard to the ammonia washers or scrubbers, most commonly these are vertical vessels, in the first of which gas is sprinkled with liquor and in the second with clean water. The efficiency of the vessels is ascertained by determining the amount of ammonia in the gas before and after each vessel; and for this determination the costly experimental meters are not used, but aspirators consisting of carboys of about 60 litres capacity, which are readily obtainable anywhere. They are set up in the room where the investigation is to be made some time beforehand, in order that the water may acquire the temperature of the room, and are weighed before and after use. The difference in the weighings (expressed in kilogrammes) gives directly the number of litres of gas aspirated; but if absolute, instead of comparative, figures are required for the proportion of ammonia in the gas, it is necessary to have a pressure gauge attached to the carboy and to bring or correct the volume of gas to atmospheric pressure. The gas is aspirated through a measured quantity of standard sulphuric acid, which for crude gas may conveniently be of normal, and for clean gas of decinormal, strength.

For the clean-water scrubbers nothing further is required in order to ascertain their efficiency; but in scrubbers in which liquor is used for sprinkling, it is necessary to take into account the strength of the liquor in order to ascertain whether it is doing the maximum amount of ammonia extraction of which it is really capable. In connection with this investigation, a simple apparatus is used for the determination of the tension of ammonia of the liquor at the temperature at which it is used. A current of clean gas or of air is sprinkled with the liquor at that temperature, and the ammonia in a measured volume of the gas thus washed with the liquor is determined by means of sulphuric acid. It is evident that the liquor, when used in the works' scrubber at the same temperature, cannot reduce the ammonia in the crude gas below the proportion found in this test; and thus the real efficiency of the scrubber may be calculated.

If the efficiency of a scrubber is found to be (say) 25 per cent. too low, the fault may be due either to insufficient liquor or water having been used, or else to the water having taken a one-sided course through the washer, either owing to the sprinkler nozzles having become blocked or to the distributing plates having become uneven, or from some similar cause. It is easy to ascertain which defect is responsible for the low efficiency, by observing the action of the scrubber about 1½ hours after the retorts have been charged, when the evolution of ammonia from the coal is at a maximum, and, again, shortly before the retorts are drawn, when the evolution of ammonia is at a minimum. If the efficiency is equally low at both times, it is almost certain that a part of the washer is not properly sprinkled, and some of the gas thereby escapes washing. If, however, the quantity of water or liquor used is insufficient, the efficiency of the washing will be greater at the time when less ammonia is entering the washer. With regard to the rotary washer-scrubbers, it is desirable to ascertain whether all the chambers are doing their proper share of the work. If it is found that practically no ammonia is entering the last chamber, the amount of water used should be reduced so that a more concentrated liquor may be obtained. Testing of the separate chambers will also disclose any unsoundness of the partitions.

The purifiers in the ordinary course need little special investigation. When cyanogen washers are not used, and the oxide purifiers are small, it is of interest to ascertain how much cyanogen is removed in each vessel and how much passes out in the clean gas. For this purpose, a volume of gas, measured by an experimental meter or an aspirator, is washed in absorption tubes containing ten bulbs, or in Drehschmidt flasks, with ferrous sulphate and a solution of caustic potash. The sludge thus obtained is taken away for analysis in the laboratory.

The representatives of the experimental works in the course of their inspection examine at least three times a day the quality of the gas as sent out from the works. The calorific power and specific gravity are determined; and if there is a photometer on the works, the illuminating power is also ascertained. The works' measuring instruments are compared with standard instruments, or else tested in an appropriate manner. If there are several gasholders at the works, it is considered important to test the quality of the gas from the different holders in order to ascertain the greatest variation which may ordinarily occur in the gas distributed. If great fluctuations are found where there is only one holder, a more prolonged investigation becomes necessary in order to ascertain the maximum and minimum values and what phase of the works' procedure is responsible for the fluctuations. Ordinarily, the course of investigation of the working of a small or moderate-sized gas-works indicated in the foregoing will entail a visit of inspection extending over two to three days.

Efficiency trials of new apparatus have been carried out by the experimental works in several instances, and have proved of considerable value. The trials serve to settle definitely whether the conditions of supply or the contractors' guarantees as to efficiency have been fulfilled. The knowledge that the apparatus or plant will be properly tested on delivery will serve to prevent unfair competition among contracting firms, some of whom might otherwise be tempted to guarantee results which the plant or the apparatus is not really capable of affording.

The conduct of investigations on various gas-works by the staff of the experimental works is beneficial to the latter in providing a substantial foundation of practical experience of works' conditions which will tend to make the instruction given at the same works, in courses of lectures, &c., for gas engineers, more valuable. As a consequence, the experimental works attaches great value in this respect to the carrying out by its staff of investigations for the control of working of gas-works and for the testing of the efficiency of plant. The most suitable time for such investigations will be when the plant is being worked nearly to its full capacity. But, on the other hand, it is usually inconvenient to the gas-works' staff to have such investigations in progress at the time of maximum make, when naturally there is much pressure of work upon them. The training of a staff for carrying out the investigations clearly is a matter of some difficulty; and the co-operation of gas-works in this direction is of great value. It is hoped, however, that the investigations already carried out will serve to justify the anticipations which attended the foundation of the Experimental and Instructional Works at Carlsruhe.

In the discussion that ensued on the reading of Dr. K. Bunte's paper, Dr. Knublauch, of Ehrenfeld, Cologne, made some extended remarks which will be referred to next week.

Glover-West Vertical Retorts for the United States.—We learn that a contract has been placed with West's Gas Improvement Company, Limited, for an installation of Glover-West vertical retorts for the Fitchburg (Mass.) Gas-Works. This is the first installation to be built on this system in the United States; and the contract has been placed as the outcome of a recent visit by Mr. Fred J. West to America. The Fitchburg Gas and Electrical Company, it may be mentioned, is one of the many similar concerns of which Mr. C. H. Tenny, of Boston and Springfield, is the President and moving spirit; and prior to the decision to introduce the Glover-West system, Mr. Tenny and Mr. H. Burgi, the Consulting Engineer to the several Companies referred to, made an exhaustive investigation into the system at Manchester and St. Helens.

SMOKE AND ITS PREVENTION.

Lecture by Professor Vivian B. Lewes.

At the London Institution last Thursday evening, a lecture on "Smoke and its Prevention" was delivered by Professor VIVIAN B. LEWES, F.I.C., F.C.S.

The lecturer began by characterizing the question of the best method of combating the nuisance arising from smoke as the most important one of the day, alike from the sanitary and the artistic aspect. He pointed out that when coal was first used for fuel purposes in the Thirteenth Century, the smoke to which it gave rise roused such indignation among the public that in 1306 a decree was passed forbidding its use. But, notwithstanding attempts to banish it, it became firmly established not only as a fuel for domestic consumption, but also as the great source of power. It was not until the latter half of the last century that the cumulative effect of smoke began to make itself felt; and the efforts of those who were interested in its abatement apparently had some slight influence in reducing the plague. Certainly, during the past ten years the fogs had not been of the same density or as frequent as they were in the preceding twenty or thirty years; but how far this had been due to efforts at smoke abatement and how far to meteorological conditions he was unable to say. Even if a certain amount of work had been done, so much still remained to do that the subject was as important now as ten years ago.

Turning to the cause of the cloud which hangs over our big towns, cutting off the direct rays of the sun and ruining health, the lecturer said that in the South of England it was the domestic grate, using bituminous fuel, which was responsible for the major portion of this pollution of the atmosphere; while farther north, in the great manufacturing centres, it was the factory chimney. Dr. Shaw had estimated that 70 per cent. of the smoke in London was due to domestic fires; but in Sheffield or Birmingham the figures would most likely be reversed. Domestic smoke was produced throughout the length and breadth of the land; whereas the factory concentrated its attention on the more limited area of the manufacturing districts. While improvements brought about by stoking machinery and attention to air supply had shown how smokeless factory shafts could be obtained, little had been done to improve the conditions of fuel consumption in the household. The ideas existing as to the composition and use of bituminous fuel were still very vague; and it was this side of the subject with which he desired to deal.

Professor Lewes then described in detail what takes place when bituminous coal is fed on to a burning fire; and this led to a lucid explanation of the nature and property of flame. From the facts he had brought before his audience, he said several points were clear: (1) That the smoke-forming portion of bituminous coal is the hydrocarbons which on destructive distillation form the tar. (2) That the true coal gas contains but little of these, and can easily be burnt with smokeless combustion. (3) That the residue left after the destructive distillation of the coal—*i.e.*, coke—burns without the formation of smoke. (4) That tar vapour and white smoke escape in the form of minute vesicles, which will float in air until burst by violent contact with some surface, on which they then deposit as tar. (5) That what we speak of as smoke consists of a mixture of tar vapour, water vapour, tarry carbon particles, products of combustion other than water vapour, and fine particles of ash.

Having indicated the causes which give rise to smoke from the domestic hearth, Professor Lewes reviewed the proposals which have been made from time to time for its prevention. These, he said, might be classified under the following headings: (1) The use of bituminous fuel in special grates. (2) The use of solid smokeless fuel. (3) The use of gaseous fuel. (4) The combined use of gas and coke. (5) Central heating by steam, water, or hot air.

In considering, said the lecturer, the claims of these various methods, we must remember that the English open fire is undoubtedly the most comfortable and wasteful method of heating that could be adopted. But though by far the largest proportion of the heat escapes up the chimney, we must clearly bear in mind that this makes it a most important engine of ventilation, and that at this time, when the ventilation of our middle-class houses is chiefly left to the "jerry" builder and to the open fireplace, it is an important factor of health. Moreover, it heats the room in the only healthy way—that is, the radiant heat from it does not directly raise the temperature of the air, but is radiated to the floor, walls, and furniture in the room, which, again, part with their heat slowly to the air in contact with them and to the inhabitants, so that the walls and other solid matters in the room are higher in temperature than the air. If one can retain the chief characteristic of the open fire—*i.e.*, heating by radiation—and eliminate the smoke production and excessive waste of heat up the chimney, we should have the ideal conditions for house warming.

Enormous improvements have been made in the domestic firegrate during the last fifteen years, both from the artistic and the economic point of view; and while with the older forms it was not unusual to find a coal consumption amounting to 7 to 8 lbs. per hour, this quantity has been reduced in the more modern forms to about half. This in itself has been an important step in smoke reduction. But grates have long lives; and the capital outlay of putting in new ones results in the modern forms being chiefly found in new houses. There have been many attempts made to construct grates for the smokeless consumption of coal; but it is found in practice that when once the heavy carbonaceous smoke is produced, it is very difficult to burn again the carbon particles completely, and the dilution caused by the large volumes of nitrogen present prevents their easy combination with the oxygen of the air. There is no doubt that the best methods of preventing smoke from bituminous coal is to feed on the fresh coal only in very small quantities, and supply the top of the fire with a sharp draught of hot air. Under these conditions, complete combustion of escaping hydrocarbons is ensured, and very little carbon is allowed to be liberated in the solid form. In order to do this, however, the stove has to be to a certain extent closed in; and it is also found that no grate for bituminous coal is absolutely smokeless.

The great factor in making special forms of grate an inefficient solution of the smoke problem is that it involves large capital outlay on the part of the consumer; and my own experience is that unless consumers can become reformed without expense or extra trouble, the majority will talk but never act. It is for this reason that the use of solid smokeless fuel, which can be consumed in all existing grates, appears the most likely solution of the great question.

Smokeless fuels may be classified as: (1) Coal which has been carbonized at a high temperature, so as to drive out practically all the volatile matter. This class is represented by gas coke and "Coalexld." (2) Coal which has been partially carbonized so as to distil out the smoke-forming constituents, but to leave enough volatile matter to give a non-luminous flame and easy ignition, as seen in coalite and carbo. (3) Non-bituminous coal, such as anthracite.

Coke, the solid product of high-temperature distillation, has never found favour with the middle and upper classes as a domestic fuel, owing to prejudice against it because of its being somewhat difficult to ignite and not burning freely. Its chief market has been for steam-raising and other manufacturing purposes; very little finding its way into the householder's grate. The result is that, if carburetted water gas had not offered a convenient and economical way of using it in gas-works, many companies would have found great difficulty in keeping up the price during the years that coal was cheap. It must be remembered, however, that during the past three years the gas industry has been in a transition stage, and England is slowly following the lead of the Continent in recognizing the fact that great economies are to be found in carbonizing coal for gas making in larger charges than have ever before been attempted; and the introduction of vertical and oven retorts is undoubtedly a step in the direction of making a coke which shall be more fitted for a domestic fuel than the overheated product made in the horizontal retorts of late years.

The large amount of attention centred upon the production of a smokeless fuel during the past three years has led to the introduction of several processes for improving the coke during gas manufacture, which, though leading to little or no improvement, have enabled the product to be sold under a fancy title, and have done a certain amount of good by inducing consumers to try under another name the coke which prejudice would have condemned untried.

The second class of smokeless fuel, and the one which many scientific men look upon as the most promising solution of the smoke problem, owes its inception to Colonel Scott-Moncrieff, who many years ago suggested the use of a half-coked coal as a fuel supply, and tried to make a commercial article by carbonizing coal at the ordinary gas-retort temperature—drawing the charge when half the usual volume of gas had been distilled out from it. Two factors, however, led to failure—one being that the time was not ripe; and the second that the means by which he proposed to carry out his entirely admirable idea, being dependent upon the ordinary gas-works practice, had to be carried out under certain conditions which led to a want of uniformity in the fuel and to certain difficulties which those who tried to make it failed to overcome.

The idea, however, of a semi-carbonized coke, which should still contain enough volatile matter to give easy ignition and a cheerful flame without any smoke, was independently revived under the name of "Coalite." This differs from the fuel proposed by Colonel Scott-Moncrieff in that, instead of shortening the period of carbonization at a high temperature, the temperature is reduced to one-half the ordinary, and is continued in suitable retorts until a uniform coke, containing from 12 to 15 per cent. of volatile matter, is formed. In both processes there is the fatal defect, from a gas manufacturer's point of view, that less than half the volume of gas is obtained per ton of coal; and as the all-conquering career of the incandescent mantle has rendered gas of high candle power unnecessary, the rich gas yielded is not looked upon as an equivalent attraction. The coalite process has the advantages over the older one that the fuel is of greater uniformity, and that the yield of tar is doubled instead of being decreased, and is much enhanced in value.

Coalite has created so much interest that, as was only natural, the Moncrieff process was revived; and the product is well known under the name of "Carbo." Coalite at present appears to be labouring under difficulties; but I am as convinced now as I was when I first examined the process that, when its manufacture is properly handled, it will be the ideal fuel, and will not only solve the smoke problem in the easiest possible way, but will also be an important economic advance in our treatment of coal.

The use of a non-bituminous coal like anthracite would result in a smokeless and very hot combustion. But here again the objection is that stoves with a special draught would have to be used, and the initial cost would prevent its employment ever being adopted; besides which, any great demand for this kind of fuel would at once send up the price to a prohibitive figure. If the consumer can be induced to take the trouble, a very good smokeless fuel can be made by using a mixture of two-thirds coke to one-third coal, and, instead of piling up the grate with cold fuel when the fire burns low, adding the fresh fuel frequently in small quantities, so as to prevent the deadening of the top heat of the fire. But this is diminishing, not killing, the evil.

Leaving the smokeless solid fuels, which I believe will in the future play a big part in the cleansing of town air, we now come to the gaseous fuels; and here at once we have ready to hand a solution of the difficulty in the use of coal gas. Gas-fires, gas-cookers, gas water-heaters, gas-engines—all these have been developed to a point which leaves no valid excuse for overlooking their claims; and ever since Bunsen, in the early fifties, gave us the atmospheric burner, in which non-luminous combustion is obtained and smoke rendered impossible, coal gas has steadily progressed in favour for heat and power as well as for light, until at present nearly as much is used for the one as for the other.

What, then, stands in the way of its universal adoption? First and foremost, initial cost crops up, as, though much has been done by the companies in popularizing gas-stoves by letting them out on hire, by easy-payment systems, and by looking after their maintenance, the consumers must pay something; and this is sufficient to damp their ardour as smoke reformers. Secondly, gas is a little more expensive than coal for continuous heating, though when used for short periods, as for fires in bedrooms, &c., the fact that one can turn it on when the fire is wanted, and turn it off when it is done with, brings the fuel cost to nearly the same as coal; while in such places as Widnes and Sheffield, where the price has been reduced to a minimum for heat and power, the gas-engine and gas-fire well hold their own.

The chief sentimental objections to the gas-fire—its non-pokerability and one's not being able to throw cigar stumps and ash into it—are got over by a suggestion made first, I believe, by Sir William Siemens some thirty years ago, and that is to decompose bituminous coal into coke, tar, and gas at the gas-works, and reunite the true heat producers, coke and gas, in our fire-grates *sans* the smoke-producing tar—to do, in fact, with coal what was done by Chevreul a century ago with tallow, when he converted the tallow dip into the composite candle. All the initial outlay needed for this is to fit the atmospheric burner arrangements of the gas-stove to any ordinary fire-grate, so arranging them that they can be made to swing back clear of the fire when they have done their work of bringing to bright combustion the gas coke used as fuel in the grate. This has always seemed to me to be the best economic method of using the products of gas manufacture, because it would be impossible to employ either gas or coke alone to supplant entirely the use of bituminous coal. A market must be made for the bye-products if prices are to be kept down and, as we hope, still further reduced. But if the use of gas and coke could be increased, the gas manager could afford a diminution in the price of tar from over-production, as he has already ruined the tar market by over-heating his retorts, and so loading the tar with free carbon and naphthalene as to make it nearly worthless.

As I have before pointed out, to my mind the best solution of the dual question of the most economical use of coal and the cleansing of our atmosphere is to be found in low-temperature carbonization and the production of such fuels as coalite, because every constituent of the coal is utilized in the best way. But when we see how little expense and personal trouble are needed to attain smokeless combustion in other ways, it becomes evident that the mere provision of means to bring about the desired end is entirely insufficient. How can the societies interested in smoke abatement influence the hundreds of thousands of small consumers whose chimneys produce the morning cloud? They may make their doctrines felt in the West End; but will they ever touch the seething population of the workers' quarters of all our towns?

One is gravely told that legislation should be passed dealing with the question, and that the use of bituminous coal should be forbidden. But I think this is scarcely feasible; and unless we revert to the conditions of 1306, when a citizen of London was executed for using bituminous coal, I doubt as to its being effective. I do believe, however, that if a future Chancellor of the Exchequer would put a 5s. tax on bituminous coal, exempting that used for gas making, smokeless fuel manufacture, and for use by those burning it in smoke-preventing forms of grate or furnace, the question would quickly be solved, coal economized, and smoke abolished.

Yorkshire Junior Gas Association.—We learn from the Hon. Secretary (Mr. E. Garsed, of Elland) that the next meeting of the Association will be held at the Leeds Institute of Science on Saturday afternoon. It will be an "informal" gathering, and discussions will be opened by Mr. Cawthra, of Halifax, on "Gas-Works Emergencies," and Mr. Halkett, of Leeds, on "The Organization of the Outside Department." The proceedings will not be reported, so the members will have an opportunity of freely relating their experiences for the general good.

MAKING BALLOON GAS IN WATER-GAS PLANT.

At the last meeting of the American Gas Institute, Mr. GEORGE H. WARING, of Omaha, read the following paper descriptive of his method of manufacturing balloon gas in water-gas apparatus.

During the past three years, there has been a great revival of interest in the navigation of the air; while ballooning has taken its place as a recognized sport. This has resulted in an increasing demand for gas of high lifting power suitable for balloon inflation. An inquiry for such a gas was made of the writer in Omaha early in the present year; and this paper is the result of his attempt to supply it. Coal gas, when available, has been generally used for the purpose; otherwise recourse is had to the employment of chemically prepared hydrogen from small temporary plants. But this is, of course, quite expensive.

The regulations of the International Association of Aëronauts require that the coal gas shall have a lifting power of at least 43·6 lbs. and the hydrogen 65·4 lbs. per 1000 cubic feet—corresponding to specific gravities of 0·43 and 0·15 respectively. Apparently a specific gravity of about 0·33 is considered best adapted to balloon use, owing probably to the greater loss by diffusion through the fabric with lighter gases.

In the writer's case, no coal-gas plant was available, so that it was necessary to substitute a special gas made in water-gas apparatus. After considerable investigation, no promising existing methods were found, and one had to be devised. The result of this effort was the development of the process to be described.

The method consists in largely decomposing a hydrocarbon into its elements, carbon and hydrogen, in the fuel-bed of the generator of a water-gas set, and completing the reaction to any desired degree in the highly heated carburettor and superheater. This process was suggested by results obtained by the writer in some earlier work, described in a paper presented to the Western Gas Association in 1906, on the "Utilization of Tar in Water-Gas Apparatus,"* where it was found that, by the use of a small amount of tar during the down run, with steam, the percentage of hydrogen in the blue gas was increased from 50 to 60 per cent., while the specific gravity was lowered from 0·554 to 0·456. From these data it was evident that practically any desired gravity could be obtained by increasing the amount of hydrocarbon to be decomposed, and decreasing the quantity of steam used.

The final tests were made with a standard 6-feet set, 4 feet in internal diameter. The oil was introduced at the top of the generator with a spray, to secure uniform distribution over the fuel-bed. The following general conditions were found to yield successful results: The fire should be carried low, and just sufficient steam used during the blow to prevent the grate-bars from burning and keep down the clinker. The fire should be kept open by a double-length blow once an hour, and by lightly breaking up with a bar twice a day.

The first half of the run is made "down," without any steam. From 15 to 20 per cent. of the oil is admitted before closing the stack-valve, so as to purge the blast gases out of the set. The last half of the run is made "up," using sufficient steam to bring the specific gravity up to the point desired. The heats should be carried high through the whole set. A copious supply of water should be run in the wash-box to keep the lampblack washed out. A typical run gave the following results with gas coke from West Virginia coal:

Total make of gas corrected	98,000 cub. ft.
Make per hour	10,900 ,,
Steam per 1000	18·5 lbs.
Oil ,,	6·9 galls.
Coke ,,	30·2 lbs.
Air per 1000 through fire	2,690 cub. ft.
Steam during blow per 1000 of air	70 lbs.
Temperature at bottom of superheater	1,630° Fahr.

Length of blow, 4 minutes; length of run, 6 minutes.
Depth of fire, 4 to 5 feet.
Specific gravity of gas: Max., 0·390; min., 0·330; aver., 0·350.

The two analyses given below show some of the possibilities of this process. Sample "A" was taken during the latter end of the run of which the results are given above; while sample "B" was taken during an earlier test, and shows the ease with which a very low specific gravity can be obtained if desired.

	Sample "A." Per Cent.	Sample "B." Per Cent.
Illuminants	1·0	0·4
Carbon monoxide	15·3	5·2
Hydrogen	63·7	75·4
Methane	11·0	10·4
Ethane	0·8	0·0
Carbon dioxide	2·6	1·0
Oxygen	0·5	0·6
Nitrogen	5·1	7·0
Specific gravity	0·37	0·25

It is very desirable that the illuminants should be kept as low as possible, to prevent their injurious action on the rubberized fabric. It is, therefore, possible to manufacture easily and efficiently in standard water-gas apparatus a gas of any desired specific gravity that will be entirely suitable for balloon inflation, and will very closely resemble in its composition a low grade of coal gas. The commercial aspects of the process will, of course, be dependent upon the possible local demand; but in time of war it

* See "JOURNAL," Vol. XCV., p. 35.

ıight prove of considerable value. From the foregoing analyses, owever, it will be seen that a gas suitable for balloon use would e one of very poor quality for public distribution.

SCOTTISH JUNIORS AT BONNYBRIDGE.

On Saturday afternoon, the members of the Eastern District f the Scottish Junior Gas Association, to the number of about hirty, paid a visit to the Bonnyside Fire-Brick Works at Bonny- ridge, belonging to Messrs. James Dougall and Sons, Limited. They were received by Mr. R. Dougall, the Vice-Chairman of the Company, and Mr. E. M. Stewart, the Managing-Director.

After the company had been photographed, they were shown ver the works, seeing the processes of grinding the blocks of clay o powder, moistening it, moulding, floor-drying, and afterwards iln-drying. It is a necessity, on account of the want of cohesion f the particles of which fire-clay is composed, that at all times he drying of the moulded pieces shall be under cover. A shower f rain would reduce unfired goods to mud. At Bonnyside, there s an immense floor-space roofed over; the floor being composed f concrete, with piping contained in it, through which waste team, augmented as required by live steam, is passed to provide eat for driving off the moisture from the newly-made bricks which are laid on it. After lying for a day or two on the floor –the length of time being regulated by the sizes of the pieces— he goods are built into the kilns and fired. Of the kilns there are wo sorts in use—the old-fashioned conical kiln heated by coal- ires direct, and a range of patent kilns heated by producer gas. The direct-fired kilns take about five days to fire, and the gas- eated kilns longer; the explanation of the longer time in the atter case being that the preliminary heating, to drive off the added noisture in the goods, is accomplished by the waste heat from he ovens which are under full heat, so that an oven may be under eat for several days before the direct gas heat is turned on to it. The gas is producer gas, made on the spot, from coal which is ob- ained in the neighbourhood. The gas is consumed uncondensed nd unpurified, and there are no residuals—the coal being gasi- ed, and the coke at a lower level in the vertical chamber, gasi- cation being there assisted by the introduction of steam. The hapes into which fire-clay goods are made are innumerable. The visitors saw a great many of these; they also saw a retort eing made. After inspecting the works, they were taken down he Russell pit, which is nearly 100 feet in depth; and though tself quite new, and the workings from it not extensive, these ommunicate with the older workings. The visitors were con- ducted through them to the working-face, where the method of etting the clay was shown—two shots being fired in their pre- ence to loosen the material.

On returning to the surface, the company sat down to a sub- tantial meat tea, in the mission hall attached to the works. Mr. R. Dougall presided, and extended a cordial welcome to the Asso- iation. After tea, Mr. E. M. Stewart, the Managing Director of he Company, read a paper on "Fire-Bricks," some extracts from which, together with a report of the discussion to which it gave ise, will be published in a subsequent issue.

The President (Mr. Walter Dunlop, of Kirkcaldy) proposed a earty vote of thanks to Mr. Dougall for presiding. They had, he aid, spent a very pleasant afternoon, and one which had been an ducation to them all.

The Chairman, in returning thanks, said he had taken great nterest in the proceedings.

According to M. Mirande, writing in the "Comptes Rendus," t has been found experimentally that the vapours given off by ar such as is used for treating roads act injuriously on green plants. In the open country, these vapours would be insufficient o act detrimentally upon vegetation; but it is considered that in shut-in streets damage to trees planted on the edge of the pave- ment may be expected.

Before the Manchester Students' Section of the Institution of Civil Engineers, Mr. H. J. F. Gourley read a paper on "Con- crete and Reinforced Concrete Piles." He said that to obtain wooden piles of standard quality had been increasingly difficult of late years; and it was necessary, therefore, to find materials which were at least as strong and economical as wood. The use of concrete, and recently of reinforced concrete, had become more extended and varied as the knowledge of their properties had increased; and it seemed quite natural that the question of their suitability for piling should have engaged the attention of engi- neers anxious to find an efficient substitute for wood. Apart from the difficulty of obtaining timber piles of uniform quality, wooden piles might also be defective, though apparently sound, judging by their external appearance. With thorough supervision and the use of properly graded materials, there should not be any difficulty in securing perfect uniformity and soundness in con- crete and reinforced concrete piles. The load placed upon an average wooden pile might be taken at 15 tons; but on concrete piles it was 40 tons or more. The wooden pile, again, must always be wet. If this condition obtained, the life of the pile was long; but should the pile be subjected to the partially wet and partially dry state, deterioration soon set in, and its life was short. There was no such risk where concrete piles were used.

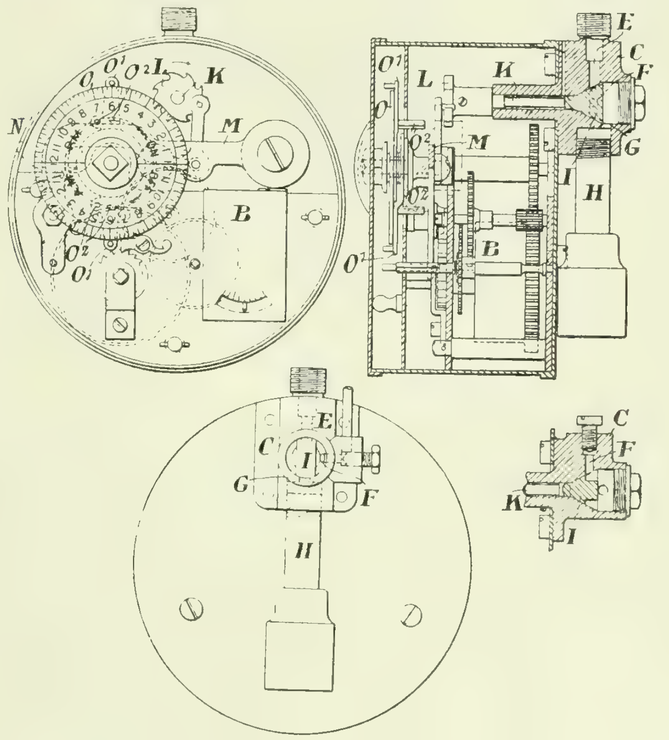
REGISTER OF PATENTS.

Gas-Controllers.

HUME, G. W., of Hyde Park Mansions, W.

No. 25,142; Nov. 1, 1909.

This invention provides a device to be actuated either by clockwork or by fluctuations of the pressure in the mains for lighting or extinguishing a number of gas-burners used in street illumination. In it, a valve controls main and bye-pass passages, and is arranged so that as it rotates one passage is uncovered before the other passage is covered —the openings to the burner and the bye-pass being exposed by the removal of a cover on the casing of the valve.



Hume's Gas Lighter and Extinguisher for Public Lamps.

The illustration shows a front elevation of the controller of the clockwork type, with the cover removed; also a sectional side view and a rear elevation with a portion removed to expose the valve.

B is the clockwork mechanism for controlling the turning on and off of the burners. C is the casing of a valve with a conical seat and with a passage or way E, which extends from it, in communication with the burner-tube (not shown). F is the passage in communication with the bye-pass tube, and G the passage in communication with the gas supply tube H. In continuation of the conical seating of the valve there is a cylindrical recess in the casing C, which is normally closed by a screw-cap, by removing which the passages E F G are exposed to allow of accumulations of naphthalene or other deposits being cleared away.

I is a conical valve which fits into the valve seat. The upper portion of the valve is formed with two lateral recesses, and the valve is mounted on the spindle K, which extends into the casing of the apparatus; its inner end having keyed to it a ratchet-wheel L, with the teeth of which there engages a pawl pivoted upon the weighted lever M, provided near its pivot with the tappet N. In conjunction with the tappet is arranged the disc O, which is rotated by the clockwork mechanism B, and has adjustably mounted upon it arms O^1 carrying pins O^2, which consequently rotate with the disc and intermittently actuate the tappet on the lever M so as to operate the pawl and turn the ratchet-wheel L to operate the valve I.

Assuming the parts to be in the position shown—with the passage E to the burner closed and the passage F to the bye-pass open—when the spindle is partly rotated by one of the pins O^2 under the action of the clockwork (that is to say, at any predetermined time for which the arms O^1 have been set), the conical valve I is moved. This movement, due to the first pin O^2, uncovers the burner passage E so as to permit gas to flow to the burner-tube; the gas on issuing being ignited by the bye-pass flame to which the gas is not yet cut off. The second pin O^2 on the same arm O^1 then actuates the tappet N and further rotates the valve I; this further movement closing the bye-pass passage F, but leaving the gas passage E still uncovered. At the expiration of a predetermined period of time, the pins on the other arm O^1 come into operation; the first of the pins further turning the valve I so as to first open the bye-pass passage F, and the second pin then closes the burner passage, thus leaving the bye-pass flame burning until the time arrives for the gas to be again ignited.

Atmospheric Gas-Burners.

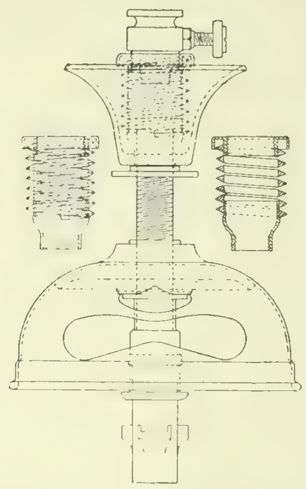
NEWHOUSE, W. A., and FITMENTS LIMITED, of Bradford.

No. 25,187; Nov. 2, 1909.

This invention has reference to the construction of atmospheric gas-burners of the type in which the rigidity of the mixing-tubes is broken by concentrically interposing a double or compound spiral spring. It

is a further application of the principles covered by patents Nos. 6700, 9740, and 15,507 of 1909.

The patentees say they depart from existing general practice in the construction of the mixing or bunsen tube in their means of making the compound gas and air mixture, by arranging for the passage of the air through a series of concentric spiral angular faced openings through which air is indrawn by the suction action of the gas passing down the tube. Simple means are also provided of controlling the air supply, and otherwise accommodating the capacity of the burner to varying conditions.



Newhouse's Anti-Vibrator Atmospheric Burner.

The invention consists (as shown) in combining with arrangements disclosed in the other patents named a compound spring of special construction composed of two springs interwound one upon or one within the other, but preferably provided with a series of concentric spiral angular faced openings upon which a similarly constructed spring formed in the obverse way works for varying the distance between the two parts of the divided tubes, and for controlling the volume of air admitted to the bunsen mixing-tube—the junction piece forming with the gas-bracket an integral part of the tube body and the primary air inlet to the gas. The action thus obtained is similar to the pendulous swing of flexible tubing—"the mantle moves as a solid unit with the whole mass of the burner when disturbed from rest by shock or vibrations." The chief merit of the arrangement of the bunsen aperture is said to be that the mixing area for the production of the mixture of air and gas can be amplified to a much greater extent to ensure complete combustion than is usual; also by mounting the bunsen tube in the way described supplementary means for varying the capacity of the burner are available when it is desired to use an extremely sensitive anti-vibratory medium in mills, by allowing the burner-tube to extend upwards inside the bunsen, so as to make the mixing area proportionate to the standard already ascertained for satisfactory results under normal conditions with a spring of average length. By this means, a much longer spring may be used with or without the air controlling supplementary spring.

Coin-Freed Gas-Meter Lock.

Gardner, F., and Emmons, F. J., of Southend-on-Sea.

No. 25,496; Nov. 30, 1909.

This invention has for its object to provide a lock so constructed that when it is placed in position with the fixed staple or eye in the slot in the body or casing of the lock, the latter becomes substantially a fixture on the receptacle to which the lock is applied; so that it is practically impossible to prise it off. To this end the body or casing of the lock is provided with a projection adapted to engage or interlock with the receptacle to which it is applied—for instance, the projection may be in the form of a hook adapted to be engaged with the material of which the receptacle is made.

Gas-Meters.

Hibberd, C. E., of Victoria Street, S.W.

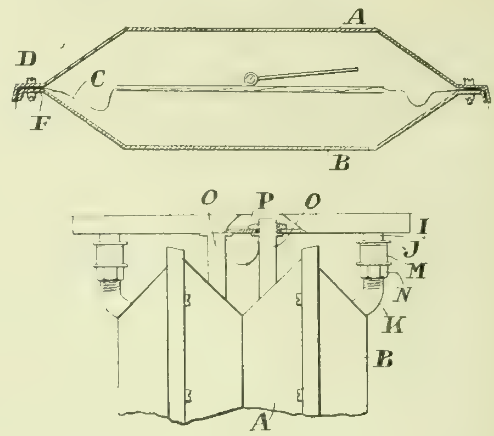
No. 26,425; Nov. 15, 1909.

This invention relates to gas-meter measuring chambers, and more particularly to means for ensuring accessibility to the working parts.

The illustration shows in plan section a form of the measuring chamber referred to, and below two such chambers assembled together —their connections to the meter ducts being also indicated.

The measuring chamber comprises a fixed wall A, which is the inner wall, and a detachable wall B, which is the outer wall. Between these walls the diaphragm C moves; the gas being admitted to, or expelled from, opposite sides in proper sequence. The wall A is formed at its periphery with a flattened edge D (with a flange extending around it), to which is fixed the edge of the diaphragm. The wall B is formed at its periphery with a circular flat edge F and flange. This detachable wall is merely pressed upon the fixed wall; the two flanges co-acting to produce a gas-tight fit, with the diaphragm acting as a washer.

In measuring chambers of this type, it is necessary to provide for the ready connection and disconnection of the gas-duct; and this may be done (in a manner in which every possibility of leak is avoided) by forming the gas-pipe I leading to the measuring chamber with a screw thread at its extremity, and a collar or the like J upon it. This is then positioned to co-act with a gas-pipe K provided upon the detachable wall B, and also screw threaded. When it is desired to connect the two pipes, the lock nut N is first screwed on to the pipe K; the sleeve M is also screwed upon the pipe, the wall B is placed into position, a washer is placed around the threaded part of the pipe I, bearing the collar J, and against the latter the sleeve M is screwed into position to bear firmly against it; the lock nut N being brought into position to retain the whole in place.



Hibberd's Gas-Meter Measuring Chamber.

The fixed wall A of the measuring chamber is provided with a duct O, which passes into the gas-channels P beneath the valve gallery of the meter. This pipe is connected to the duct by a flange upon it, which is brought firmly to bear upon the wall of the duct P by a nut co-acting with a screw thread formed upon its upper extremity.

Treating Gases from Gas-Retorts or Coke-Ovens.

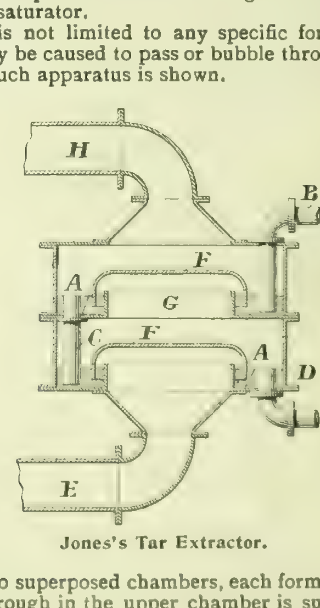
Jones, A. O., of Whitley Bay.

No. 26,428; Nov. 15, 1909.

In treating gases obtained from coke-ovens and gas-retorts for the extraction of the tar, ammonia water, and other products, it is usual to pass the gases through (say) a condenser, and afterwards through a series of air-cooled chambers, to cause the deposition of the tar; and the gases passing therefrom, and still containing some tar and ammoniacal vapour, are then passed through a Pelouze extractor, which may consist of a series of superposed plates having perforations.

Now the object of the present invention is to extract the tar from the gases in such a way as to facilitate the subsequent extraction of the ammonia. To carry out this object, the gas is conducted through a body of liquid tar which is at a similar temperature to the gas—namely, about 110° C.; and through this tar the gas is caused to bubble as has been previously proposed. The gases at this temperature, after having been passed through the heated liquid tar, will be found to be free from all the tar, or substantially all the tar, originally contained in them, while at the same time the water vapour in the passing gas will not have been condensed, and the lighter hydrocarbons will be deposited with the tar in the bubbling apparatus. If the temperature was greater than about 110° C., the lighter hydrocarbons would have been vaporized; and, on the other hand, if the temperature was less, the water vapour would condense. Thus at this temperature the tar from the gas is collected and added to the tar in the bubbling apparatus, and the gas passes over at the same temperature with the water vapour uncondensed, and is then admitted directly to the sulphuric acid solution in a saturator, where the ammonia is taken up. The solution in the saturator is also maintained above the boiling point of water; and, consequently, the water vapour contained in the gas still passes along with the gas from the saturator.

The invention is not limited to any specific form of apparatus by which the gas may be caused to pass or bubble through the tar; but a suitable form of such apparatus is shown.



Jones's Tar Extractor.

It consists of two superposed chambers, each formed with an annular trough A. The trough in the upper chamber is supplied with heated liquid tar by a pipe B, and when the tar reaches above a certain height in the trough (the height being governed by the upwardly projecting end of a pipe C), the tar flows through the pipe into the trough in the lower chamber; and the amount of heated liquid tar retained in this trough is governed by an overflow pipe D. The trough in the lower chamber surrounds an opening connected with the gas inlet pipe E, leading from the gas-retort or coke-oven, and located above the opening is a hood or bell F, the depending edge or flange of which is

immersed in the liquid tar in the trough. A similar hood or bell is arranged above an opening C in the upper chamber, and connected to the upper wall of the chamber is the gas outlet pipe H.

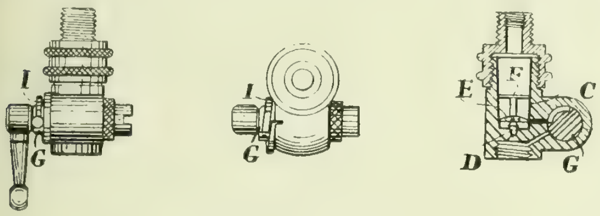
The gases are forced through the inlet pipe E to under the hood or bell F in the lower chamber. By this hood the gases are directed into the liquid tar in the lower trough, through which tar they bubble and pass into the lower chamber. They then pass from the lower chamber into the hood in the upper chamber, and are similarly directed by the hood through the tar in the trough in the upper chamber, and eventually leave the apparatus by the outlet pipe H; all the tar having been extracted by passing the gas through the body of heated liquid tar.

Gas-Tap.

LUCKWILL, E., of Cardiff.

No. 26,991; Nov. 20, 1909.

This invention relates to taps and valves for gas of the kind wherein when the valve is opened by external means the pressure of the gas serves to keep it open until the pressure falls, whereupon the valve closes again, and closes the gas aperture against leakage or escape until the valve is again operated. The invention comprises a gravity plug disposed directly in the gas-passage, to which is connected a disc or plate, adapted to rise and fall within a conical chamber, and a bye-pass device, whereby the gas may be led above the plug to effect the initial raising of the plug from its seat.



Luckwill's Gas-Tap.

Within the body part of the plug is formed (as shown) a tapered or conical chamber C, the lower part of which has a seating for the conical valve D, which is provided with an upwardly extended stem terminating in a disc F; the stem being provided with a perforated guide E. G is a controlling bye-pass cock disposed transversely of the body part and formed with a bye-pass channel adapted to establish communication between the gas supply and the chamber C by ports. The plug (which is provided with a handle) may be returned to the closed position by a spring such as I.

In operation, when it is desired to open the gas supply, the plug G is turned until the ports connect, whereupon the gas impinges on the underside of the disc F, which rises and lifts the plug D from its seat—the gas issuing through the valve-seating through and around the perforated guide E, and past the disc. As soon as the valve has been lifted from its seat, the bye-pass is closed, either by hand or by the spring I; the valve being kept up and free of its seat by the flow of gas. Upon the gas being shut off at the meter, the plug falls and seals the chamber.

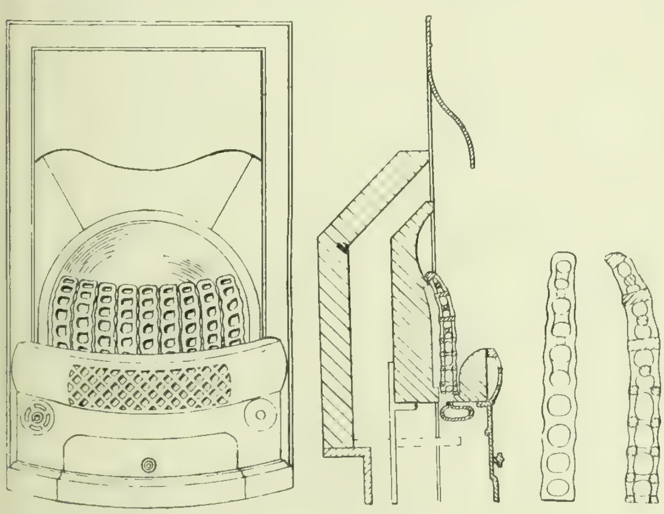
Gas-Fires.

VALENTINE, H. S., of Stirling.

No. 28,390; Dec. 6, 1909.

The object of this invention is to produce a gas-fire which could be readily adapted to existing coal-fire grates; the chief feature of it consisting in the formation and combination of the fire brick or bricks which enclose the flame and artificial fuel.

Across or around the front of the flame bed, a brick (or bricks) of fire-clay or other suitable material is (or are) placed, as shown, so that the heat shall be radiated therefrom backward against the back brick, which, in turn, radiates the heat, along with the heat it directly receives, forward into the room.



Valentine's Gas-Fire.

The illustration shows an embodiment of the improvements in a gas-fire for use in an existing coal-grate—a front elevation of an ordinary grate with the front bars removed and with a gas-fire of the kind patented fitted into the fireplace; a side sectional elevation of same; and a front elevation of a single piece of the fuel for use with the fire.

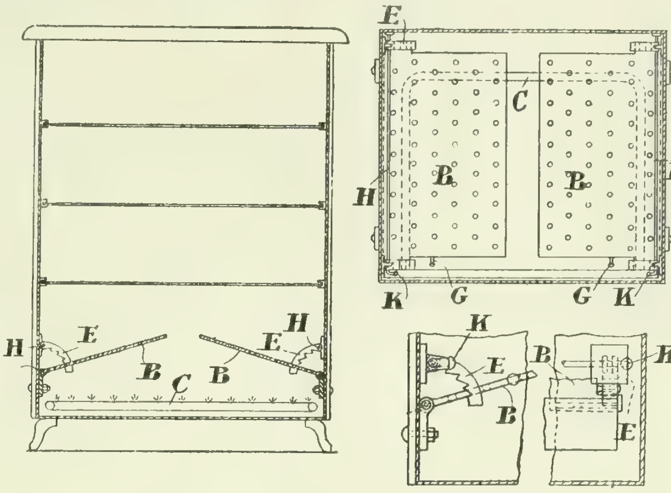
Stoves and Ranges Heated by Gas.

WILLS, C. E., of Southport.

No. 2675; Feb. 3, 1910.

This invention has for its object to provide means whereby the heat from the gas jets or burners of stoves, &c., can be directed, as desired, to any part of the joint being cooked or heated.

The interior of the stove is fitted with one or more adjustable deflectors so arranged that the heat can be directed on to the object being cooked or heated at the part or parts desired.



Wills's Heat Adjusters for Gas Cooking Stoves.

As shown, the oven is provided with two deflectors or vanes B, arranged opposite one another and in proximity to the gas-jets C; the deflectors being hinged so as to be capable of moving through the arc of a circle, while the deflectors are adjustably supported in an inclined position by notched or toothed quadrants E arranged at one or both ends of the deflectors. To enable the inclination of the deflectors to be readily adjusted, each deflector has a projecting knob G. The quadrants are preferably ratchet-toothed, so as to enable the deflectors to be raised and then automatically retained in position. Each pair of quadrants is preferably connected together so as to be capable of operation simultaneously by a transverse rod H terminating at the front in an actuating knob or handle K. The deflectors are preferably perforated so as to enable part of the heat from the gas-jets to pass through the deflectors and to be distributed above them.

The arrangement is such that if, for instance, a joint of meat is to be roasted, the deflectors can be manipulated so as to direct the heat from the gas-jets to precisely such part of the joint as may be desired. The invention also "enables practically all the heat to be effectively utilized for cooking the meat, and consequently less gas is required than at present and waste is avoided."

Clockwork Movements for Recording Instruments.

COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINÉS À GAZ, of Paris.

No. 7335; March 23, 1910. Date claimed under International Convention, July 9, 1909.

In the frequently occurring case in which a clockwork movement is required to do a varying amount of work while at the same time preserving a uniform speed (as, for example, in unwinding paper in recording instruments, engaging or disengaging mechanical parts at determined intervals of time and so forth), it is desirable, the patentees point out, to maintain a constant power or force on the pendulum or circular escapement. The means proposed for this purpose have usually been the power of a barrel spring or other motor device transmitted to the escapement through a train of wheels, one of which is loose on its spindle and is rotated thereby through the medium of a spiral spring attached to the spindle and loose wheel. The spiral spring, when it acquires sufficient tension, effects a stoppage of the spindle on which it is mounted, and thereby causes the barrel or motor device to be stopped when the power transmitted by the latter is too great. On the other hand, it effects the release of the barrel or motor device when the power transmitted becomes too small. The object of the invention is "to provide efficient apparatus for the purpose in question."

With this object, the patentees employ a sleeve adapted to move axially along a helical surface under the action of the spiral spring attached to the spindle and loose wheels, and against the action of a spring tending to oppose the movement. This axial movement of the sleeve has for effect to lock or stop a wheel which, through gearing, participates in the movement of the spindle that serves to wind up the spiral spring. The invention also comprises the combination with a clockwork movement of the character described and wound up automatically by an electro motor, of a brake adapted to stop the winding motor when the spring of the barrel has been wound to a given extent, and to release the motor when the movement has run to a given extent.

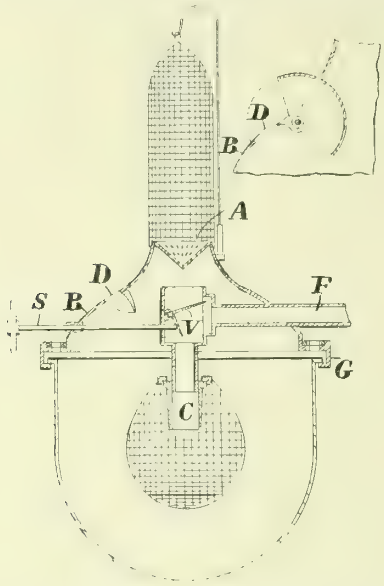
Incandescent Gas-Lamps.

NICHOLLS, F. J., of Wandsworth, S.W., and FLETCHER, E. J., of Upper Clapton, N.E.

No. 3289; Feb. 10, 1910.

This invention relates to incandescent gas-lamps constructed on the principle of Boughton's patent, No. 13,754 of 1908, with the objects: (1) To so construct the conductor or part leading to the body of vertical

burner that, where a closed bottom chimney or globe is used to surround the lower inverted mantle, a portion of the products of combustion from the inverted mantle and burner may be permitted to escape or be conducted to the outer atmosphere, and also, where desired, to so arrange such means of escape that the amount may be adjusted or the escape may be entirely cut off. (2) To apply a device to the combined up-and-down vertical extension of the mixer that the flow of bunsen mixture simultaneously flowing upwards and downwards may be regulated and adjusted for the purpose of balancing such flow, in order that the two mantles may be equally filled with the required flame.



Nicholls and Fletcher's Double-Mantle Burner.

A sectional elevation is given of the incandescent gas-lamp mentioned above, with the improvements applied thereto.

F is the mixer, with a vertical upward extension leading to the body of the vertical burner A; and a downward extension leading to the inverted burner C. A horizontal perforated flange is arranged round the outer circumference or lower rim of the conductor B, and a gallery G extends therefrom to carry the bottom globe or chimney. On to the perforated flange is fitted a perforated flat ring, which is free to be moved round so that the holes in it may partly or entirely close the holes in the perforated flange, and thus regulate the amount of air entering the globe or chimney at the top.

Openings D are made in the conductor B, and each opening may either have a fixed inward extending cowl or baffle, or the baffle or cowl may be pivoted, whereby it may be moved so as to extend either entirely inwards or partly inward and partly outward so as to partly cover the opening D or else fully cover and close them.

The bunsen mixture, flowing along the conducting pipe F into the upward and downward vertical extensions, is regulated by means of a pivoted flap valve V, having a heel which bears freely against the inner end of a horizontal screw S, by which the flap is tilted upwards, thereby restricting the flow of bunsen mixture to the vertical burner and permitting more to flow to the inverted one, and *vice versâ*. In this way, the flow of the mixture upwards and downwards may be regulated, and the supply to the respective burners can be balanced so as to fill both mantles entirely with the flame required.

Removing Tar from Coal Gases.

BROUGHAM, F. J.; a communication from SOLVAY ET CIE., of Brussels. No. 7915; April 1, 1910.

For the purpose of avoiding the production of ammoniacal waters which have to be distilled for removing the ammonia they contain, the patentees point out, it has already been proposed to deliver the gases produced by the distillation of coal in coke-ovens and gas-works direct to an acid solution; the passage of the gases through the acid solution producing the saturation of the ammonia—that is to say, the latter combines with the acid to form a salt. In order that this saturation may be successfully effected, a preliminary separation of the tar contained in the gases is required; and this separation has hitherto been effected while accompanied by a cooling process; so that it was necessarily attended by condensation of water. It has been proposed to recover the tar at temperatures at which the water does not condense; and it has also more particularly been proposed to use liquid tar itself as a liquid serving to recover the tar in suspension in the gas. All these various proposals are said to be "published in prior publications and belong to the domain of common knowledge."

The present invention consists of apparatus suitable for carrying out the operation of removing the tar in the presence of heat. It comprises a bubbling column or gas-scrubber made in sections, of the kind usually employed for washing gases and provided with an inlet and outlet for each section or series of sections for the washing liquid (which in this case is tar), and a surface heat regulator adapted to suitably regulate the temperature of the gas at the inlet of the scrubber, and a surface heat regulator for controlling the temperature of the tar supplied to the scrubber. This arrangement of apparatus is essential for correcting the variations of temperature resulting from the distillation of coal; and as the proper working of the entire apparatus necessitates the whole of the water remaining in the state of vapour, but without being uselessly superheated, it is necessary that means should be provided for raising or lowering the temperature of the gases and tar at will.

The illustration given in the specification is the same as that which accompanied the description of the apparatus given in the "JOURNAL" for Nov. 1 last, p. 324, and no further description is necessary.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Coalite Fiasco—Position at Plymouth.

SIR,—After reading in a recent issue the short article touching on points with which Sir William Preece may deal at the forthcoming general meeting of the British Coalite Company, I see that you are very imperfectly informed as to what has gone on at the Plymouth Gas-Works. The coalite batteries there have been pulled down and reinstated three or four times—in fact, two cargoes of scrap-iron from wrecked batteries have been sent round from Plymouth to Barking, to be followed during the last few months by several cargoes of coalite, unsaleable at Plymouth. This latter stuff was three parts breeze when unloaded at Barking.

The British Coalite Company have built a large coal-store inside the Plymouth Gas-Works. They have also installed expensive electrical plant there, besides a regular "underground railway" for their various conveyors; also apparatus for cleaning their gas, and tanks for storing their tar. Their total expenditure at Plymouth cannot have been far short of £50,000. In return for this, all the British Coalite Company will receive by-and-by will be a few hundred pounds for scrap-iron, as they did in the case of Hythe. The manufacture of coalite at Plymouth was stopped at the beginning of November.

Of course, the old story is being put about that a fresh discovery, or fresh process, for making coalite is on the verge of being proved to be a commercial success. The Plymouth gas authorities have again given extra time for the Coalite Company to set their house in order, and so the farce will go on for another few months.

A SUBSCRIBER.

London, Nov. 30, 1910.

Use of Calcium Chloride on Roads.

In the course of the paper read by Mr. L. A. Legros, at a recent meeting of the Institution of Mechanical Engineers, on "The Development of Road Locomotion in Recent Years," he referred, as mentioned in the "JOURNAL" last week, to the treatment of road surfaces with the view of binding the dust, and stated that one of the suggestions in this connection which had been abandoned was the use of calcium chloride. We learn from the Sales Manager of Messrs. Brunner, Mond, and Co., Limited, that this is by no means the case, inasmuch as the firm have for some years been selling the material named in increasing quantities for the purpose indicated, and their deliveries "amount to thousands of tons per annum." He states that had the rainfall last summer not been so heavy, the deliveries would doubtless have been considerably larger, "as the public bodies who have employed the material have expressed themselves as thoroughly satisfied with it in freeing the roads from dust."

The Supply of Cheap Gas in Manchester.

In the last number of the "JOURNAL," a report was given of a deputation to the Gas Committee of the Manchester Corporation on the subject of the mitigation of the smoke nuisance by the extended use of cheap gaseous fuel. One of the speakers, it may be remembered, remarked that by reducing the price of gas an apparent sacrifice might have to be made by the Corporation; but he believed that for every £1000 of loss the City would gain tens of thousands of pounds in the way of added health to the community. A correspondent who is in business in Manchester writes on this point as follows: "I personally do not think there would be any sacrifice ultimately, seeing that a reduction made in the price of gas for power and heating only would give such an impetus to its use for these purposes as would more than recoup the Corporation for the preliminary loss occasioned by such reduction. It would be a case of a small loss on the comparatively small amount of gas now used, as against a very greatly enhanced profit through the increased sales, though the margin would be less than (say) on lighting gas."

LEGAL INTELLIGENCE.

GAS-METER RENT CHARGES.

A Test Case at Salford to Go to Appeal.

At a sitting of the Salford Police Court on Friday, a case was heard which raised the question of the right of the Corporation to charge rents for gas-meters. Mr. James W. Cooke, Chairman of the Salford Ratepayers' Association, was summoned by the Corporation for the non-payment of his gas account for the quarter ending Sept. 30 last; the sum being 10s. Mr. Cooke had offered to pay for the gas consumed —namely, 8s. 6d.—but declined to pay the 1s. 6d. charged for meter-rent. The case was understood to be a test one; and a large number of interested people were present in Court.

Mr. L. C. EVANS, the Town Clerk, appeared for the Corporation; and Dr. ATKINSON represented the defendant.

Mr. EVANS, in opening the case, explained that in June last the Corporation decided by resolution to impose a rent for gas-meters supplied by them; and the question was whether the Corporation had the right to charge such rents. He submitted that, under the provisions of the Salford Improvement Act, the Corporation had such power, and the defendant was bound by the regulations as to the supply of gas.

Dr. ATKINSON argued that the Corporation had no power to charge for meter-hire. When his client decided to take gas, the agreement contained no mention of meter-hire; and he was only bound to pay the price charged for gas consumed. He agreed that the Corporation

had power to vary the price charged for gas; but they could not impose other charges, as in this case. The bill sent to Mr. Cooke was for gas supplied from July 1, whereas it was not until July 7 that the resolution of the Corporation to charge meter-rents was confirmed. This gave a consumer no chance of defending his rights. Even if the Corporation were entitled to make the charge, they could not do so until they had notified consumers of such intention. He reminded the Magistrates that the Council had decided to abolish the meter-rent charges as from the end of the September quarter.

After consultation in private, the Magistrates came to the conclusion that the defendant had put himself under obligation to pay any charge the Corporation might fix for the meter, and defendant remained liable until he gave notice of his intention to discontinue the use of the meter. They further held, however, that, before the Corporation could impose or alter a charge for the meter, as distinguished from gas, they must give notice to the consumer; thus affording him an opportunity, if he desired, of ending the agreement. Under the circumstance, they only ordered defendant to pay 8s. 6d., the amount of the charge, for gas consumed, the item of 1s. 6d. for meter-rent to be remitted. They further directed that each side must pay its own costs. The Bench agreed to state a case.

AUTOMATIC LIGHTING—BREACH OF AN AGREEMENT.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Dec. 6.

(*Before Mr. Justice* SWINFEN EADY.)

British, Foreign, and Colonial Automatic Light-Controlling Company v. Hutchings.

This was an action to obtain an injunction and damages for breach of an agreement.

Mr. PATTERSON appeared for plaintiffs; defendant did not appear.

Mr. PATTERSON said the Company was incorporated in 1905; their principal business being to manufacture and supply clockwork apparatus for automatically lighting and extinguishing gas and electric lamps. The defendant, William Ernest Hutchings, was a former employee of the Company; and the action was brought to restrain him from committing a breach of the agreement he made with them. There was a motion for an interim injunction, on which Mr. Owen Thompson appeared for the defendant; but he (Counsel) had ascertained that he was not now instructed. The defendant left the plaintiffs' service in November, 1908, and the two years during which the covenant in question was to run had expired; so that the only relief he asked was damages for the breach and the costs of the action. The clockwork apparatus was the invention of Mr. Gunning, who made and sold it; and in 1904 he employed the defendant as a traveller. In 1905, the Company was formed and took over the business, and the defendant continued to work for them as he had done for Mr. Gunning; there being at that time no written agreement with them. On Jan. 24, 1907, the agreement set out in the statement of claim was entered into; and it was modified in an immaterial respect the following October. The second clause provided that the defendant should not, without written consent, be directly or indirectly interested in, or concerned with the manufacture or sale, or solicit or take orders on behalf of, any other person or company for any automatic apparatus for lighting or extinguishing lamps. This provision was to continue in full force for two years after the expiration of the service, so as to restrain the employee from acting in the way described in any town or district in the United Kingdom in which the local authority or the gas company were or had been customers of the Company prior to the determination of the agreement. Under another clause, notice was given to the defendant in August, 1908, which expired on Nov. 21; and almost immediately afterwards he joined the firm of Alder and Mackay, of Edinburgh, who had a rival system of automatic lighting and extinguishing lamps by means of pressure instead of clockwork. Among the customers of the plaintiff Company were the Corporations of Darlington and Bournemouth and the Barnard Castle Gas Company, with whom they had contracts; also the Gas Companies at Newcastle-on-Tyne and Windsor. When the defendant left their service the Company were managing the street lighting at Barnard Castle; but some time in 1909 the District Council took it over. The defendant stated himself that he had displaced the clockwork controllers at Barnard Castle; and he said practically the same thing with regard to Newcastle, Darlington, and Windsor. At the end of 1908 or the beginning of 1909, he approached the members of the Lighting Committee of the Bournemouth Corporation, asking them to give Messrs. Alder and Mackay's system a trial; but as they had a contract with plaintiffs then running, nothing was done. At the end of 1909, however, he repeated his application; and the letters would be produced.

His LORDSHIP said one case of breach should be proved—it did not matter which one was taken.

Evidence having been given,

Justice SWINFEN EADY said the plaintiffs had proved a breach of the agreement, and were entitled to judgment, and therefore to the costs of the action. They were also entitled to unliquidated damages. As to this there would be an inquiry, the costs of which would be reserved.

Action to Recover the Cost of Pumping Plant.

The Petersfield Rural District Council have had judgment given against them in the High Court of Justice, at the instance of Messrs. Thomas and Son, who sued for £65, the price of a steel windmill, pump, and accessories, together with the cost of erection. The defendants had paid £40 into Court, and counterclaimed for alleged damages by the loss of customers at Liss through the machinery not being of sufficient power to pump the water into a reservoir. The reservoir was to hold 30,000 gallons of water, which was to have been pumped 960 yards from the source. Judgment was given for plaintiffs on the claim and counterclaim, with costs on the High Court scale.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of the Proprietors of this Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. J. H. BIRCHENOUGH, C.M.G., in the chair.

The SECRETARY (Mr. William Martin) read the notice calling the meeting; and the Directors' report (see *ante*, p. 584) and the accounts were taken as read.

DIRECTORIAL CHANGES.

The CHAIRMAN said it was his duty to move the adoption of the report and accounts for the past year. Since the Directors last met the proprietors, they had had to deplore the death of a colleague, Mr. F. Tendron. He was well known to all; for he had been connected with the Company for 37 years, and had served as a Director for 22 years. He had greatly endeared himself to them all by his amiable and kindly qualities. His devotion to the Company was only equalled by his confidence in its future. He (the Chairman) was sure the proprietors shared the regret of the Board at the loss of a colleague of such tried loyalty. The Directors had elected in his place Colonel Le Roy-Lewis, who was already honourably associated with other important gas undertakings. He (the Chairman) was satisfied the Company were most fortunate in securing so strong and able a Director at a time when there were many difficult problems to solve. And, if he might say so in Colonel Le Roy-Lewis's presence, his colleagues were confident that they could not have made a wiser choice. He hoped the stockholders would unanimously ratify their action.

INCREASED SALES—THE FLOODS NEAR PARIS.

Before dealing with the affairs of their own Company, he would like to say a few words about the Union des Gaz. It would have been noticed in the report that, in spite of the strike at the Italian stations of the Company, and of the abnormal and disastrous floods which affected two of its French stations, the total gas sales of the year increased by $1\frac{3}{4}$ per cent., which proved that, even under adverse circumstances, there was a healthy elasticity about the business, which was very encouraging for the future. It would be within the recollection of the proprietors how severe the floods were in the neighbourhood of Paris last winter. The Nanterre works of the Union des Gaz suffered severely. The waters of the Seine invaded the works to such an extent that they reached the ash-pans of the ovens in the retort-house. The coal conveyors and elevators were stopped, and 120 tons of coal per day had to be carried by men from the coal-store some distance away to the hoppers on the third storey of the retort-house. Notwithstanding these difficulties, and in spite of the fact that the whole district supplied by the Nanterre works was under water, the regular supply of gas was maintained without interruption, thanks to the admirable efforts and devotion to duty of the Manager (M. Lhomme) and his excellent staff. A word of praise was also due to M. Moussoir, the Manager at Montargis, and his staff for their conduct during the floods.

THE STRIKE IN ITALY.

When he addressed the proprietors last year, he dealt very fully with the great strike at the Italian works of the Union des Gaz, from which the Company were at the time emerging. He told them that the object of the Board of the Company in facing and seeing through so serious a strike was "neither to reduce wages nor to curtail the privileges and advantages of the men with regard to pensions, sick-pay, &c.," bus simply and solely "to restore to the Company such control of its works as was absolutely essential for efficient and economical working." He was happy to tell the proprietors that this object had, in a very large measure, been attained. At Milan and at Genoa, and also at the two smaller Italian stations of the Union des Gaz, discipline had been re-established, the services of a large number of superfluous men had been dispensed with, individual efficiency had been increased; and the works now presented the appearance of better and more economically organized industrial establishments. The result was a very decided improvement on the working both in the retort-houses and in the yards. He had before him statistics relating to the past eight months. He would not trouble the proprietors with them, but would content himself with saying that they were very encouraging. It was true that a portion of the increased production of gas must be attributed to new and improved plant; but under the old *régime*, new plant did not always yield the satisfactory results expected of it. From all the Italian stations, the managers and engineers reported, and the Directors of the Union des Gaz had seen for themselves upon their visits to Italy, a greatly improved demeanour on the part of the men—a willingness and an alertness which were conspicuously absent in former times. Under these circumstances, it would be a pleasure, as well as a duty, for the Directors of the Union des Gaz to foster this better spirit, and to endeavour that those who deserved it might share in the results of their increased exertions.

STARTING THE NEW YEAR FREE FROM LEGACIES OF THE PAST.

But, while he stated with satisfaction that the sacrifices the Union des Gaz made in combating this strike were now beginning to find a reward which would in time amply justify the action of the Board, he had to admit that the strike was a costly business. It was immediately followed by the floods in France, and by a mild winter, which brought about a serious fall in the selling price of coke. Then the charges for interest and redemption of bonds, issued to finance the construction of the new works, weighed with exceptional heaviness on the year's accounts, owing to the fact that these new works were not in full action, and were not earning anything like their maximum profits. The result was that the Union des Gaz had to face at the same time a greatly increased expenditure, and a temporary inelasticity of revenue. The Directors of the Union des Gaz decided to meet the position boldly, to

reduce the dividend from 9 per cent. to 7½ per cent., and to write off the whole of the expenditure caused by the strike and the floods, partly out of profits and partly by taking a considerable sum from the special reserve. By adopting this course, they were able to start their new year unencumbered by any legacies from the past year. He thought it was clear that the policy of the Board was approved of by the general body of proprietors and investors, because the price of the Company's shares on the Paris market rose after the declaration of the reduced dividend. So far as the Union des Gaz were concerned, they entered upon their new year (as he had already stated) unencumbered, with coal prices in their favour, and so far as one could judge, with a fair prospect of industrial peace and of increased efficiency within the works. If coke sold well, and fetched a good price, the coming year should be a prosperous one.

THE POSITION AT MESSINA.

Turning now to the affairs of the Continental Union Company which concerned them more immediately that day. Last December he put before the proprietors very fully the position of the undertaking at Messina; and he told them that the situation was a complicated and delicate one, that the Directors were fully alive to the duty they owed to the stockholders, and would endeavour to make the best they could of a bad business. They had been engaged upon this task throughout the whole of the past year; and a very anxious and difficult one it had been. In the first instance, they sent to Messina Mr. Bickley, the Engineer in charge of the Sampierdarena works of the Union des Gaz at Genoa, with instructions to provide the Board with a technical report, giving details as to the condition of the works and mains, the probable cost of reinstatement, and the prospects of both immediate and ultimate business in Messina. It was essential to have such a report before the Directors could determine upon their best course of action. Mr. Bickley informed them that the works themselves could be reinstated at comparatively small cost—that the damage done by the earthquake was by no means irreparable, but that the whole system of canalization was practically useless. The fine city they had lighted for so many years, with its esplanades, wide streets, prosperous shops, and immense public buildings—all making a large demand on the output of their works—was still a heap of ruins, and a new town (consisting of wooden huts housing a population of 70,000 people) had grown up to the west of the old city on the far side from the works. Mr. Bickley reported that it was this temporary town the Company would have, in the first instance, to canalize and light, with the prospect of doing the work all over again as and when the new city of Messina arose from its ruins. Moreover, the Royal Commissioner, who, for the time being, exercised the powers and functions of the Municipal Council, informed Mr. Bickley that one of the conditions which would be imposed upon the Company in any negotiations for a new contract would be the eventual removal of the old works from its present site on the seashore to a new site upon the port. Taken as a whole, Mr. Bickley's report did not leave a very encouraging impression upon the minds of the Board. The proprietors might ask—and he thought it natural they should ask—why the Board did not abandon at once the concession and cut the loss. Well, there were always two parties to a contract; and it was not easy for one of the parties—even after an earthquake—to walk away from it, especially when he would have to leave so much behind as the Company would be compelled to do. Moreover, they had to consider the town debt as well as the concession and works. They felt that, given certain conditions which they regarded as absolutely essential, it might be better business for the Company to take on a fresh contract. With this view, early in the year, the Directors submitted certain proposals to the Royal Commissioner, which dealt with both the town debt and the future of the gas undertaking at Messina. Since these proposals were submitted, negotiations had been going on practically without a break. In the late spring, Colonel Le Roy-Lewis, Mr. A. F. Phillips, and he (the Chairman) visited Italy; and they endeavoured to meet the Secretary of State and the Royal Commissioner in Rome. But the visit of the King and Queen of Italy to Sicily, which occurred at that particular time, made such a meeting impossible. In September, Mr. Phillips, accompanied by the Secretary (Mr. Martin), went to Messina; and under the advice, and with the assistance of, the Company's distinguished advocate at Genoa, and with the help of their legal adviser in Sicily, carried on personal negotiations with the Royal Commissioner. It was agreed that the parties should meet at a later date in Rome, where it was anticipated that a final agreement would be arrived at. In November, Mr. Phillips and Mr. Martin returned to Rome, and renewed the negotiations, with the assistance of the Company's Italian legal advisers. Finding that the conditions upon which alone the Board were prepared to undertake a new contract encountered insurmountable opposition from the authorities, their negotiators made proposals, which, on the one hand, dealt with settlement of the town debt, and, on the other hand, sought to free the Company from all responsibility whatever for the future. A basis of agreement appeared to have been arrived at; and he had had every expectation of being able to announce it that day. The Royal Commissioner had, however, he feared, again changed his mind. In any case, the Board had not yet received the definite reply which had been expected through the medium of Mr. P. S. Morton, the Manager at Genoa, who had rendered valuable assistance throughout the negotiations. This being so, and the negotiations being at a critical stage, it was impossible for him to be as explicit with the proprietors as he should like to be, lest, by any words of his, he should prejudice the negotiations. He could only repeat what he said last year, that the Directors were fully alive to the importance of making the best of a bad business for the stockholders. To this he adhered. From what he had said, it would be seen that, in drawing up the balance-sheet, the Directors could only deal with the accounts as they were at the time. Negotiations were in progress; and any attempt to deal drastically with the Messina assets in the balance-sheet would inevitably have prejudiced the negotiations. They would take his meaning without him dotting the "i's" and crossing the "t's." The Board therefore continued the policy that the proprietors approved of last year. He remembered Mr. H. E. Jones expressed his appreciation of the courage and sound finance of the Board. They had continued this policy, and had taken £10,000 from the profits of the year, and carried it to the Messina amortization account. This now stood at £32,000, reducing the amount to the debit of the Messina outlay to £48,446, which he would point out was almost balanced by, or at all events did not largely exceed, the sum which stood to the credit of the reserve fund. He need hardly say that, whatever might be the outcome of the Messina negotiations, the Board would next year make proposals for dealing with the Messina items in the accounts upon simple but adequate lines.

THE ACCOUNTS.

Turning now to the accounts for the year, he would ask the proprietors to look at the general revenue account. On the left-hand side, it would be seen that the charges for management were much the same as last year. There had been certain adjustments. A pension had been transferred from this account; but, on the other hand, there had been no contribution from Messina towards general charges as was the case in previous years, the effect of which was to reduce the total. The item for pensions was new. It was due, of course, to the liquidation at Messina. They had certain obligations to the survivors there; and these had now all been settled. On the right-hand side, the notable and important item was the reduction in the dividends received from the Union des Gaz by £12,104. Of this, the proprietors were informed in the report. The effect of the drop in the receipts was to reduce the balance carried this year to net revenue to £54,012, as compared with £67,098 last year. Adding to this amount the balance of £12,954 brought forward from June 30, 1909, it would be seen that the total amount of undivided profits the Directors had to deal with was £66,966. Out of this amount, it would have been possible to pay a 5 per cent. dividend, and to carry forward a substantial sum; but the Directors, with a full sense of responsibility, and a complete knowledge of facts before them, preferred to ask the proprietors to pass £10,000 to the Messina amortization account, in pursuance of the policy approved last year, and to agree to a dividend of 4 per cent. for the year, carrying forward £11,783. The Board were satisfied that it was in the best interests of the stockholders themselves to submit to this temporary sacrifice of dividend, for they fully believed that nothing so effectually strengthened the permanent position of a Company as prudent finance.

The DEPUTY-CHAIRMAN (Mr. Arthur Lucas) seconded the motion.

Mr. EDWARD CLARKE said there was one question which suggested itself to him, though the time was probably not yet ripe, in view of the pending negotiations, to deal with it. In the first place, it seemed that the proprietors might look upon Messina, and the large sum absorbed by it, as now being the subject of a sort of arbitration; but they were apparently very unlikely to continue operations there. If this were so, it was surely a matter for the consideration of the proprietors, and for the recommendation of the Board, whether the time had not come when they should deal with their Union des Gaz shares—deal with them in the nature of a trust; and let the French on their part absorb them at the price at which they now stood on the Paris Exchange.

Mr. R. STEVENS asked for an explanation of what appeared to be an apparent discrepancy in the shares held in the Union des Gaz now and in the previous year. This year the number was 40,019, valued at £822,076; while the previous year the number was 40,839, valued at £847,781.

Mr. CAVE ORME said he should like to associate himself to some extent with the remarks made by Mr. Clarke. It might not be prudent to carry into effect the suggestion at the present time; but it was one the Board might take into consideration.

Mr. LEONARD R. WILKINSON desired to dissociate himself from the last two speakers. He believed there was great vitality in the gas business. With the conservative finance incorporated with the Company, he viewed the position with great confidence. While it was difficult to get any big town in these days, small places and the suburbs of large towns might be obtained in which to extend business. He was a great believer in the future of the gas industry; and he hoped the Board would continue.

The CHAIRMAN observed, with reference to the remarks of Mr. Clarke and Mr. Cave Orme, that he was glad they agreed with the Board that the time had not arrived to consider the question raised; but it would, he could assure them, receive the Directors' most careful and respectful consideration. He thanked Mr. Wilkinson for his views as to the future of the gas industry. He assured him that the Board concurred with him. As to the difference in the figures which Mr. Stevens saw in the balance-sheet for this and last year, it arose from the fact that, during the year, the Directors sold a certain number of the Union des Gaz shares. When the last issue of Union des Gaz shares was made, the Board took up rather more than they wished for; and it was always their intention, as opportunity offered, to sell some of them. They had sold a certain number during the past year—about 800—at a profit; and the proceeds of the shares appeared in their assets, either under cash or investments. This was the entire explanation of the difference.

On the motion of the CHAIRMAN, seconded by Mr. N. E. B. GAREY, dividends were declared of 4 per cent. on the ordinary stock (free of income-tax), and 7 per cent. on the preference stock (less income-tax), deducting the interim payments of 2 and 3½ per cent. respectively.

Proposed by the CHAIRMAN, and seconded by the DEPUTY-CHAIRMAN, Mr. Garey was re-elected to his seat on the Board, as was also Colonel Le Roy-Lewis, on the motion of the CHAIRMAN, seconded by Mr. R. S. GARDINER.

Moved by Mr. BERNARD F. HARRIS, and seconded by Mr. R. STEVENS, the Auditors (Messrs. A. T. Eastman and C. P. Crookenden) were re-appointed.

The CHAIRMAN moved that the thanks of the proprietors be given to the Secretaries, Managers and Engineers, and the staff of the Company and of the Union des Gaz, both in London and abroad, for the able services rendered by them during the year. No one, he said, knew better than the Directors how loyal and how great were these services. Their Secretary was indefatigable; and their whole staff in London did their work with great devotion. With regard to the staff abroad, he had personally the warmest appreciation of the services of each member. He should like Mr. Phillips, who was in constant contact with these gentlemen abroad, to say a few words.

Mr. A. F. Phillips said he had much pleasure in seconding the motion. He had visited during the past year the principal stations of the Companies several times; and he could testify to the loyal devotion of all their Managers to the best interests of the Company. It was difficult for any gentleman who had not been connected with the gas business, especially the gas business in Italy, to appreciate the numerous difficulties with which these gentlemen had to contend. They had to be continually on the watch. On the one hand, the public authorities were most exacting in having every condition in the contracts fulfilled; and, on the other hand, the labour question was continually causing difficulties. The proprietors would be surprised if they knew the number of arbitrations their Managers, especially in Milan and Genoa, had to attend to decide questions which were raised by the workmen; but he could assure the proprietors that, under all these difficulties, their Engineers were devoted to their interests, and they might be relied upon to obtain the best possible results they could.

The Chairman remarked that Colonel Le Roy-Lewis had since his election visited every one of the stations of the Union des Gaz.

The motion was heartily agreed to.

The Secretary having acknowledged it on behalf of himself and his fellow officers,

Mr. Walter Hunter, in proposing a vote of thanks to the Chairman and Directors, remarked that the proprietors were rather disappointed at the result of the year's working. But they also felt that the Board had been in a difficult position; and they were quite certain the Directors did the best possible to improve the position. There was one matter upon which the Chairman gave them some hope, and that was with regard to the improved relations with the workpeople. He (Mr. Hunter) must confess that sometimes he had thought the Board had shown a little want of courage in dealing with their workmen. He knew the difficulties to which Mr. Phillips had alluded; but the proprietors had confidence that the results of the courage displayed on a recent occasion would encourage the Board to take a similar course in the future.

Mr. A. W. Oke seconded the motion, which was cordially passed.

The Chairman, on behalf of himself and his colleagues, thanked the proprietors for their vote of confidence. In reply to Mr. Hunter, he might say the Board were fully sensible of the feeling underlying his excellent advice; and they were continuing to consider in what way, now that discipline was restored, they could gradually improve the position of their workpeople.

Gas Supply in Amman Valley.—The supply of gas manufactured in the Amman Valley, Carmarthenshire, has received a considerable impetus by two successful exhibitions which have been held in Ammanford and Garnant within the past fortnight. The Gas Company are extending their mains in all directions, and will ultimately embrace a growing and largely populated district which at present contains upwards of 30,000 inhabitants.

LISBURN GAS-WORKS PURCHASE.

Terms of the Agreement.

In the last number of the "Journal" (p. 730), it was mentioned that an agreement had been come to between the Lisburn Urban District Council and the Gas Company for the purchase of the undertaking of the latter for the sum of £33,000. At the monthly meeting of the Council on Monday last week, the Town Solicitor (Mr. Wellington Young) made an interesting report on the subject, in which he recounted the circumstances which led to the settlement, and explained its terms, which are as follows.

1.—Possession to be given to Council on Dec. 31, 1910.

2.—Company to pay all expenses of working up to that date.

3.—Accounts furnished by Company as at the 1st of December to be collected and retained by Company; and the Council not to be responsible in any way for their collection.

4.—The Council to be entitled to the benefit of all gas supplied by the Company as from the 1st of December up till the 31st of December, including gas supplied for public lighting, and to collect and retain the price for its own use.

5.—On the 31st of December the quantity of gas in the holders and pipes to be measured by a person mutually agreed upon, and to be paid for by the Council at the ordinary consumers' prices without discounts being deducted.

6.—Stock of coal, coke, and all other stores and consumables which the Council are to take over under the Act, save the above, to be taken by a person mutually agreed upon, who shall also fix the price to be paid by the Council to the Company therefor. The figure so fixed shall bind both parties, and shall be paid by the Council at their first meeting after being ascertained.

7.—The amount to be put into the award shall be the sum of £32,145, which, with the further sum of £855, making together the sum of £33,000, shall be paid on Dec. 31, 1910; and this shall cover all that the Council are to pay, exclusive of costs, and save the amounts which may be fixed by the arbitrator or valuer under the last two preceding clauses.

8.—The Council, on taking possession, to take over all existing contracts for the supply of coal, material, and other stores, and to be entitled to all benefits derivable therefrom. They shall also take over all the employees under their existing engagements.

9.—An agreement embodying the above terms, and nominating the arbitrator or valuer to act under the fifth and sixth clauses, to be sealed on or before Dec. 6, 1910.

In closing his report, Mr. Young said: "I consider this a most satisfactory arrangement, as it will avoid a very considerable amount of expense, and the £855 will, in my opinion, all be paid back to the Council in the gas accounts paid by consumers, the saving in the

lighting of the town, and the profit on the coal contract. I forwarded copy of the consent to your Parliamentary Agents, and received a letter from Mr. Lees stating that he was perfectly satisfied with the arrangement, and that we had made a good bargain. As the contract must be completed and the works taken possession of before your next monthly meeting, I recommend that a paying order should be drawn on Monday, Dec. 5, in favour of the Gas Company for £33,000, to be held over until possession is given, and that a Sub-Committee be appointed to attend with the Town Clerk and myself at the gas-works on the 31st of December to take over possession. As the stock of coal and consumables is the only remaining matter to be dealt with, and as this must be done by one valuer mutually selected, or, failing such selection, by a valuer appointed by the Board of Trade, Mr. Barbour and I consented to the appointment of Mr. Wilfred Tallantyre, Gas Manager at Lurgan. The other side consenting, the Town Clerk and I had a meeting at the gas-works in Lisburn on the 2nd inst. with Mr. Stevenson as representing the Company, and Mr. Tallantyre, when I pointed out to the latter the different matters of which he was to make a valuation, and fixed his fee at £15. The amount which will be found by the valuer will have to be paid at or before the monthly meeting of the Council in February. This will conclude the entire arrangement, which I consider, on the whole, most satisfactory to the Council and the ratepayers."

The Council considered Mr. Young's statement very satisfactory.

SALFORD GAS PROFITS.

Labour Councillor and Alleged Loss in Slot Meters.

On the minutes of the Gas Committee being presented for confirmation at last Wednesday's meeting of the Salford Town Council, Mr. Purcell, one of the Labour members, asked the Mayor (Alderman Phillips), as Chairman of the Gas Committee, to answer the following: (1) The total sum paid from the gas undertaking to the district fund, from the first payment to the end of the last financial year. (2) The total sum paid to the borough redemption fund to the end of the last financial year, also the date it commenced. (3) The total net profits, since the inception, transferred to the district fund. (4) The number of ordinary gas-meters at present in use in the borough in the houses where rates are paid to the Corporation direct by the tenant. (5) The number of ordinary meters at present in use in the borough in houses where the rates are paid by the owners, agents, or others than the actual tenant.

The Mayor said that, as Mr. Purcell was a member of the Gas Committee, the proper method for him to obtain the information required was to move at the Committee meeting that it be obtained.

Mr. Purcell observed that the reason he brought this matter before the Council was because he had been told they were losing £150 a year on the slot-meters.

WESTMINSTER STREET LIGHTING SPECIFICATION.

Explanation by the City Engineer.

In the course of the paper read by Mr. Haydn Harrison, at a recent meeting of the Institution of Electrical Engineers, on "Street Lighting by Modern Electric Lamps" (some extracts from which were given in the "Journal" last week), reference was made to the somewhat unique character of the specification on which the tenders were based for the Westminster street-lighting contract, which, as readers are aware, has been secured by the Gaslight and Coke Company. This specification having been referred to by the "Contract Journal" as the production of Mr. Jacques Abady, the Chairman of the Works Committee of the Westminster City Council, the City Engineer (Mr. J. W. Bradley, M.Inst.C.E.) sent to that publication the following letter.

The specification in question was prepared by myself, as Engineer responsible for the work, on the framework of similar specifications drawn up by me during the past ten years, in which "measured candle power per lamp in position" is the basis of the contract, instead of "energy consumption" generally customary. I believe prior to the issue of my first specification on this basis in 1901 on no occasion had specifications been issued which allowed of tenders for street illumination by gas, oil, or electricity being considered strictly on their merits, and entirely apart from such questions as size of units, height and spacing of columns, &c. Competing schemes of gas and electricity usually differed widely in these respects—rendering difficult an economical consideration of different illuminating media.

On the basis of the 1901 specification previously referred to, the City of Westminster adopted for the first time in England a system of large units (some 900-candle power street measure, since increased in size to 3000-candle power street measure) of gas-lights on high columns at a greatly reduced cost, illumination considered, per mile of street, as compared with that previously existing; and since then other contracts for both gas and electric lighting have been similarly entered upon. . . . I have not at any time found such a specification other than a most convenient and workable one. It provides means of contracting satisfactorily for the supply of street illumination on a strictly competitive and definitely comparative basis for either gas, electricity, or oil, and further permits of a ready test at any time to ascertain if the conditions of supply are being fully observed by the contractors.

Messrs. John Wright and Co.'s "St. Andrew" gas-heated steam radiators have been installed for heating the premises of the Civil Service Co-Operative Society, Limited, at 28, Haymarket, S.W. We understand they have been fitted throughout the entire building.

COST OF GAS AND COAL FIRES.

The interview between a deputation from the Manchester and Salford Sanitary Association and the Manchester Corporation Gas Committee, with regard to the mitigation of the smoke nuisance (which was reported in last week's issue), has led to some correspondence in the "Manchester Guardian"—the point referred to being the cost of a gas-fire as compared with a coal-fire.

The first letter, signed "A Working Man," pointed to a statement in the paper to the effect that if gas could be sold at about 1s. 9d. per 1000 cubic feet, it would be as economical as coal for heating purposes. The writer said: I am a working man, and live in a small house, the lower rooms of which are parlour and kitchen. We burn coal in the kitchen from about 7 o'clock in the morning till 11 at night, using on an average not more than 2½ cwt. per week. So for 2s. 6d. we get a fire of coal for seven days of 16 hours at about ¼d. per hour. In the parlour, we have a gas-stove, such as the Corporation sell and recommend. By carefully watching the gas-meter index, I find it burns about 35 cubic feet per hour, which costs 1d.; so that if I burn the gas-stove for the same length of time that the coal-fire is used, it will cost me over 10s. per week, or if gas were reduced to 1s. 9d. per 1000 cubic feet about 8s. per week. Of course, a gas-stove in a parlour is not burned like this; but if it is to supplant the kitchen fire, it would have to be burned like this, or it would be of no use. Also I have tested with a thermometer the warming power of the coal-fire, and found it at least twice as efficient as the gas. Apart from this, there is the comfort and appearance of the coal-fire. When I look at the gas-stove, I feel like Scrooge's clerk, who tried to warm himself at the candle. Surely there is something wrong in the statement that gas at 1s. 9d. per 1000 cubic feet would be as economical as coal for heating purposes.

To this Mr. J. W. Graham, Principal of Dalton Hall, replied: The thoughtful letter from "A Working Man" states that the cost of gas at 1s. 9d. per 1000 cubic feet compared with coal at 1s. a cwt. would be about as 8s. is to 2s. 6d. As I was responsible for suggesting at the recent deputation to the Gas Committee that gas at 1s. 9d. was about as cheap as coal, I may perhaps be allowed to extend my statement a little in reply to your correspondent. His figures are probably correct. They are in harmony with the elaborate report published by the Coal Smoke Abatement Society in 1906, after a month's test of 25 stoves. The report may be obtained from the Society at No. 25, Victoria Street, London, S.W., for 3d. The report says: "When the initial raising of the temperature of the rooms had been accomplished and the fires had produced a fairly steady rise, the cost per hour for each degree of rise in temperature was about four times as great with the gas-fires as with the coal." This took gas at 3s. per 1000 feet and coal at London prices. It is also to be noted that gas-fires are improving with great rapidity, and that the best obtainable now are much better than they were five years ago. But now I come to the reasons which have led me to the conclusion that in many cases the extra cost of a gas-fire would be very little. (1) Gas-fires heat a room much more quickly than a coal-fire does, because of the time taken to get the coal-fire into a hot condition. (2) The coal that is wasted in lighting-up and in dying-down is saved by using gas. (3) The firewood, the chopping of it, and the laying of the fires are saved. (4) The labour involved in housing the coal, shovelling it and carrying it into the rooms, cleaning out the grate, taking the ashes away and disposing of them, is all saved. (5) Through the absence of dust, the hygienic quality of a gas-fire with a good draught is better than that of a coal-fire. It does not vitiate the air of the room, nor does it produce any drying effect as is popularly supposed. (6) It is not necessary to keep the gas-fire on all day. Even in a working-class kitchen there are probably many hours in which the gas can be turned off; and if a gas-cooker is used, there need be no fire the whole of the summer. I believe this point to be the greatest economy of all. It will be plain that for passages, consulting-rooms, offices, dining-rooms, bedrooms, drawing-rooms used in the evening only, and all the numerous rooms which in the houses of the middle class are not in constant use, gas-stoves offer many advantages. The deputation had also manufacturing smoke in view. Here the use of gas can be much more economically conducted, and it appears to be generally agreed that gas at 1s. 6d. to 2s. per 1000 cubic feet can compete with coal. The cost of fuel at the 25 Metropolitan electric light undertakings was found to be equal to the cost of gas at 2s. 1d. per 1000 feet. I hope the Gas Committee will adopt the suggestion of lending out gas-fires free and fitting them for nothing.

COST OF ALTERING GAS-MAINS.

At the Meeting of the London County Council last Tuesday, the Improvements Committee reported that, in connection with the widening of Woolwich Road, which is being undertaken by agreement with the Greenwich Borough Council, certain mains belonging to the South Metropolitan Gas Company will be brought under the carriage-way instead of being, as at present, under the footway, and the depth of cover will be reduced. The paving works outside the tramway area are being executed by the Borough Council; the County Council contributing two-thirds (not exceeding £8000) of the cost. A question arose between the Borough Council and the Gas Company as to the liability for altering the mains at a certain point in the road where the works are being executed under the Metropolitan Paving Act, 1817 (Michael Angelo Taylor's Act); and, as the matter was urgent, it was suggested, as a compromise, that the Company should bear one-third of the cost, and that the remaining two-thirds should be regarded as coming within the arrangement as to paving made between the County Council and the Borough Council. The Company who will do the work to the mains state that the cost will probably be about £100, and will certainly

not exceed £150. The Committee were advised that the proposal was reasonable; and as provision for the expenditure had been made in the estimate of £62,850, already approved by the Council and in the capital votes for 1910-11, they recommended that, subject to the Company bearing one-third of the cost of the alterations referred to, the remaining two-thirds be regarded as part of the cost of the works. The recommendation was adopted without debate.

SCARCITY OF GAS COKE AND COAL-WAGGONS.

This subject was dealt with in a leading article in the "Iron and Coal Trades Review" for the 2nd inst. In the course of it, the writer made the following remarks.

At the present time there is quite a gas-coke famine in the land. Not for years have factors and merchants had so much trouble and anxiety in meeting the requirements of their customers, which have naturally increased very considerably with the continuance of the cold weather. Prices have risen something like 3s. per ton within the past two or three weeks. Buyers, finding supplies short, have hurried into the market with orders for prompt delivery, with the result that for the moment the demand apparently exceeds the make, and very little best gas coke can be obtained in London at less than 20s. per ton, while more has to be paid in some cases. The Gaslight and Coke Company's price is 17s. per ton at the Beckton works, as compared with the current contract rate of about 14s. 6d.; while inferior Sheffield and Bristol cokes are quoted at about 18s. and 19s. 4d., respectively, at London stations.

Various reasons are advanced to account for the present position. It is pointed out, for example, that the increasing number of water-gas plants has decreased the quantity of coal carbonized, and consequently the output of coke, and also led to the consumption of coke at gas-works themselves. Then, again, the bright weather of late and the comparative rarity of fogs have diminished the amount of gas burnt and so reduced the make of coke accordingly; while the activity in the cement trade has greatly increased the consumption of the latter. Moreover, there is the prevailing scarcity of waggons to be taken into consideration; this adding to the difficulty of obtaining adequate and prompt supplies of gas coke. Waggons are rarely plentiful about Christmas—being taken out of the coal trade to meet the exigencies of the special holiday goods traffic. But this year the shortage has occurred earlier than usual, probably owing in some measure to the General Election, which will absorb the energies of a substantial section of the public having more than the average purchasing power during the greater part of this month.

Some collieries are suffering badly from want of waggons, a large number of which are under load at shipping ports—the export trade being quiet; and coal, as well as gas coke, is not reaching buyers promptly. There is not likely to be a much better waggon supply this side of Christmas; but with shorter and darker days, the make of gas coke will probably increase, and become more nearly equal to the demand in the near future. At the present time holders who bought on the open market before the recent rise, or who have supplies available under contract, and are able to give prompt delivery, are making substantial profits.

GAS AND ELECTRICITY AT HASTINGS.

Questions as to Cost and Efficiency.

At the Meeting of the Hastings Town Council last Friday, Mr. W. A. Matthews put the following questions to the Chairman of the Electricity Committee (Mr. Clement Hill): (1) What is the candle power of the electric lamps recently installed in some parts of the borough? (2) What was the candle power of the gas previously used? (3) How do you account for the general opinion existing in several parts of the borough that the new system of lighting the streets by electricity is inferior as an illuminant to the previous system of public lighting? (4) What is the amount charged per unit for current supplied to public lamps? (5) What is the average cost per unit without capital charges? The replies were: (1) 45-candle power, British. The candle power drops very little during the life of the lamp. (2) Nominally 50-candle power; but the candle power of gas-mantles, as is well known, drops very rapidly and considerably. Many of the mantles in the street-lamps are also smaller than others. (3) So far as my own observation goes, and the observation of the people I meet, the illuminating power of the electric lamps is fully equal to that of the gas-lamps displaced. I make frequent inquiries as to the opinion of others, and the answer is almost invariably the same. The very few people I myself have personally met who were of a contrary opinion happened to be interested in the sale of a competing illuminant. Possibly a similar interest influences the opinion of others. (4) The charge made to the Public Lighting Committee for each street lamp lighted by electricity is £3 5s. 8d., which was the sum paid to the Gas Company at the time the arrangement was come to. Of this sum, £2 0s. 10d. represents the charge for current, which is calculated at 2d. per unit. (5) Taking the figures for the year ended March 31, 1910, the cost of production, without capital charges, is as follows: Cost of coal and coke, 1·06d. per unit; other expenses (including oil, stores, &c., wages, repairs, maintenance of buildings and machinery, repairs and maintenance of mains, rents, rates and taxes, management expenses, insurance, and bad debts), 1·8d. per unit—total cost of production per unit sold, 2·86d. The expenditure on everything except coal is obviously exactly the same, whether or not the street-lamps are lighted by electricity. Hence the electric light concern makes a profit of 0·94d. for each unit supplied to the street-lamps, or a total profit of 19s. 2d. per lamp per annum. There will also be a further profit of several shillings per lamp in renewals.

UNPROFITABLE ELECTRICITY SUPPLY AT DUDLEY

At the Meeting of the Dudley Town Council last Tuesday, Mr. H. W. Hughes mentioned that the members had before them the decision of the Arbitrator in the matter of the charges made by the Corporation for electric current supplied to the Tramway Company. He said that the terms had been readjusted by the Arbitrator, and he (the speaker) reckoned that the Corporation would lose £1000 a year. This was disappointing; and unless they succeeded in getting a revision by means of costly litigation, the new terms would have to run for five years. He was sure they all tried their best to make the electricity undertaking a success. A Sub-Committee had been formed to pay particular attention to this department of the Corporation. Alderman Cook pointed out that the arrangement with regard to the supply of electricity was part and parcel of the tramway purchase agreement, the rental from which would give them a profit. Mr. S. C. Lloyd asked whether it was not desirable to dispose of the undertaking, and make an effort to acquire the gas-works. Mr. Hughes admitted that during the past year there was a loss on the work amounting to £600. The sum of £1169 was transferred from the reserve to the capital fund to pay for motors, &c. He added that the arbitration had not been in vain; the price awarded being better than that which was offered. Referring to Mr. Lloyd's suggestion as to the desirability of the Council disposing of the electricity undertaking, a local paper characterizes it as a "somewhat ingenuous" one on his part, after deploring the loss incurred in connection with it. The matter then dropped.

Lecture to Brentford Gas Company's Employees.

The meeting of employees of the Brentford Gas Company on the 30th ult. was addressed by Mr. Thomas Glover, with particular reference to the special gas-fires made by Messrs. R. & A. Main. The lecturer dealt with the matter in a thoroughly interesting and practical manner, and succeeded in showing that it is possible to introduce a considerable amount of humour even into so prosaic an article as the gas-fire. The instructions given, particularly in regard to the "D.S.O." and "St. Nicholas" fires, are bound to be helpful to all who have any connection with their fixing and maintenance.

St. Petersburg Drainage and Water Supply.—The question of the drainage and water supply of St. Petersburg is again agitating the minds of the Russian authorities. It appears that some time ago a Special Commission was appointed to inquire into the whole matter, with power to obtain such technical advice as they thought proper. The Commission recently retained the services of Sir Alexander Binnie, Son, and Deacon, to report and advise generally on the question. Sir Alexander and his son, Mr. W. J. E. Binnie, lately left London for St. Petersburg.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There was a very good attendance of members of the Scottish Junior Gas Association—Eastern District—this afternoon at the works of Messrs. James Dougall and Son, Limited, fire-brick manufacturers, of Bonnybridge. This is not the first occasion on which the Company have entertained the Association; the Western District having been similarly received by them three years ago. As on that occasion, so to-day the whole of the working in fire-clay was shown and explained, and much was seen which will be of value to the visitors in their business life. The feature of the gathering which was of most consequence, however, was the paper by Mr. E. M. Stewart, the Managing-Director of the Company, on "Fire-Bricks." There was much that was instructive in the paper; but the spirit which dictated the contributing of it, and which dominated its entire contents, is not fully capable of being inferred from the paper itself. It is, therefore, fitting that this should be independently and specifically acknowledged. On the merits, among the questions raised perhaps the most important one was that in which the author referred to the heats in different parts of furnaces. On this subject the attitude of Mr. Stewart is the generous one of asking those who require bricks to withstand high heats to take him into their confidence, and he will endeavour to produce an article which will be at least made with a view to meet their requirements. The offer is a fair one, and worth acceptance. Fire-brick is an article which, by variation in manufacture, can be greatly altered in character, and it is not by any means the uniform article it was once considered to be.

On Tuesday evening, about a quarter to seven o'clock, a bad breakdown of the electric lighting service in Glasgow took place; the cause being a short-circuit of a serious nature in one of the trunk mains running between the Port-Dundas and Pinkston power stations, which are about half-a-mile apart. For fully half-an-hour the principal thoroughfares, with the exception of some of those in the outlying districts, were in total darkness; and all private lighting was also extinguished. Much inconvenience was caused by the occurrence. In the streets there was no help for the situation; all that could be done being to wait till the light could be restored. But in some of the public halls and other places in the city, where electric lighting had been introduced, the gas-fittings had not been removed; and these being brought into use again, the inconvenience felt by the audiences was of much shorter duration than was the case generally.

In the Dysart Town Council on Tuesday, the Clerk reported the receipt of a letter from the Secretary of the Gas Company, in which it was suggested that a joint meeting between the Council and the Company should be held to discuss the question of the Council's proposal to claim discount on the burgh's gas account in lieu of wayleave for the Company's pipes. Such a meeting, it was represented, would save time and correspondence, and might result in an amicable arrangement

being come to. The proposal of the Company was agreed to; the whole Council being appointed to confer with them.

Matters such as are dealt with in the preceding paragraph are admittedly infectious. This claim by the Dysart Town Council has presumably arisen as a result of the disclosure, through litigation, of the existence of an arrangement in the neighbouring burgh of Kirkcaldy, existing since 1867, under which the Gas Company have allowed the Corporation a discount of 25 per cent. upon the charge for gas for public lighting, in lieu of paying wayleave. The litigation (see *ante*, p. 584) was called before Lord Dewar in the Court of Session on Tuesday, for discussion upon the relevancy of the action by the Company. Mr. Moncrieff, for the pursuers, said there was a much larger question between the parties, in the shape of an arbitration in a transfer of the Company's undertaking to the Corporation; and there was a probability that in the arbitration all questions between the parties would be settled. It was agreed, therefore, to ask his Lordship not to proceed with the discussion. Lord Dewar thought this was very reasonable; and the hearing was postponed. The proceedings in the arbitration, I understand, may be expected to begin in the second week of January. According to present arrangements, they must be concluded before Jan. 31.

The Town Council of Old Meldrum have resolved to reduce the price of gas from 10s. to 7s. 6d. per 1000 cubic feet, in the hope of increasing the consumption.

The extensions at the works of the Inverkeithing Gas Company, Limited, are nearing completion. The works have been almost doubled in size. In addition to the enlargement of the works, the Company have greatly extended their mains, and have provided a good number of householders with prepayment meters. To meet the additional expenditure, it has been decided to issue a further £1100 of capital, in shares of £1 each, to be offered to existing shareholders for subscription in proportion to their present holdings—being at the rate of one additional share for every three shares now held.

At the monthly meeting of the Dumfries Town Council last week, it was reported by the Gas Committee that a letter had been received from a workman, with reference to his dismissal from employment at the gas-works. It was stated that the Committee having learned from the Manager that he had had to dispense with a number of workmen on account of the introduction of machinery at the gas-works, the Committee, by a majority—the minority being in favour of the writer of the letter being heard—decided that in the circumstances the matter be left in the hands of the Manager. The Gas Committee also reported that, on the suggestion of Bailie O'Brien, they recommended that remit be made to the Committee to consider and report upon the appointment of a chief clerk and cashier for the gas office. It was stated that during the time of the late Mr. Malam, Mr. Dickie was chief clerk and cashier. Mr. Dickie had been promoted to the position of Manager, and it was impossible for him to overtake the work of both offices. The proposal gave rise to a very acrimonious discussion; and it was subsequently withdrawn. The subject of complaint of inconvenience caused to neighbours by the noise of the machinery in the gas-works was again before the Council. It was suggested that the windows in the retort-house on one side be built up, and that those at the ends be filled in with rough glass. The cost, it was stated, would be about £45. This was agreed to. It was also resolved that during the night electric power be used to drive the machinery, instead of a gas-engine. It was agreed to procure a new gas-exhauster, at an estimated cost of £400; and a settling-tank, at the price of £37 10s.

The principal contract in connection with a new water supply for Fraserburgh has been let to Mr. James Hinniburgh, of Glasgow, at a price of £40,000. The work is to be completed in one year.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 805.]

LIVERPOOL, *Dec.* 10.

Sulphate of Ammonia.

There is again no new aspect in the market, and throughout the week it has continued quietly steady without change in either tone or value. Notwithstanding the fact of there having been a paucity of fresh business, all tendered parcels have been taken up at the prices lately ruling, and the closing quotations are £12 12s. 6d. per ton f.o.b. Hull, £12 13s. 9d. per ton f.o.b. Liverpool, and £12 15s. per ton f.o.b. Leith. With regard to the future position, consumers are decidedly apathetic, and no further sales have transpired. For delivery over the spring months, manufacturers are asking a small premium on prompt values; but dealers are reported to be soliciting orders at current prices, or even at a slight discount.

Nitrate of Soda.

The market remains without any alteration, and holders still require 9s. 4½d. per cwt. for ordinary and 9s. 7½d. for refined quality, on spot.

LONDON, *Dec.* 12.

Tar Products.

The markets for tar products have remained fairly firm during the past week. Pitch has been a little steadier, with a fair amount of inquiry for forward delivery. Benzol seems a trifle weaker, and consumers will not pay the prices asked at present by sellers. Creosote is quiet, and business is very difficult in this article. Crude carbolic makers are still firm in their ideas of price, while consumers are just the opposite. Solvent naphtha is quiet; and heavy naphthas are fairly firm.

The average values during the week were: Tar, 17s. to 20s. 9d. *ex* works. Pitch, London, 34s. 6d. to 35s.; east coast, 33s. to 34s.; west coast, Clyde ports, 33s. 6d. to 34s. 6d., Manchester, 32s. 6d. to 33s. 6d., Liverpool, 33s. to 34s. Benzol, 90 per cent., casks included, London, 8d. to 8¼d.; North, 7¼d. to 7½d.; 50-90 per cent., casks included, London, 8d. to 8¼d.; North, 7¾d. to 8d. Toluol, casks included,

London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4¼d.; North, 3⅜d. to 3¾d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 11d. to 1s. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2⅛d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d.; west coast, 1s. 1d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market remains in about the same position, and prices are unaltered. Towards the close there was a fair amount of inquiry for this month's delivery, which was the means of steadying the prices at several ports. Beckton are now only quoting for spring delivery. Outside London makes are quoted at £12 6s. 3d.; Hull, £12 16s. 3d. to £12 17s. 6d.; Liverpool, £12 16s. 3d. to £12 17s. 6d.; Leith, £12 15s. to £12 17s. 6d.; and Middlesbrough, £12 15s. to £12 16s. 3d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a fuller demand in the coal trade; but the deliveries are hampered through lack of ready tonnage. In the steam coal trade, the inquiry is better, and prices have been stiffened. Best Northumbrian steams are about 9s. 6d. to 9s. 7½d. per ton f.o.b., second-class steams are quoted at 8s. 6d., and steam smalls are from 5s. to 6s. 3d., according to quality. The collieries are working a little fuller, but there are still occasional idle days. In the gas coal trade, the demand is now at its heaviest point; and the long contracts take up a large portion of the output of the best collieries. Durham gas coals vary in price from 8s. 3d. to 9s. per ton, according to quality, for the usual classes; while for "Wear" specials, up to 10s. 3d. is now quoted for prompt cargoes. There have been some contracts arranged in large quantities for the South of England; and though the price is a little uncertain, it is believed to be about 1s. 3d. per ton below that of the last similar contracts. It is also said that the contracts for one of the great companies have been concluded almost entirely at figures such as these. Coke is firmer; and gas coke maintains a strong price at about 14s. 6d. per ton f.o.b. for good quality.

Scotch Coal Trade.

Trade was fairly active last week; ell in particular being in better demand, and splint finding a ready market. An improvement in terms is looked for. The prices now quoted are: Ell, 9s. 3d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 6d. to 9s. 9d.; and steam, 9s. to 9s. 3d. The shipments for the week amounted to 324,642 tons—an increase of 15,802 tons upon the previous week, and of 47,085 tons upon the corresponding week last year. For the year to date, the total shipments have been 14,974,185 tons—an increase upon the corresponding period of 769,490 tons.

Topical Advertising for the "Ironclad" Gas-Mantle.

The interest taken by the general public in the Parliamentary Elections has been turned to good account by Curtis's and Harvey, Limited, of 3, Gracechurch Street, E.C., the manufacturers of the "Ironclad" gas-mantles. Wherever possible, they have taken space on the election results pages of the leading London morning and evening newspapers, and also of the Provincial morning papers, with this topical announcement:

> SPECIAL ELECTION RESULT.
>
> A Popular Victory.
>
> *1. "Ironclad" Gas Mantles.
>
> *British Made.*
>
> 2. All other Gas Mantles.
>
> * Sweeping majority.
>
> Actual figures not yet known.

This kind of topical advertising should be appreciated by the trade; for it will be seen that the manufacturer's name and address are omitted, and that the whole idea of the advertisement is to create a demand for the "Ironclad" mantles through ironmongers, gas companies, corporations, and dealers. Not content with newspaper advertising, a similar announcement of these mantles has been flashed on the screens at points in the City and suburbs of London, where large crowds have assembled nightly to get the first intelligence of the result of the polls in London and the Provinces. Similar announcements have also appeared between the election results flashed on the screen during the evening performances at the principal London variety theatres.

Price of Gas at Ellesmere.—Complaints having been made as to the high price charged for gas at Ellesmere, Mr. F. Ashley, the Gas Manager, reported to the Urban District Council that he had found on inquiry that 550 gas-works throughout the country charged more and 40 charged the same as they did. Of the 40, all (with the exception of seven) made more gas and were nearer the collieries than they were. When the report came before the Council, Mr. Tims said it appeared to him that they were charging too much, and that the system on which they operated the gas-works was unfair to the consumer. They wanted to get a profit on the gas, and also to make sufficient to pay back the principal and interest. It was not fair that the consumer should be charged the price he was. He thought they should charge a certain portion on the general fund. The Chairman (Mr. B. R. C. Tower) said the question should be brought before the Council at the beginning of the financial year.

Liability for the Maintenance of Stopcock Boxes.

At the Westminster County Court on Wednesday last, before his Honour Judge Woodfall, an action was brought by Mr. Thomas Wickens, of 69, Arkley Road, Walthamstow, against the Metropolitan Water Board, for £100 compensation for personal injuries caused by defective stopcock boxes in the pavement of Arkley Crescent, Walthamstow, which plaintiff alleged to be a nuisance upon the highway. Mr. Dunbar, who appeared for the plaintiff, called evidence to show that Mr. Wickens had been seriously injured by falling over defective boxes fixed outside two houses (Nos. 35 and 37) in Arkley Crescent on the 26th August last, and had since been unable to follow his calling as a fitter, whereby he had lost in earnings £2 a week, besides incurring expenses for medical attendance. Mr. Ross-Brown, who represented the Water Board, cited authorities and statutes to show that the obligation to repair rested upon the owner or occupier of the premises; and he submitted that stopcock boxes were fittings connected with the communication pipes, which were the property of the owner of the premises, and not under the care or control of the Board. He reminded his Honour that in October last he decided in favour of the defendants a similar action which was now under appeal. His Honour said he would defer giving judgment in the present case until the action referred to had been decided by the King's Bench Division.

Death from Gas Poisoning.—At an inquest in Liverpool on the body of Louisa Roberts, aged 54, a domestic servant, Miss Poole said deceased had been in her employ for some months, and had been going about her work in her usual good spirits. One morning, however, she went to her room and found her dead; the apartment being full of gas. Deceased had no sense of smell. Medical evidence showed that death was due to gas poisoning; and the Jury's verdict was to this effect.

"Tarless Fuel" Shares.—The "Financial News" on Wednesday last called attention to the fact that Messrs. J. H. Iredale and Co., of Liverpool, are pushing the shares of the Tarless Fuel Syndicate, Limited, in the following terms: "In this Company the total capital will be £300,000, of which £100,000 will be working capital, and the remaining £200,000 of shares will be divided among the shareholders of the Syndicate. As the capital of the latter is only £30,000, this will represent a free bonus to shareholders of over six new shares to each Syndicate share held. There can be little doubt that the shares of the new Company will soon be worth considerably more than par. On the results from this flotation alone, the Syndicate shares are consequently much under-valued at their present price, though few shares are now obtainable. On the basis of this flotation, the shares should, at any rate, be worth over £6, apart from other interests." It appears that the firm named were a year ago pushing rink shares in all directions; and our financial contemporary remarks that if Tarless Fuel does no better than the rinks, the purchase will be a poor one.

Proposed Improved Public Lighting of Kensington.

At the meeting of the Kensington Borough Council last Tuesday, the Works Committee reported that in December last an offer was received from the Gaslight and Coke Company to take over the whole of the public street lighting by gas in the borough. The matter had been referred to the Street Lighting Sub-Committee for consideration; but they saw no reason to justify the Council in abandoning the system under which they have with satisfaction carried out their own street lighting for upwards of thirty years. Dealing with the question of the advisability of the Council at once proceeding to provide lamps of a more modern pattern in the streets of the borough, the Sub-Committee said they did not favour the immediate outlay of any such sum as £9000, which would be necessary to give effect to the changes proposed by the Gas Company, as they were of opinion that a considerable improvement could be effected by the adoption of an improved pattern of inverted burner and reflector in the existing lamps; and the improvement made by this alteration would, they believed, be found adequate, so far as regarded the lighting of the smaller streets, at least for such period as would lapse before the existing Kensington pattern lamps were worn out. The Sub-Committee also proposed to inspect a number of the existing lamps fitted with two and three inverted burners respectively and improved reflectors, with the view of considering whether the Kensington pattern lanterns should not for the present be retained in other and more important thoroughfares; and they said that so soon as they had had adequate time to consider these suggested alterations, they would report further thereon. The Works Committee expressed concurrence in the views of the Sub-Committee, and recommended that the Gaslight and Coke Company be informed that the Council do not see their way to accept their offer. The report, after having been heavily damaged in debate, was sent back to the Committee.

Egremont Gas Company to be Wound Up.—At an extraordinary general meeting of the Egremont Gaslight and Coke Company recently held, a resolution was passed to the effect that the Company should be wound-up voluntarily.

Cudworth and its Gas Supply.—The ratepayers, at a public meeting, have expressed approval of the action of the Cudworth Urban District Council in promoting an application to the Local Government Board for a Provisional Order authorizing the Council to construct gas-works in the township. At present the gas is supplied in bulk to the Council by the Barnsley Gas Company. Mr. G. H. England presided, and said the Council had decided to purchase land costing £850; and Mr. Newbigging, their Engineer, had stated that it was possible to supply gas to consumers at 3s. 6d. per 1000 cubic feet, and make a profit. It was suggested that gas-works should be erected to produce 15 million cubic feet a year. Mr. G. H. Gray moved that the Council enter into a contract with the Barnsley Gas Company, for a period of fourteen years, to supply gas at 2s. per 1000 cubic feet. This was seconded; but only ten hands were held up in its favour.

Gas Supply in Monte Video.—The British Consul in Uruguay states in his annual report that the Monte Video Gas Company are now established in a handsome new building in one of the principal streets. It is lofty and spacious, with ample window fronting, which affords full opportunity for a brilliant and attractive display of goods. In spite of the keen competition of electric lighting, the Company are steadily increasing their business, and at the present time have about 125 miles of mains in use. The price of gas, which in 1867 was 4s. 1d. per 1000 cubic feet, has been gradually reduced to the present moderate figure of 1s. 9¾d. for lighting and 1s. 4½d. for other purposes.

Improved Lighting for Bideford.—A scheme by which the lighting of the town is to be greatly improved was submitted by the Bideford Gas Company to the Town Council at their last meeting. The subject has been under negotiation through a Sub-Committee, and the Council reappointed these gentlemen with instructions to consider and report further upon it. In view of the larger outlay required, the Company stated that if the scheme were accepted they would require the lighting contract to be entered into for five years, instead of three years as hitherto. Mr. Cocks said the members of the Committee were very much impressed by the fact that if the scheme were carried out the town would be very much better lighted than it had been in the past. The annual charge would be £580—an increase of £70 or £80 upon the present basis; but this would not be more than the town had had to pay the past few years. Mr. Adams remarked that the Gas Company had met the Corporation very fairly. Mr. Goaman said it was proposed to light the main streets in a very brilliant manner. Indeed, Bideford promised to be the best lit town in North Devon.

Improved Public Lighting at Lewisham.—The Highways Committee of the Lewisham Borough Council have had under consideration applications from the South Metropolitan Electric Light and Power Company and from the South Metropolitan Gas Company, for permission to erect high-power lamps and standards on the footway on a portion of the west side of High Street, Lewisham; also from the Electric Light Company, to erect similar standards in Burnt Ash Road, and from the Gas Company to erect 24 standards in Brockley Road. The first-named Company forwarded with their application a memorandum signed by sixteen tradesmen in High Street, agreeing to pay the Company for the lighting and maintenance of the lamps if erected, and also from one asking that the Company might be allowed to erect an electric light standard in front of his premises. The Gas Company sent a similar memorandum signed by eighteen tradesmen in support of their application. The names, with few exceptions, were the same in both cases. Similar applications from these Companies had been conditionally granted on former occasions; the Gas Company giving a public lamp free for the concession, and the Electric Light Company keeping an incandescent light of 50-candle power burning after the high-pressure lamps were extinguished. The Committee decided that the application of the Gas Company in respect of parts of High Street, Lewisham, and Brockley Road, and that of the Electric Light Company in regard to Burnt Ash Road, should be granted conditionally.

Vancouver Water Supply.—According to the "Monetary Times" of Toronto, the Municipality of Vancouver propose to expend a sum of about £142,000 in laying another water-main from the Capilano River to the Little Mountain reservoir.

New Joint-Stock Companies Registered.—The Gas Maintenance Company, Limited, has been registered with a capital of £5000 in £1 shares, to carry on, in Nottingham and elsewhere, the business of a gas and electric light maintenance company, and to adopt an agreement with A. Docking. The subscribers (all of Nottingham) are: A. Docking, gas engineer; T. Callan, colliery agent; F. Stokes, incorporated accountant; F. H. Guy, engineer; and F. W. Barnes, lace manufacturer. The Combination Gas-Steam Engine Syndicate, Limited, with a capital of £500, in 1s. shares, has been formed to acquire certain patents for an invention for a combined internal combustion and fluid-pressure engine, and to adopt an agreement with H. B. Stocks. The Furness Chemical Company, Limited, has been registered with a capital of £2000, in £1 shares.

Bideford Water Supply.—The question of improving the water supply has been under the consideration of a Committee of the Bideford Town Council. A report on the subject was prepared by Mr. Portsmouth; but the Committee did not agree with him that a new reservoir was needed. They found, as the result of tests, that there was sufficient pressure to supply the higher portion of the town when the water was taken from the lower reservoir and not from the filter-beds; and they therefore recommended the use of patent filters as advised by Mr. Portsmouth. They suggested that the question of increasing the capacity of the reservoirs should be referred to Mr. Baldwin Latham. Alderman Metherall explained that the matter of renewing the mains had also been considered; and the opinion was that some portion of the mains which had been reported upon need not be relaid if the patent filters were adopted, because the extra pressure would give an abundant supply for the top of the town.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Messrs. A. & W. Richards offered for sale, by order of Directors, new issues of capital in the Southend Water Company and the Barnet District Gas and Water Company. The first lots consisted of £5000 of 4 per cent. perpetual debenture stock of the Southend Company; and they were all sold at £100 to £100 10s. per £100. The new issue by the Barnet Company consisted of £10,000 of "D" capital water stock, ranking for a maximum dividend of 7 per cent., but carrying 5¼ per cent. as from the 1st prox. It fetched £110 to £112 per £100. The same day, Messrs. W. Watson and Son sold a few fully-paid £5 shares in the Ripley Gas Company at an average price of £10 16s. 6d. each. According to an announcement which appeared in the "JOURNAL" a few weeks ago, Messrs. Nichols, Young, Hunt, and Co. offered for sale last Thursday £15,000 of 5 per cent. maximum capital stock and £10,000 of 4 per cent. debenture stock of the Bristol Gas Company. The average price realized for the ordinary stock was £113 18s. per £100, and for the debenture stock £100 6s. 1d. per £100; the total of the former being £17,085 5s.; and of the latter £10,030 10s.

The Admiralty have placed an extensive order for coal tipping and loading plant with Messrs. Ed. Bennis and Co., Limited, of Little Hulton, Bolton.

Referring to the recent successful gas exhibition at Theale, a notice of which appeared in the "JOURNAL" last week (p. 729), we learn that it was organized by the Davis Gas-Stove Company, Limited, in association with the Theale Gas Company.

In the report presented at the meeting of the Hastings and St. Leonards Ratepayers' Association last Thursday, reference was made to the amount spent in the opposition by the Corporation to the Gas Companies (Standard Burner) Bills; and it was remarked that the ratepayers would have noted with surprise that it was not given up before. In the course of the proceedings, attention was called to the proposal to have electric light instead of incandescent gas at the Workhouse; and it was decided to ask the Local Government Board (to whom the matter has been referred) to suspend their decision until they have further information.

The Westminster City Council, in order to carry out photometric tests of street lighting in connection with the new contract with the Gaslight and Coke Company, are further equipping the existing dark-room at the Taylor's Buildings depôt, and providing apparatus for standardizing the photometer. The Highways Committee have considered the lighting of the yard at the Monk Street depôt, and have decided on having a high-pressure gas-lamp. They have accepted the quotation of the Gaslight and Coke Company for installing and maintaining a 300-candle power gas-lamp, at an initial cost of £4 and an annual cost of £6 10s. for gas and maintenance.

At last Wednesday's meeting of the Manchester City Council, Mr. Jennison called attention to the action of the Gas Committee in agreeing to let the gas supplied to the exhibitors at the Rusholme and City Hall exhibitions be invoiced at 1s. 6d. per 1000 cubic feet; and that all gas-fires, gas-stoves, and other apparatus sold for cash at list prices during the existence of the exhibitions be fixed free of cost to the purchasers, provided that they are consumers in the Committee's district of supply. He thought if gas could be supplied to these people at the prices named, it was unfair to charge the penny-in-the-slot users 2s. 9d. per 1000 cubic feet. The action was defended as fair and reasonable in that it was likely to encourage trade and the use of gas for cooking and heating purposes, and thereby tend to the purification of Manchester air. The Council approved the Committee's proposal.

In the report which the Directors of Messrs. James Milne and Son, Limited, will submit at the annual general meeting on Thursday, they state that the volume of business increased in the year ended the 30th of September last; and that, notwithstanding the keen competition and cutting in prices, there is a marked improvement in the trading as compared with the previous twelve months. There is a surplus balance of £591, against which, however, depreciation on plant, machinery, and buildings to the extent of £1147 has to be charged; thus leaving a debit of £556. Adding to this the sum brought forward from last year, including the Directors' fees for 1908-9, £5073, the total amount at the debit of the profit and loss account is £5629. On the 22nd of November a most unfortunate fire occurred, completely gutting the gas-meter shop. The producing machinery and store of meter parts were, however, untouched—being in a separate building. The loss is fully covered by insurance.

APPLICATIONS FOR LETTERS PATENT.

27,679.—BARRETT, S. R., "Fuel and backs for gas-stoves." Nov. 28.
27,697.—EVERETT, S., "Obtaining various products from coal, shale, peat, and the like." Nov. 28.
27,706.—MEYER, F. C., "Gas-cooking apparatus." Nov. 28.
27,742.—COVENTRY, W., and SCHUTE, H. G., "Injectors for incandescent burners." Nov. 29.
27,747.—COOK, H. T., "Stopper for pipe leaks." Nov. 29.
27,758.—BELL, W., "Gas-stoves." Nov. 29.
27,810.—SHONE, G., "Prepayment meters." Nov. 30.
27,843.—LAMKIN, A. E., and GODWIN, L. G., "Manufacture and use of oil gas." Nov. 30.
27,848.—LIEBLICH, E., "Generating compressed gas." Nov. 30.
27,873.—WEIL, J. A., and HUTCHINS, T. W. S., "Gas-producers." Nov. 30.
27,908.—TOWNSEND, W. W., "Gas-heating stove with down-take flue." Dec. 1.
27,921.—WATSON, C., and FORD, J., "Gas-fittings." Dec. 1.
27,934.—GOLBY, F. W., "Gas-engines." A communication from H. H. Taylor, C. L. Spade, and W. A. Murray. Dec. 1.
27,940.—HART, C., "Burner for water-heater." Dec. 1.
27,985.—CANNING, T. F., "Electric gas lighting and extinguishing apparatus." Dec. 1.
27 998.—LETHBRIDGE, C. E. H., "Generating and utilizing gaseous fluids." Dec. 2.
28,004.—GREEN, W., and HUNCOAT PLASTIC BRICK AND TERRA COTTA COMPANY, "Gay Lussac and Glover or other towers." Dec. 2.
28,007.—BEARD, G. F. H., and R. & J. DEMPSTER, LTD, "Washing or scrubbing gas." Dec. 2.
28,031.—VOORHEES, G. T., "Compressing air or gas." Dec. 2.
28,032.—SCHAFFER, V., "Fuel." Dec. 2.
28,033.—TANNETT-WALKER, F. W., "Hoisting and discharging coal." Dec. 2.
28,111.—HELPS, G., "Gas-lamps." Dec. 3.
28,128.—HARRAP, J. E., "Connecting flanged pipes." Dec. 3.
28,153.—LUCAS, F. L., "Burners." Dec. 3.
28,154.—COFFIN, A. G., "Atmospheric burners." Dec. 3.
28,174.—GRANT, H. C. S., and GUMBRELL, G. E., "Combustible turbine gas-engine." Dec. 3.
28,176.—MORGAN, W. L., "Incandescent burners." Dec. 3.

The "battle of the lights" is being vigorously fought at Reading. The Reading Electric Supply Company recently came out with a bold advertisement in a local paper in which they quoted Dr. George Carpenter to the effect that "gas in burning gives off quantities of carbonic acid and sulphuretted hydrogen, which vitiate the air." The Gas Company replied in an equally bold manner, correcting the mis-statement as to sulphuretted hydrogen; and pointing out that the Medical Officer of Health has always certified the Reading gas to be free from this impurity under the test imposed by Act of Parliament. Another assertion by the Electric Supply Company was that theirs is the only artificial light which keeps the air of a room as pure as in daylight. The Gas Company replied by calling attention to the fact that the Society of Medical Officers of Health have substituted gas for electric lighting in the large room in which they hold their meetings, in order to obtain a better light, and to assist in the ventilation of the room. The Society have placed it on record in their "Journal" that the new pattern ventilating gas-lamp in the centre of the ceiling has been found an excellent substitute for the electric lamps previously employed. This confirms the statements made by Dr. Rideal, Professor Vivian B. Lewes, Dr. W. A. Aikin, and others, that the change of air which is necessary in rooms is retarded by the absence of gas-burners.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Dec. 10. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	21/-	18/6 21/-	19/- 21/3	19/- 21/-	19/- 21/-	—
Pitch	,,	34/- 35/-	32/- 32/6	32/6 33/-	33/- 34/-	33/-	33/-
Benzol, 90 %	per gallon	-/9	-/7½ -/8	-/8	-/7¼ -/7½	-/7¾ -/8¼	-/8
Benzol, 50-90%	,,	-/10	-/8¼ -/8½	-/9	-/8 -/8¼	-/8 -/8¼	—
Toluol, 90%	,,	-/10	-/9 -/9¼	-/10	-/10	-/9½ -/10	-/10
Crude naphtha, 30%	,,	—	-/3¼ -/3½	-/3½	-/3½	-/3½	—
Light oil, 50%	,,	—	-/3¼	-/3½ -/3¾	-/3⅛	-/3⅛	—
Solvent naphtha, 90-160	,,	—	-/10½ -/11	-/10	—	-/11½	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11	-/11	-/11½ 1/-	-/11
Creosote in bulk	,,	-/2½ -/2¾	-/2 -/2¼	-/2	-/2 -/2⅛	-/2 -/2⅛	-/2
Heavy oils	,,	-/3 -/3¼	-/2½ -/2¾	-/2¼	-/2¾	-/2⅞	-/2⅞
Carbolic Acid, 60's	,,	1/0½ 1/1	1/- 1/1	1/1	1/0½	1/0½ 1/1	1/1
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	47/6	47/6 50/-	—
,, pressed	,,	—	60/-	63/-	60/-	60/- 72/6	—
,, whizzed	,,	80/-	—	—	70/- 72/6	60/- 72/6	65/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 769.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord.	83—86	..	5 16 3
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6⅝—6⅞	+⅛	5 1 10
40,000	5	,,	7	Do. New, £4 paid	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
330,000	Stk.	Aug. 12	12½	Brentford Consolidated	248—251	..	4 19 7
330,000	,,	,,	9½	Do. New	186—188	..	5 1 1
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99—101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	158—161	..	4 19 5
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	90—92	..	4 17 10
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	$5\frac{2}{10}$	Commercial 4 p.c. Stk.	106—109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	..	3 14 1
800 000	Stk.	June 10	4†	Continental Union, Ltd.	88—93	..	4 6 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103—105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¾—24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	105¾—106¾	..	4 7 5
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	,,	June 29	3	Do. 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½	..	6 5 8
131,070	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	114—116	+2	5 1 3
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	185—187	..	4 16 3
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	164—165	+½	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4¾—5	..	6 0 0
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¼—12¾	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	136—138*	..	5 15 11
60,000	5	Sept. 15	8	Ottoman, Ltd.	6¼—6¾	..	5 18 6
31,800	53	Aug. 31	13	Portsea Island A.	131—133	..	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼—7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅛—5⅜	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	95—97*	..	4 2 6
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
115,000	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅔	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	109—111	..	4 10 1
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	June 29	4	Do. 4 p.c. Deb.	97—99	..	4 0 0
182,380	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	113—115	..	4 6 11
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c.	140—142	..	4 15 1
85,766	,,	June 29	3	Do. 3p.c. Deb. Stk.	74—76	..	3 18 11

Prices marked * are "Ex div." † Next dividend will be at this rate.

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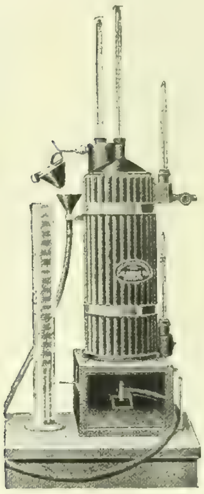

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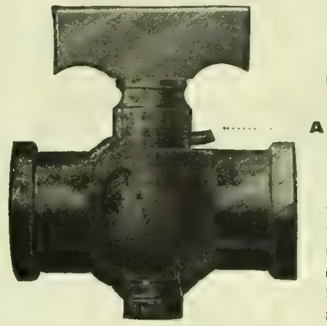

Fig. 1. The Old Style with the Old Trouble.
Note the Pin **A.**

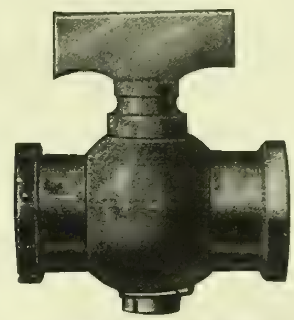

Fig. 2. **Evered's Patent "Safety Stop."** No Pin. No trouble.

Fig. 3. Underside showing "Safety Stop" in lieu of Pin.

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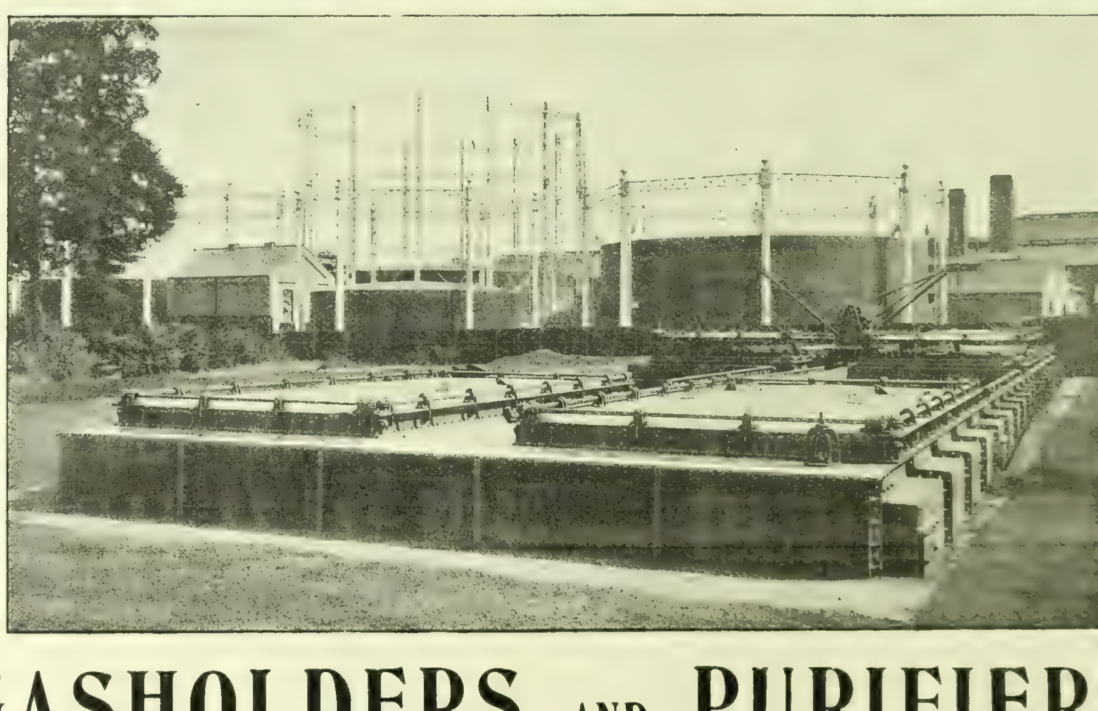

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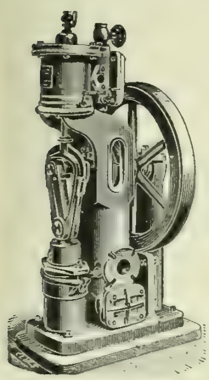
Fig. 705. "SINGLE RAM" STEAM-PUMP.

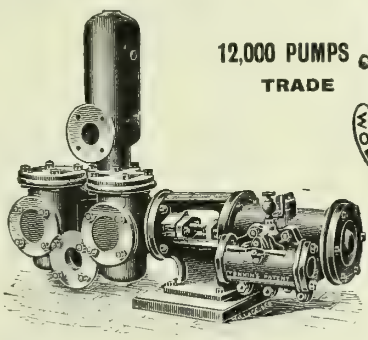
Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

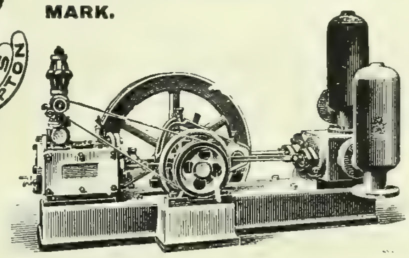
Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

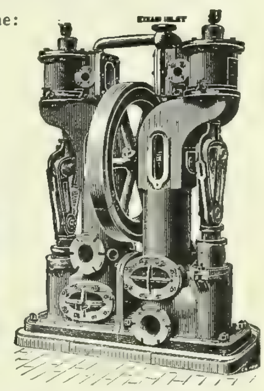
Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXII. No. 2484.] LONDON, DECEMBER 20, 1910. [62ND YEAR. PRICE 6d.

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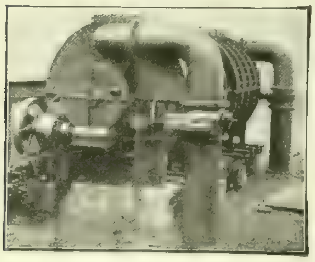

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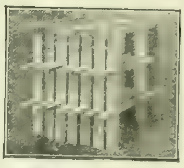

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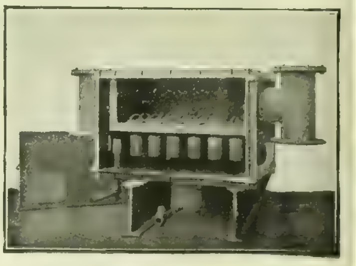

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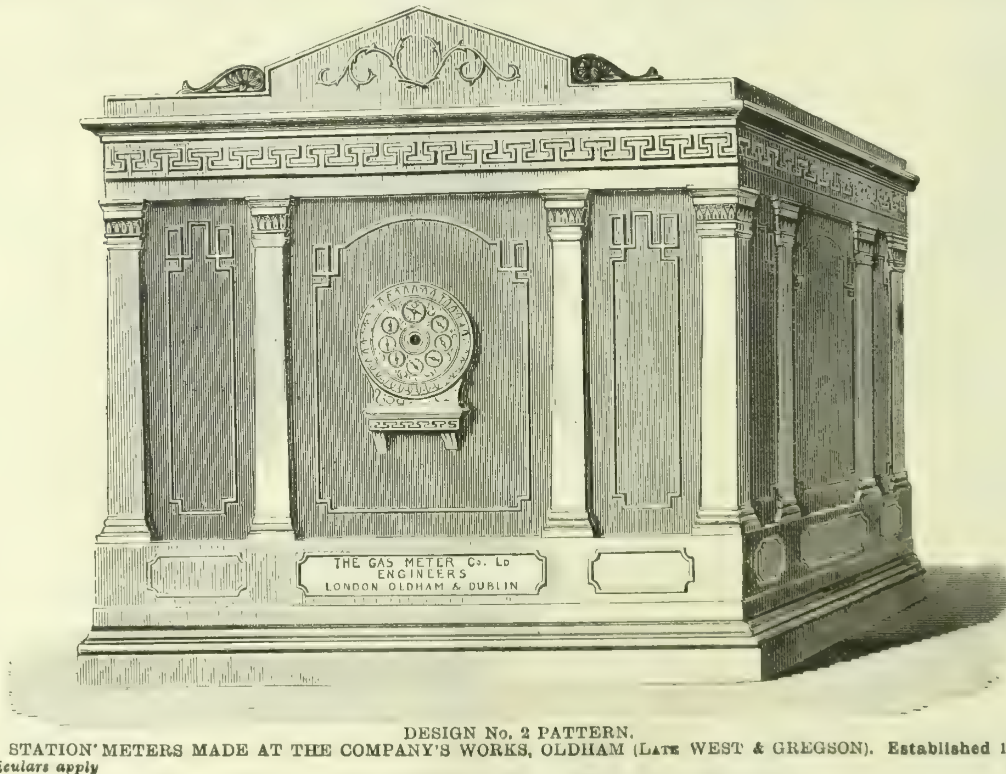

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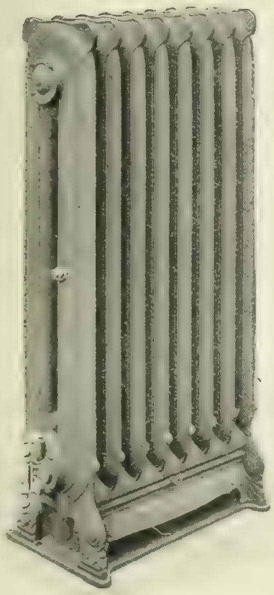

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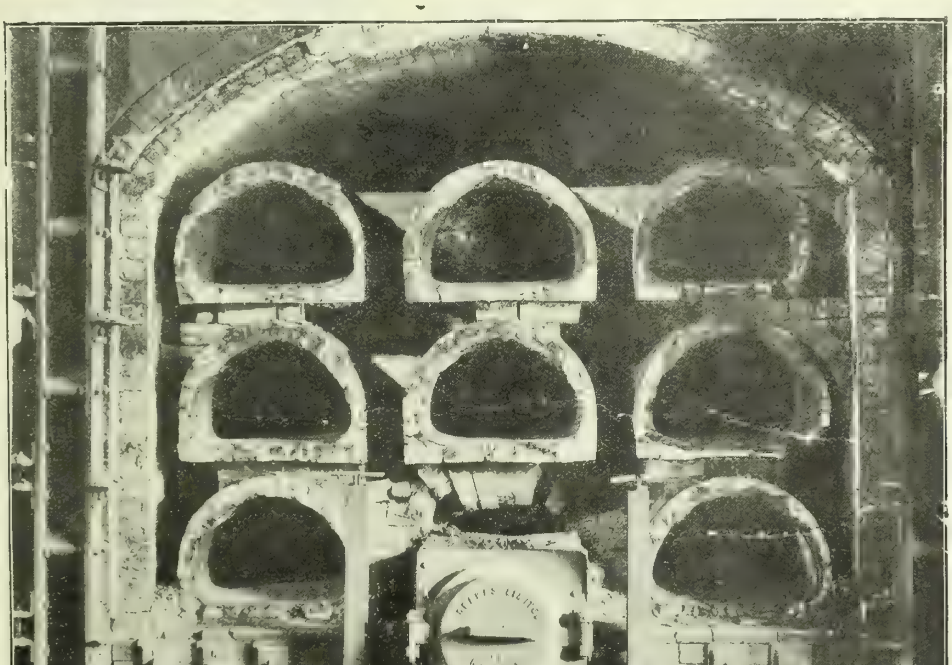

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2484.——TUESDAY, DECEMBER 20, 1910.

EDITORIAL NOTES—GAS, &c.

A Specification for Retort Material.

WHEN Mr. F. J. Bywater read his paper on "Refractory "Materials" before the Institution of Gas Engineers, it was thought by not a few (though, on the other hand, he received the support of many) that his indictment of the methods and the productions of British manufacturers of refractory materials such as are employed in gas-works was somewhat severe. Whether or not that was so is not a matter for discussion to-day; but rather thanks are due to Mr. Bywater for the bold action he then took, for it was the initial step that, succeeded by others, has shown that the British manufacturers of retorts and other fire-clay goods were not so much to blame, as at first sight appeared, for any truth that existed in the charge, as the conditions under which they were labouring. To an extent, they were operating in the dark; there was not that intercommunication between their methods and practical uses in gas-works that was desirable to attain the best ends. This was made apparent when, at the last meeting of the Institution, on the presentation of a report showing the pyrometrical results of an investigation carried out at a large number of gas-works under the direction of the Refractory Materials Committee (which was an appointment directly arising out of Mr. Bywater's paper), Mr. W. P. Gibbons, the Chairman of the Fire-Brick Section of the Society of British Gas Industries, and one of his fellow members of that section, Mr. C. W. Thomas, acknowledged that the report contained information which the makers had been wanting for years, and that it would be of considerable value, and they there and then pledged the makers to do their utmost to further the objects the Committee had in view. That pledge has been, and is being, fulfilled; and British gas undertakings must do their part now to encourage the manufacturers, and keep open the communication, want of which hitherto has been proved to have been largely responsible for somewhat rigidly pursued traditional methods. What has now been done has disclosed precisely where we are, and what is wanted, in this matter of the production of refractory goods suitable to gas-works purposes; and in this is the complete answer to any who may regard it as presumptuous on the part of gas engineers to have interposed in this manner in the operations of an industry from which they draw supplies that are, of all parts of an entire gas plant, subject to the most drastic actions. When producers and users of any commodity or article of utility are out of touch, then it is high time, in the interests of both, to bring them together.

It should be acknowledged, before referring to the specification (published elsewhere in this issue) for the manufacture and testing of retort material, that the Refractory Materials Committee, of which Mr. James W. Helps is Chairman, has proved itself one of the most diligent that the Institution has ever appointed; and the members have, in dealing with the duty delegated to them, made one of the most thoroughgoing investigations that the Institution has ever taken in hand. We feel secure against any denial, but very confident of support from his associates in the work, of the assertion that, in no small measure, this is due to the energy and the belief in the intrinsic value of the task in hand of Mr. Bywater, the Hon. Secretary. But to the first specification. It is the work of a Joint Sub-Committee (over which Dr. Harold G. Colman presided) of five representatives elected by the Retort and Fire-Brick Section of the Society of British Gas Industries, and an equal number of members of the Refractory Materials Committee; and in obtaining guidance in resolving upon the terms of this specification, they have had the highly valued assistance, as technical adviser and investigator, of Dr. J. W. Mellor, of the Staffordshire County Pottery Laboratory, of Stoke-on-Trent. This is the first commendable feature about the specification—that it is submitted for acceptance as the product of a joint body equally representative of makers and users, and is not a mere code of requirements of only one party to a matter subject to mutual contract. The next notable point is that the Committee are not attempting too much at a time. They prefer step-by-step progress. This first specification only deals with the manufacture of retort material and the tests to be applied; and fire-brick material, blocks, tiles, &c., are to have a separate specification, the appearance of which may be expected in the spring of the New Year. Even then the work of the Committee will not be finished, as it is proposed to undertake an inquiry into the thermal conductivity of various kinds of retort material—a quality which (as the Committee's report says) is considerably influenced by the texture. Furthermore, the specification now issued is merely to be taken as introductory and, so to speak, tentative; so that the tests may be strengthened as may be found reasonable with time and experience.

The caution thus evidenced in the Committee's procedure will, we are sure, commend itself as judicious, inasmuch as there is in this co-operative work much that is in the nature of a new, and therefore previously untried, route to a specific end. The makers showed that they would welcome guidance to the proper meeting of requirement; and the main purpose the present specification is intended to serve is as a lead to them in the right direction. But it is not to be taken as marking finality; for as development proceeds, it may be found possible to specify somewhat more stringent tests. It will also be observed that the specification does not intrude into the region of the manufacturers practical operations. It merely says what is required; and it is for the manufacturer to employ what methods and mixtures he, through experience and investigation, finds best to comply with his customers' demands. This again is prudent. The manufacturer will now know precisely what conditions he has to meet, and to what standard tests his products will be exposed (until such time as there may be revision); and there is confidence that British manufacturers will not—the spirit with which they have entered into this inquiry, and the arrangement of, if so they may be called, the terms of agreement declare it—be found wanting in doing what is requisite. It would, in our opinion, have been extremely unwise in such work as this to have attempted to reduce methods and mixtures to prescription; for in manufacture there is nothing that militates more against individual effort in the development of a higher status for any form of production, than to hedge it round with definitions that must not be varied. The only stipulation in connection with the materials is found in clause 1, in which there is a statement as to the general character of the material needed for resisting the rapid changes of temperature to which retorts are subject. What is required here is the exclusion of all dust and very fine material from the "grog" or burnt clay. The want of exclusion is one of the chief reasons for the material hitherto having been so dense and close-grained, which characteristics cause it to crack when exposed to variations of temperature. Another fruitful cause of the latter is insufficient burning, to which is attributable the shrinkage when the material is brought into ordinary service. These are the reasons for the porosity and contraction tests mentioned in the specification.

Speaking generally, the tests prescribed have had no haphazard birth. They are based on a thorough investigation by Dr. Mellor with examples of materials from all quarters for the purpose of ascertaining their porosity, and the extent of contraction and expansion on heating. The Committee have not sought to effect any violent departure from present practices; and for every line of their specification sound technical reason can be adduced. But while this is so, the tests presented are rather below the average of the results obtained with the best materials upon which investigation

was made. This is the reason for the suggestion that no finality, in degree, has been reached in respect of certain of the tests. Take the tests for contraction and expansion, the criticism may be heard that these are of scarcely sufficient severity to ensure good material. They have been purposely placed low for the present in deference to the wishes of the manufacturers. The explanation of the Committee suffices. The test for refractoriness of retorts will be regarded as satisfactory, in view of the Committee's report, presented last June, on the average of actual temperatures found in retorts under ordinary working conditions. The piece of material submitted to test is to show no signs of fusion when heated at a temperature not less than Seger Cone 28 (about 1630° C.). This is the equivalent of 2966° Fahr.; while the average maximum of actual temperatures found by the experiments under working conditions, as stated in the June report, was 1909° Fahr. The subsidiary conditions in the specification will be subscribed to as being equitable to both parties to a retort contract.

Heedful reading of the specification convinces as to the care and reasonableness that have been exercised in its preparation, especially in view of it representing the first movement in striking out into new lines of co-operative work for mutual benefit in this particular line of goods. If engineers and manufacturers will only give the specification a fair trial (allowing, as the Committee suggest, for a time, some little latitude in the interpretation of the conditions), there is confidence that it will soon result in better retort material being available. As a matter of fact, the material that will satisfy the prescribed tests, it may be taken, will be of somewhat higher standard than that represented by the definition. We congratulate the Committee on the service that has so far been rendered in this matter to the gas industry by the exertions they have put forth.

The Partial Illuminating Expert.

In the cause of street illumination, there is not voluntarily a busier man than Mr. Haydn Harrison; and if he does not make a name as a suitable consultant for local authorities prepossessed by electrical illumination, it will assuredly not be his fault. In the midst of his professional work, he has, within quite a small number of days, found time to read a paper before the Institution of Electrical Engineers, take part in a discussion at the Society of Illuminating Engineers, and, in addition, write an article on "Lighting London as "a Fine Art" for the "Evening News." The ostensible objects of the article are to condemn the amazing variety of lamps there are to-day in the streets of London, to advocate —naturally—that the local authorities should take counsel with the illuminating expert (most of those with whom we have had experience, either personally or through their writings, are conscientiously partizan), and to laud the adoption of greater uniformity in street lighting by the application of frequently placed low units of light on brackets affixed to houses to avoid glare and obstruction. And we have not the slightest doubt that metallic filament lamps enclosed in lamps with fittings designed by this censor and mentor of the Metropolitan lighting authorities would meet with his sincerest and unqualified approbation. But we think that Mr. Harrison is a man who is in too great a hurry. Order cannot be produced in a day from such chaos as exists in connection with the lighting of London. The Gas Companies are working hard to the ends of improvement and greater uniformity. In Westminster, the City Council are doing excellent work in these directions, and without the aid of any "expert" outside their own body; and they are accomplishing precisely what (in the part of the article not dealing with uniformity) Mr. Harrison says they should do, and what would be done if an "expert" were employed—that is giving to the various streets an illumination "in proportion to their importance." There are now in use in Westminster thousands of inverted gas-burners (about which this partizan illuminating expert does not say anything) all of the same type; and thousands of others of the same model are now going into the streets of Hackney, Bethnal Green, Finsbury, Stoke Newington, and possibly of other boroughs. The same applies to the spread of inverted gas-lighting in the south of London. This being so, the march to street lighting improvement and greater uniformity, precisely as Mr. Harrison advocates, has well started, and that without the aid of any outside illuminating experts. This work, too, on the part of the Gas Companies is rousing the electricity suppliers to a better sense of their duty, and has put them on the defensive, with the result that the old-style electric arc lamps are being displaced in feverish haste, in certain important situations, in favour of flame arc lamps, and as a consequence greater glare and unsteadiness are being introduced into the streets.

However, we have a few words to say to Mr. Harrison on this subject of glare. No one would accuse him of being an independent expert; and no one would expect him to say much that is kindly on the subject of gas lighting for the streets, notwithstanding the rebutting evidence existing in London to-day to the defamatory statements so often seen in electrical quarters concerning gas lighting. In passing, it occurs to us that we have not observed any photometrical tests published by our electrical contemporaries as to the new inverted gas lighting—high and low pressure—in Westminster. Perhaps the penal, official photometrical tests are acting as a deterrent, as we have no doubt the Gaslight and Coke Company will, under the circumstances, be on the watch for any aspersions as to dereliction of contractual duty on their part. But to the point. Looking through the article the only generous allusion Mr. Harrison makes to gas lighting is when he condescendingly sandwiches high-pressure gas-lamps between electric flame arc and metallic filament lamps in referring to efficient types. He says nothing whatever about the low-pressure inverted gas-lamp, though he submits that the ideal system of lighting would be lamps of comparatively low illuminating power spaced closer together than is now usual.

In pointing, however, to the bewildering variety of the lamps that may be seen by anyone driving from Victoria Street, Westminster, *viâ* Regent Street and Oxford Street, to Paddington, he starts by speaking of the "dazzling glare" of the 1800-candle power high-pressure lamps in Victoria Street. This dazzling-glare sensation is not experienced by us in Victoria Street, nor by anyone with whom we have come in contact who has been through the street lately after dusk. On the contrary, the eyes have experienced a comfortable feeling after passing from the dazzling glare of certain arc lamps in Whitehall to the portion lighted by high-pressure inverted gas-lamps. In his allusion to the Whitehall flame arc lamps, however, the would-be educator of London Borough Councils says nothing whatever about glare, nor does he in referring to the Regent Street lamps, or those in Oxford Street, or those in Marylebone. Only the Victoria Street high-pressure gas-lamps have the stigma of dazzling glare attached to them! In his view, the Regent Street lamps, fitted with specially designed prismatic globes, give an even and efficient illumination; while in Oxford Street "a genial warmth and comfort is diffused by the yellow arcs, "which make life worth living." On the occasion of the reading of Mr. Harrison's paper before the Institution of Electrical Engineers, Mr. A. H. Seabrook, of West Ham and Marylebone fame, asserted that the "dioptric globes in "Regent Street seemed to him to give a considerable and "unpleasant glare." This is an instance of doctors differing. As to the genial warmth and comfort of the Oxford Street yellow arcs which make life worth living, we strongly recommend the human wrecks which disgrace the Embankment at night time to transfer themselves to Oxford Street, for expert opinion declares that the flame arcs there will greatly improve their conditions and circumstances.

Of course, in Mr. Harrison's view, the Borough Councillors are a lot of ignorant fellows on this matter of street illumination; and they will never be right until they employ an expert who knows the whole science of illumination. The employment of such an illuminating expert would set things right. Illumination would be even, glaring lamps would be dispensed with—that is to say, high-pressure gas-lamps, by no means flame arcs and metallic filaments, about which we were hearing something recently at the Illuminating Engineering Society [*ante*, pp. 767, 784]—and the result would have some relation to cost. Now supposing a Borough Council took Mr. Harrison's advice, and engaged an "illuminating expert." Supposing, too, they deliberately selected, in view of his article in the "Evening News," Mr. Harrison himself. Could we venture to predict to that Borough Council the system he would advocate—gas or electric? We should have a good try, and should have a fair amount of confidence in our powers of prediction in this instance. It is feared by us that the wholly independent illuminating expert is yet unborn, and that the supreme judges must still be the local authorities when those local authorities are not, as unfortunately so many of them are, influenced by the possession of electricity undertakings.

Gas for Industrial Purposes.

The attention that is being devoted to this subject is expanding at a rapid rate. There are some gas-supply areas in which it is more important than others; the character of the districts, whether largely industrial or purely residential, being the controlling factor, while the characters of the industries also affect the matter. But, speaking generally, there is, as Dr. Schilling was illustrating to our German friends away last June, a big field for the development of the uses of gas in industry. In our opinion, we are only at the fringe of this industrial gas business at present. That the business exists in some districts, but only awaits development, is shown by what the Sheffield Gas Company succeeded in accomplishing, in a very brief period, in the placing of gas-furnaces. That there is a big belief in the future of this "line" of trading is also very clearly shown by what is being done in Birmingham, in the distribution of gas for industrial purposes at high pressures. The East-end of London is also a specially good field for the industrial business; industries both large and small and variegated in their character abounding there. It was not long since that the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw) was telling the proprietors that the staff were entering, with energy, upon a very promising field of business in the supply of gas-furnaces to industrial establishments; and in his address to the Southern District Junior Gas Association last Friday evening, the President (Mr. L. F. Tooth), who is connected with the sales of gas department of the Company, gave further information as to what is being done. Such addresses must contribute to development in this direction; and the suggestiveness to be drawn from experiences like those of Mr. Tooth must be of considerable use.

Mr. Tooth was suggestive. There are gas furnaces and gas furnaces for industrial use; and just any form of structure will not suffice. There must be scientific construction, and construction suitable to the object in view. We think Mr. Tooth will be prepared to say that his experience does not support Dr. Bone's theorem as to surface-contact of a gas-flame usefully accelerating combustion; for his diagrams show that in a furnace which he has designed for metal melting, where flame contact does not exist to any great degree, he gets a more rapid rise of temperature, and it is continued at a higher level when it reaches the points of temperature maxima, than where there is flame-contact with the sides of the furnace and the pot or crucible. But, of course, experiences vary with variation of condition; and when the scientists, upon whom we are prone to base our faith in such matters, do not agree, there is excuse for refusing to be too positive, or to accept any experience as being conclusive in respect of general application. Mr. Tooth's experience as to better results being obtained by fixing the burners so that the flames enter the furnace at a tangent, is confirmed by the work that has been done elsewhere, as is also the experience that only the best of refractory material must be employed for furnaces that are to be subject to high temperatures. In connection with this subject, of course, the economy of the use of gas in such industrial operations as metal melting cannot be determined alone on the fuel basis. The whole factory economy that results from such an adoption—the economy of time, any increased output per furnace or per man—must all be placed to the credit of the system. This is important.

A Live Subject.

The specification for retort material that has been issued by the Refractory Materials Committee of the Institution of Gas Engineers overshadows all other contributions to the general subject; and, in view of the earlier comment upon that document, we must refrain from dealing at length with the papers on the topic that appear in this week's issue. It is particularly noteworthy that the paper of 1908 by Mr. Bywater gave a fillip to interest in this matter that is unexampled in recent times in connection with any other single constituent of a gas-works equipment, save, of course, the large question of carbonization plant and method. One satisfactory issue has been the manner in which the manufacturers of retorts and other fire-clay goods have thrown open their works to the inspection of members of Junior Associations; and there have been papers contributed to the technical proceedings—the one by Mr. E. M. Stewart appearing to-day is an instance—showing that the manufacturers are perfectly willing to give all information in their power, and that they have nothing that they particularly wish to hide. Incidentally, too, the contributors have disclosed that the manufacturers have not been under such complete servitude to rule-of-thumb procedure as has been too commonly imagined.

A paper that should be read in conjunction with the specification for retort manufacture and testing, is the one that Dr. Rudolf Lessing has read on "Refractory Materials and "their Testing," before the Liverpool Engineering Society. There is, however, one statement of the author which we cannot accept as any sufficient excuse for production and conditions of use being out of harmony. He submits: "The "fact that the study of refractory materials has not up to "now been a very general one is evidently due to the difficulties of their examination under the conditions under "which they are used in practice—viz., at high temperatures." There were, on the one hand, the makers of the goods with raw materials of excellent quality; there were, on the other hand, the gas-works with the conditions of use and the high temperatures. There was no good reason for an absence of a confluence of opportunities. But until lately producers and users have kept at arm's length—there seemed to be no thought of approaching each other—as though they had no interests in common. That is altered now; and the manufacturers have information which will be of much assistance to them in the future. There is not the slightest reason —in fact, it will be advantageous to both the producers and the users—why, in future, conditions of manufacture and use should not be kept in closer touch. For the rest, Dr. Lessing's paper was historical and informative, and in it will be found further explanations for the conditions of the new specification for retort materials and testing. One suggestion the author makes in dealing with retort-settings is that, for the outer walls, ordinary building bricks of high porosity and low thermal conductivity should be more generally used, in order to reduce, as far as possible, losses by radiation to the atmosphere of the retort-house. An integument of insulating material, or an insertion of non-conducting material between the inner and surface parts of the walls of a setting, has also an excellent effect in conserving heat, and in realizing some reduction of the fuel account.

Seasonable Fiction.

It is sometimes necessary to go from home for intelligence that intimately interests one. Some astonishing statements have appeared in the "Stock Exchange Gazette" concerning certain remarkable developments that are said to be going to take place in the gas industry through means knowledge of which on our part is confessedly defective, if our financial contemporary's facts are not at fault. But we rather think that it is not our knowledge that is defective, but that our contemporary has somehow or other got into a tangle in properly allocating the facts to the past and the future. We read that "developments are impending of the highest im-"portance to the Gaslight and Coke Company; and if, as "there is every reason to believe, the necessary formalities, "which will have to be complied with, proceed smoothly, the "position of the undertaking before long will have undergone "a great change for the better." We, too, are exceedingly hopeful of seeing the Company in a better position even than it is at present; but the great change for the better has been proceeding without intermission during the past five years. The writer of the article correctly refers to certain of the powers that are to be sought by the Company in the next session of Parliament. But then he goes on to state: It is probable that in the "near future the Company will "apply to Parliament for leave to further curtail the illumi-"nating power of the gas it produces, in view of the fact "that a well-known expert has recently invented a burner "which is capable, by means of the closer regulation of the "air supply in the pipe [*sic*], to provide a flame of equal "illuminating power to that which has hitherto been pro-"duced by a higher standard of gas." Our friend has evidently only just learned of the Carpenter "Metropolitan" No. 2 burner, which has been in use as the standard for testing the illuminating power of the gas supplied by the Gaslight, South Metropolitan, and Commercial Companies since 1906, when it was first prescribed by the Metropolitan Gas Referees, in conformity with the power conferred by Parliament. Then we come to another surprising piece of information; and it is that, if Parliament sanctions this new burner, it is estimated that "the saving to the Companies "will range up to 8d. per 1000 cubic feet, according to the

"quality of the coal used for carbonizing." Since the No. 2 burner has been in use for the official testing, the price of gas has been reduced by the Gaslight Company by 4d. per 1000 cubic feet; but this 4d. (which represents upwards of £300,000 a year to the consumers on the present sale of gas) is not to be credited to the burner, but in greater part to the economies that an expansion of technical knowledge has enabled the Company to make in manufacture. The *dénouement* of this little romance is that gas consumers and shareholders in sliding-scale gas companies will be highly pleased, gas shares will go up, and the electric supply industry will be made to "sit up" even more than it has been made to do in recent times.

Parliamentary Representation.

In addition to previous notification, three other members of the new Parliament have close connection with the gas industry. Mr. W. H. Cowan continues to represent Aberdeenshire (East) as a Liberal. Mr. Alderman Cotton, Chairman of the Alliance and Dublin Consumers' Gas Company, goes to Parliament as a member of the Redmond party, representing Dublin County (South). He was only beaten in contesting the seat last January by 66 votes; and this time he secured a majority of 133. Mr. J. H. Duncan, one of the Directors of the Otley Gas Company, retains his seat, in the Liberal interest, for the West Riding of Yorks.

Experimental Lighting in the City.

It may be taken that we shall not advance far into the New Year before the Court of Common Council of the City will be considering the experimental lighting now running in their streets. In view of this, our electrical contemporaries are already bestirring themselves in an attempt to show by columns of matter that the electrical display that has been made is infinitely the better. The electrical papers, there is good ground for believing, have all been supplied with the same information from the same source; so that the City Fathers who happen to see what appears in those papers will know that the material, the adjectives, the colouring, and so forth all have a common origin. They will know, for instance, if they read that "one is immediately and forcibly struck with the vast superiority of the new electric lighting" over the new gas lighting—of course, having regard to comparable units of light, and not to the extremes of flame arcs and low-pressure lamps of between 300 and 400 candle power as are seen in both Cheapside and the Poultry—the statement means what it says, that it is "one" who has been so "immediately and forcibly struck." The "one," we believe, is Mr. Frank Bailey, the Chief Engineer and Managing-Director of the City of London Electric Lighting Company; for we assume that the typewritten matter which has reached the "Electrical Times" through him is the same that the other electrical papers will be publishing, or have commenced to publish. Taking it that there will be no denial of this, it is, we think, extremely good of Mr. Bailey to have suppled our friends indiscriminately with so much interesting copy penned by a very interested person.

Points to Bear in Mind.

Mr. Bailey does not (this is ungenerous of him) give credit to the Gaslight and Coke Company for having stirred up his own Company in this matter of street lighting, or for being the means of putting an end to the long period of supreme repose during which antiquated arcs drew from the pockets of City ratepayers a heavy sum per annum. So far as we can trace, too, he does not suggest that other people may have different views from him as to the "vast" superiority of which he speaks through our contemporaries. But the City authorities are not likely to be misled in this matter by *ex parte* expressions of opinion. There would not have been much sense in having the trial demonstration, if the Corporation were not going (as they have hitherto done during the battle of the lights in the City) to decide for themselves on the merits of the lights from the financial and efficiency points of view. The opinion of all disinterested people who have seen the centrally suspended Keith high-pressure lamps in Cannon Street is that they are equal in their illuminating efficiency to any that are shown by the electrical people—in Cannon Street or Cheapside, or standard supported in Farringdon Street—and so are the Fleet Street lamps. An eye-arresting lamp does not necessarily mean that that lamp is the most efficient illuminating agent. In the demonstration, the Gaslight Company have also proved, by what has been done in Cannon Street, the feasibility of central suspension in the case of gas-lamps, which was a point that the Streets Committee—in compliance with the (to gas) favourable report of their deputation last year—desired to have demonstrated. A drawing showing the simplicity of the suspension, travelling, and lowering and raising devices, appears in the present issue (p. 838). The members of the Corporation will look at the Cannon Street lighting as typical of high-pressure gas lighting, and will not be deceived by the flame arcs in Cheapside being in juxtaposition to low-pressure gas-lamps. The two forms of lighting have nothing about them that is comparable.

An Effective Advertisement.

It is not always easy to gauge the effect of advertising. Sometimes the results are not immediate and direct, and those who spend money and energy in this way cannot always see the fruit of their outlay. In an indirect way, the advantages of an advertisement may occasionally be seen in the manner in which it provokes rivalry. Some circulars recently sent out by the Plymouth and Stonehouse Gas Company seem to have "touched the spot" in a very effective manner. A few months ago the Electricity Committee of the Corporation were bemoaning the fact that the law did not permit them to enter into competition with the Gas Company in advertising. Now some members of the Council are seriously disturbed because the Company have issued a circular demonstrating the superiority of gas from the point of view of health as well as economy. This view is enforced in the circular by reference to the example of the Society of Medical Officers of Health, who at their London offices and exhibition rooms in Upper Montague Street, Russell Square, W.C., have discarded electricity in favour of gas. "This is one example," says the circular, "of joint experience with electricity and gas, each extending over a number of years, finally proving that gas is the most satisfactory light." It is further pointed out that many medical men show marked preference for gas over electricity, both for lighting and heating; recommending it to their patients, and using it for heating and lighting their own consulting-rooms. The action of the Medical Officers of Health appears to have made a strong impression on at least one member of the Plymouth Corporation. At the meeting of that body last week, he was anxious to know whether the medical officers spoke in their official capacity in commending gas and criticizing the electric light. What difference it would make in the actual superiority of gas or in the opinion of the medical men on the subject, whether the opinion was expressed in an official or a private capacity, is not quite clear. Nor was any light on the matter to be obtained from the Electricity Committee. All that could be said on their behalf was that inquiry should be made. The point of the thing, however, is that the circular is one which has attracted attention to the subject. If it has led to a question in the Town Council, it has, no doubt, provoked discussion elsewhere. An advertisement which does this can scarcely fail to produce good fruit; for, after all, the object of advertising is to awaken curiosity and excite inquiry. When these are aroused, the salesman must do the rest.

A Surcharge before the Courts.

A point which Counsel remarked was of the greatest importance to local authorities in England, occupied the Judges in the Court of Appeal on one or two days recently; the judgment being followed by an order that the costs on both sides should come out of the rates. Thus the people of Bournemouth—the Corporation of which town was the one concerned in the action—may console themselves with the thought that the amount which they will be called upon to pay may benefit the country generally. A casual glance at a report of the proceedings might not lead one to infer that the matter in dispute was of such great general importance as was stated in Court; but the point involved is one that it may be well to keep in mind. Briefly, the Local Government Board Auditor surcharged those members of the Bournemouth Corporation who signed a cheque for £2 12s. 6d., interest on a loan of £600, which the Corporation had been authorized to borrow, and obtained from the Wilts and Dorset Banking Company upon the security of a charge on the rates. Subsequently, the Corporation accounts were transferred to the National Provincial Bank, who paid off all sums advanced by the first-named Company, which included many other loans besides that named. The mortgage

of £600 was not, however, legally transferred to the National Provincial Bank; but the receipt for the money was endorsed thereon. The grounds of the surcharge were principally that the transaction was contrary to the provisions of the Public Health Act, 1875; that the Council had borrowed money without giving proper security; that their borrowing powers were subject to statutory conditions, and payment of interest on money borrowed without the fulfilment of these conditions was illegal; and that there was no authority in law for payment of interest on money borrowed in the way that was here adopted. The Divisional Court upheld the Auditor's objections; and the members of the Council involved thereupon took the matter to the Court of Appeal, who unanimously reversed this finding, and ordered the overcharge to be quashed. Lord Justice Vaughan Williams expressed the opinion that the borrowing in this case was not, at any stage, a borrowing for temporary purposes. The question was whether there had been a transfer of the debt with which they had to deal to the National Provincial Bank, so that the debt was a live debt. It was clear that when there was a transfer of the Corporation account from one bank to the other, it was not intended that the debt of the Corporation to the Wilts and Dorset Bank should be blotted out. The idea was that there should be a transfer of the loan and a transfer of the mortgage, securing it to the National Provincial Bank. There had been no re-borrowing; and therefore there was nothing in respect of interest on the loan for the Auditor to surcharge.

Rumoured Coalite Reconstruction.

Reconstructions are often the beginning of the end. Rumour says that the Directors of the British Coalite Company are contemplating marring the pleasures of the shareholders at Christmas time by proposing to them a scheme of reconstruction, which is a confession of the falsification of the old hopes, and of this coalite business having been constructed on shifting sands. The meeting of the shareholders is not being held so early this year; but it is stated as part of the rumour that it is to be held on the 29th inst. Is this true? If the answer is in the affirmative, Why hold it in Christmas week? Is there hope on the part of the Board that some of the discontented shareholders will be holiday making? Surely, from what is known of the affairs of the Company, a less inconvenient week for the meeting could have been chosen.

Cost of Gas and Electric Current.

At the close of the abstract of the paper on "The Requirements of Illumination and the Status of Gas Lighting," read by Mr. J. C. Briggs at the meeting of the Graduates' Association of the Institution of Mechanical Engineers on Monday last week [see *ante*, p. 776], it was mentioned that the author gave a table showing the comparative cost of gas and electric light. The table referred to did not accompany the abstract supplied to us; but we are now able to give it from a print of the paper which the author has sent. He introduced the table with the following remarks: "The improvements wrought in mantle production have in no small measure contributed to the high efficiencies and reduced maintenance costs now prevailing in gas lighting. This fact is more in evidence with the advent of the inverted burner; the suspended mantle having a distinctly longer life than the centrally supported form employed with the vertical burner. The life of the mantle employed with low-pressure burners should not be less than 500 hours, and 300 hours in the case of high-pressure; and the light-emitting power should not sensibly depreciate over this period. When this is compared with the 1000-hour Osram lamp, costing 3s. 9d., maintenance is all in favour of gas lighting."

Gas Lighting.

Burner.	Efficiency per Cubic Foot per Hour.	Consumption in Cubic Feet per Hour.	Cost in Pence with Gas at		
	Candles.		3s.	2s. 9d.	2s. 6d.
Flat-flame	3	333·3	12·000	11·000	10·000
Incand. (inverted) .	30	33·3	1·190	1·090	0·999
Keith's high-pressure	60	16·6	0·597	0·547	0·498

Electric Light.

Lamp.	Efficiency per Watt per Hour.	Consumption in Watts per Candle.	Cost in Pence with Current at		
			6d.	3d.	1½d.
Carbon filament . .	0·028	3500	21·0	10·50	5·250
Metallic filament .	0·800	1250	7·5	3·75	1·875

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 872.)

Business on the Stock Exchange last week grew quieter and quieter as the holiday time approached nearer; and the chief consideration was the settlement of the fortnightly account. Movements were irregular but slight; and the steady progress of money rates downward imparted a tone of much cheerfulness. A minor feature of the week was the discovery of a new counter in the game of speculation—viz., Tea, *vice* Rubber invalided. The opening day showed little animation; but it was cheerful and had some strong points. Government issues were firm, and Consols rose $\frac{1}{8}$; while Rails were sympathetic. On Tuesday, fresh business was incommoded by the claims of the settlement, but the abundance of money made the general tendency quite bright. Consols gained another $\frac{1}{4}$; and Rails were lively at the prospect of pacification in the labour arena. This state of things continued through Wednesday. A good demand for Government issues sent Consols up $\frac{3}{8}$; and in Rails some nice advances in price were made. Thursday was a quiet day—content with the present and hopeful for the future. All the leading markets were firm and almost unchanged. On Friday, there was a little of the normal realization, which affected some of the prices slightly. Consols lost $\frac{1}{4}$ out of their gains. The general tone, however, was still good. Saturday was naturally a very quiet day, and almost devoid of feature. Consols closed unchanged. In the Money Market, there was a very abundant supply demanding employment at light rates. Discount terms eased down steadily; but they rallied before the close. Business in the Gas Market was much lighter, showing unmistakable signs of the coming holidays. It was, however, fairly well distributed, and the general tendency was favourable. In Gaslight and Coke issues, the ordinary was rather inactive but as steady as a rock; all transactions being within the same limits as the previous week —$105\frac{3}{4}$ to $106\frac{1}{2}$. In the secured issues, the maximum was done at 87, the preference at from $103\frac{1}{4}$ to 104, and the debenture at 79 and $79\frac{1}{2}$ *ex div.* South Metropolitan was steady, and did not range outside the limits of the week before—$121\frac{1}{2}$ to $122\frac{1}{2}$. The debenture realized 81. In Commercials, one bargain in the 4 per cent. was marked at 109, and one in the $3\frac{1}{2}$ per cent. at $102\frac{3}{4}$. Among the Suburban and Provincial group, Alliance and Dublin was done at 80 (a fall of 4), Brighton and Hove ordinary at 161, British at from $44\frac{1}{8}$ special to $44\frac{3}{4}$, and (on the local Exchange) Liverpool "A" at 220. In the Continental Companies, Imperial adhered strictly to its old figures of $185\frac{1}{2}$-$186\frac{1}{2}$, ditto debenture was done at $94\frac{1}{2}$, Union at $89\frac{1}{2}$ and $89\frac{3}{4}$ *cum div.* and at $87\frac{3}{4}$ *ex div.*, and European fully-paid at $23\frac{15}{16}$ to $24\frac{1}{8}$. Among the undertakings of the remoter world, Buenos Ayres debenture changed hands at $97\frac{3}{4}$, Monte Video at $12\frac{5}{8}$, Primitiva at $7\frac{5}{16}$ and $7\frac{3}{8}$, ditto preference at from $5\frac{3}{16}$ to $5\frac{3}{8}$, ditto debenture at 97, and San Paulo at $15\frac{5}{8}$.

ELECTRICITY SUPPLY MEMORANDA.

Electrical Engineers and Cooking and Heating—Real Cause of the Want of Progress—Comparing the Incomparable at Islington—Overtures for Peace between Wirers and Municipal Traders—Consumers and their Lamps—A Whitby Discovery—Those Concerned Satisfied with the Holborn Competition Terms.

Christmas is close at hand, and the thoughts of the Editor of the "Electrician" have been wandering to the subject of cooking and heating. Christmas and cooking and heating have something strikingly in common, and peace and goodwill to all men enter into the happy conditions of the season. But our contemporary takes up the question in a spirit of combativeness, and hurls accusations directly and indirectly at that poor long-suffering individual the station engineer. His want of qualification and his misdemeanours are many—in print. He has often been told that in the commercial struggle he is next to useless; and now he is charged with being responsible for "the scanty use at present made of electrical apparatus" for heating and cooking. His past attitude is alleged to be at fault. But that is not all. The ugly question is thrown and catches him fully and squarely in the face: How many station engineers have their meals cooked electrically, or their houses heated by electricity? The answer, of course, is just as many as are foolish. Station engineers would doubtless be interested in knowing how many electrical journalists have their meals cooked electrically or their houses heated by electricity? The force of example is great; but there are very few persons who are so benevolently inclined that they choose to be examples to others if it is going to affect both their pockets and their personal comfort.

Perhaps our contemporary has erred in assigning the cause of the want of success in electric heating and cooking to the attitude of electrical engineers. "If," it is suggested, "they themselves employed electricity for heating, cooking, and other applications, they would soon realize what is lacking for the successful development of this field." Perhaps, without putting themselves to any personal inconvenience, they have discovered what is lacking for the successful development of the field; and it may be imagined that they have found, as we have done, at other people's expense, that for any domestic heating purpose electricity sadly lacks the

B.Th.U's. necessary to make its use economical. It is said that if the "man in the street" were asked why he does not use electricity for heating and cooking, he would say that the method is too expensive, or the apparatus not satisfactory; and our contemporary asserts that judging from the replies received to inquiries, there are *many* station engineers who are not prepared to refute these statements. The testimony to the honesty in this regard of station engineers is extremely satisfactory; and we set it to their credit against the deadly-fumes slander and the misrepresentation as to electric lighting being cheaper than gas. We shall after all begin to entertain a little hope for the central station engineer. It is an unnatural thing to expect that cheapness and inefficiency should really run together. The "Electrician" seems to think that they ought to; but in its curiously illogical article, it proves that the station engineers who are not prepared to refute the statements of the man in the street are perfectly justified. Let us show this by an extract from the article: "As to electric cooking apparatus, some dissatisfaction has been expressed. Considering the lengthy period these appliances have been on the market, it is surprising that they are not more uniformly satisfactory. Take such a simple piece of apparatus as an electric kettle. The convenience of these is so easily demonstrable that little difficulty should be experienced in persuading consumers to adopt them. But the number of electric kettles in use is surprisingly small. This is partly accounted for by lack of enterprise on the part of supply engineers, and also, we must admit, to unsuitable design. Thus, many electric kettles take a very long time to boil water. . . . This is typical of many of the faults of electric utensils; the manufacturers producing articles which do not meet practical requirements." Want of progress is not so much due to the attitude of electrical engineers, as to the low calorific value of electricity and the inefficiency of the appliances. But, however much the appliances might be improved, there is a limit to the thermal value of a unit of electricity.

Electricity for public lighting is cheaper than gas lighting. At any rate, Alderman Vorley, Chairman of the Lighting Committee of the Islington Borough Council has said so; and that omniscient organ of the electric industry—the "Electrician"—also so avers, or rather it states that "it is becoming increasingly evident that the majority of gas companies are no longer able to quote, at any rate on a commercial basis, figures which can compare favourably with those now obtained with flame arcs or metallic filament lamps." If we believed in our contemporary's powers of penetration as much as it believed in them itself, we should have nothing more to say on the subject. But as it happens, we do not. Let us have a little quiet inspection of the grounds on which the fresh outbreak of electrical belief is based. Alderman Vorley has been guilty of a piece of indiscretion that one would not have expected from a man of business. He has been comparing the cost per mile of flame and other arc lamps with small unit low-pressure vertical incandescent gas-lamps, with the result that in Islington 100 miles of gas lighting cost only £13,112 under the old conditions, and 24 miles of street lighting by electricity cost £15,225. That is to say, if Islington had been content with the quantity of illumination afforded by the old-type incandescent gas-lamps, and the prices for that type of lamp (which is greater than for the higher efficiency low-pressure inverted lamps), the ratepayers might have had for only £1000 more than they are paying for electricity alone for 24 miles of street, the whole of the 124 miles of streets in the borough lighted, and been £12,000 a year in pocket. The relative prices per mile are £634·4 for electricity, and for gas £131·1. But says Alderman Vorley, comparing something for which he pays £634 per mile with something for which he pays only £131 (which any schoolboy of average intelligence would tell him is a silly thing to do, and not cricket), he gets 48,664-candle power per mile at the higher price, and only 1900 candles at the lower price. So he argues gas is dearer than electricity. The performance hardly does credit to an Alderman of the Islington Borough Council. But we beg leave to regard with a big amount of scepticism the 3500-candle power attributed to the Islington flame arcs. Now supposing we come to a fair and common basis of comparison, and take high-pressure gas-lamps as the competitors of arc lamps. Supposing the £634 per mile was handed over to the Gas Company, and they were asked to show what they could do for this amount of money per mile, instead of £131 per mile. According to the report issued last summer by the City Engineer (Mr. Frank Sumner), the over-all price of each of the Fleet Street inverted 1500-candle power high-pressure gas-lamps was £15 2s. 6d. (the Gas Company have announced a reduction in the price of gas again, to take effect at the end of this year); so that £634 per annum would pay for 42 of these lamps per mile, giving a total illuminating power of 63,000 candles. Under a five years' contract, and no doubt taking into consideration the largeness of the contract as a whole, the Gaslight and Coke Company's price for 3000-candle power units in Westminster was £22 per annum. The £634 would allow of 29 of these 3000-candle power lamps to be supplied per mile; and these would represent 87,000 candles. What about Alderman Vorley's 48,664 candles in comparison with a rational basis? We hope for the future that he will compare things that are comparable, and not be misled into the opposite course. As to the £131 per mile for the low-pressure lamps, has he failed to note that the new contract with Hackney works out to £74 per mile for inverted incandescent lamps of higher illuminating power than the old vertical type; so that the illuminating power will be greatly increased per mile of street?

It was remarked last week that the long-talked-of promotion in the next session of Parliament to confer upon local authorities wiring and fittings powers was unrepresented by the first formality of a notice in the "London Gazette;" and therefore we presumed that something had happened to cause the idea to be dropped or postponed. The explanation appears to be that the promoters have thought well to have a conference with the electrical contractors, and that conference is still proceeding—*in camerâ*. The parties are as nice and polite to each other as they can possibly be at the present moment. It was not always so. There is no doubt about it that the contractors have the whip-hand; but they have not the capital with which to go into the hire and hire-purchase parts of the business. The promoters, too, of the projected Bill to confer powers, if Parliament think fit (which they have not done in a General Bill up to the present), have no doubt felt it would be a bit irksome to attempt to approach Parliament with municipal opinion so largely divided on the subject of the propriety of extending municipal trading into this highly speculative region. At a meeting of the Committee for the Protection of Electrical Interests the other day, the matter was under guarded discussion; nothing was said about what were the probable terms of agreement over which the two parties will (if they can arrive at that point) shake hands. It is, however, suggested that the outcome may be that the wiring will be left to the contractors; while the municipal authorities will be left to develop the hire and hire-purchase of electrical appliances. There is not much value in discussing probabilities. We must wait and see what is the outcome of the secret conference. The parties may propose, but the municipal authorities will have to obtain statutory powers, and Parliament may dispose of the matter in quite a different way from what is contemplated. At the meeting of the Committee for the Protection of Electrical Interests, the hoary statement was again heard with radiant satisfaction, that, for cooking, electricity at anything like 1d. per unit compares very favourably with gas. That is why the gas cooking stove connection rises in number with graceful ease, while electrical engineers look on from a distance, breaking the tenth commandment with all their might.

The question of consumers' lamps is a very difficult one for electricity supply undertakings, owing to the great expense of the lamps, and the reluctance of consumers to spend the money when renewal is necessary, and when they are not at all sure that they will get the lamp safely to its bayonet joint before there is a collapse of the filament. A writer assuming the *nom de plume* of "Metal," has contributed an article to the "Electrical Review" advocating the supply of electric lamps by electricity undertakings, holding that it is the duty of such undertakings to supply light rather than current. This fact sunk deeply into his mind on receiving the intelligence that a certain large town even now is finding its disconnections of lamps almost equal to the connections, although the current is sold at low rates. It will be remembered that Mr. A. H. Seabrook was saying the other night at the meeting of the Illuminating Engineering Society, that he was only able to retain, on account of the cost, some of his consumers who used metallic filament lamps by getting them to employ Holophane globes and shades, and so enabling the cutting out of some of the points of lighting. What the anonymous writer in our contemporary holds is that electricity stations must furnish lamps to consumers if the best is to be got out of electricity supply. If this be true, the outlook is not all that some of our volatile friends suggest in the electrical press. To undertakings as well as consumers the metallic filament lamps are costly; and the supply of lamps means labour in addition to lamp cost. The point of the article by "Metal" is reached when he describes how he is meeting the situation. In place of a consumer having a cash discount of 5 per cent. on his electricity account, he is supplied with lamps at a cheap rate; the lamp account being subject to a discount of 10 per cent. He is of opinion that this scheme is better than reducing the price of current. That is a debatable point; but "Metal" is satisfied that his lamp-supply scheme has been of advantage to his undertaking. Then comes the inevitable contractor with a letter to our contemporary with his irrepressible complaint that "Metal" is trespassing in his province as a trader in electric lamps.

Writing in the editorial columns of our issue of Nov. 22, under the title of "The Antiquated in Gas Lighting," it was pointed out how much injury was done by the indifference displayed in bringing before influential consumers the latest in the means of realizing efficient and economical gas lighting, and thus giving electricity a better chance. Reference was made to the subject again last week in the final paragraph of the "Memoranda." We have since clipped the following from an electrical paper: "The Board room of the Whitby Guardians is at present supposed to be illuminated with gas. So poorly does the illuminant perform its functions, however, that the Clerk to the Guardians has intimated that, owing to bad light, no work can be done in the room. It is therefore proposed to put in electric light. Plans are to be prepared." We have no doubt the announcement is as highly coloured as it is possible for it to be; but if the Clerk has only just discovered that no work can be done in the room because the light is bad, what has the Clerk been doing that he has not sought the advice of the Gas Company, and had some modern gas-burners put in? That would have been far cheaper than an installation of electricity.

The experimental installations of gas and electric lamps in Gower Street, which are to show the Holborn Council what the Gaslight and Coke Company and the Electric Light Companies

in the area are offering for the new public lighting contract, have been completed, and the comparison begins. From notes that have appeared in the "Memoranda," it will have been seen that the "Electrical Times" thought it their duty to meddle between the Borough Council and the competitors as to the terms of the test; and poor "Meteor" has, in consequence, had a facer in connection with the matter which he accepts as gracefully as he knows how. It will be remembered that the Westminster specification was mauled about in curious fashion, that the angles at which the tests are made under the West-end contract were treated in a manner to suggest that the intelligence of those who were responsible for their selection was microscopical in the eyes of "Meteor," and that the palpable object of the criticism was to get a preferential specification for the electric lamps. It did not seem to cross the mind of "Meteor" that the Westminster and Holborn Councils are the purchasers of the illumination they desire, and that they have the right to dictate the terms that best comprehend their views in the matter. The upshot of the little exhibition of bad humour is that "Meteor" has now been informed that the specification prepared by the Surveyor to the Holborn Borough Council was submitted to the Electric Supply Company who are lighting a section of Gower Street experimentally; that this Company conferred with the other two Companies having statutory powers in Holborn; that every opportunity was given for suggesting amendments; and that the conditions were accepted absolutely. When all parties directly concerned in a matter of this kind are satisfied with the conditions, then it is not the business of other people to interfere. Our friend of the "Electrical Times" may be left to get rid, in the manner he thinks best, of any discomfort he has experienced in having to swallow this particular leek.

GAS AND ELECTRICITY TESTS AT CANTERBURY.

Some little time ago, the Directors of the Canterbury Gas and Water Company threw out a challenge to the Lighting Committee of the Corporation to have a comparative test of electric and gas lighting—each party to fit up its own illuminant. As the challenge was not accepted, the Company undertook to carry out the experiment themselves; and their Engineer (Mr. H. C. Page) accordingly fitted up an installation of gas and electric light side by side in one of their show-room windows. The tests were of special interest to the ratepayers, in view of recent discussions at meetings of the Board of Guardians in regard to the lighting of the Workhouse, and the statement by the Borough Electrical Engineer that electricity would be cheaper than gas.

The results of the tests, which were conducted in full view of the passers-by, were strongly in favour of gas, as shown by the following figures for 180 hours' running—Nov. 25 to Dec. 13:

Gas	1s. 6¾d.
Electricity	3 10¼ (net)
Difference in favour of gas	2s. 3½d.

The price of gas is 2s. 9d. per 1000 cubic feet, and that of electricity 4½d. per unit, less 5 per cent. for cash. The gas-burner used was a 60-candle power incandescent, and the electric lamp was a 50-candle metallic filament. The gas pressure was kept constant during the tests (from 11 a.m. till 11 p.m.); never falling below 30-10ths. That the illuminating power of the gas was better than that of the electric light was clearly shown by the printed matter placed in the window at equal distances from the centre of each light.

The results are published in a prominent advertisement in the "Kentish Observer" for last Thursday, which devotes a leading article to the subject; and opportunity is taken to call attention to the relative effects of gas and electric light on the purity of the air in a properly ventilated room, as set forth in the article by Mr. G. Stanley Cooper which appeared in the "Journal" for the 6th inst. (p. 705). His experiments showed that the net increase in carbonic acid after a three-hours test was 0·132 per cent. in the case of gas, and 0·154 per cent. in that of electric lighting; thus proving that gas burnt under proper conditions promotes ventilation, and is healthier than electric light.

We learn that Mr. Page is continuing his tests with a 110-candle power high-pressure inverted incandescent burner and a 100-candle power Osram lamp. The first twelve hours' run resulted as follows: Gas, 2d.; electricity, 5¼d.—still well in favour of the former. Tests of the two lights carried out in the way described are certainly object-lessons of the highest value, as they are open to public inspection.

The death is announced, at the advanced age of 86 years, of Mr. William Thompson, who had long been connected with the public and commercial life of Blyth. He became a shareholder of the Blyth and Cowpen Gas Company in 1858, was appointed a Director in 1860, and made Chairman of the Company in 1879—a position he filled up to the time of his death. He attended the last meeting of the Directors on the 1st inst. In 1904, the Board presented him with a silver tea and coffee service, on the occasion of his eightieth birthday, and in recognition of his work for the Company.

PHYSICAL SOCIETY'S EXHIBITION.

In accordance with the intimation in the "Journal" last week, the sixth annual exhibition of the Physical Society of London is being held to-day at the Imperial College of Science, South Kensington. Arrangements were made for exhibits by certain firms whose names are known to our readers, among them being the following: The holophane lumeter—a surface brightness photometer which will measure the brightness of any object from the hundredth of a candle-foot up to 100-candle feet power—by Messrs. R. & J. Beck. A bi-meter CO_2 recorder—a new pattern, working on very simple and practical principles, containing no absorbent liquids (the only absorbent material used being lime), and capable of adjustment so as to make as many as 25 analyses per hour—made by the Cambridge Scientific Instrument Company. Messrs. Everett, Edgcumbe, and Co. promised a varied collection of instruments, including a pocket "luxometer" for use either with daylight or with artificial light; a Trotter portable photometer; a portable direct-reading lamp photometer, for the direct measurement of the candle power of incandescent lamps in broad daylight; and a portable photometer bench equipment, comprising the latest form of Trotter-Conroy photometer head, fitted with the Trotter light-filter arrangement. Among the other instruments to be on view were the "Dionic" water-tester, sent by Messrs. Evershed and Vignoles; the Foster fixed-focus radiation pyrometer, by the Foster Instrument Company; the Mahler-Krocker bomb calorimeter, by Messrs. A. Gallenkamp and Co., Limited; the Féry spectrograph, by Messrs. Adam Hilger, Limited; and Mr. Somerville's CS_2 and H_2S test apparatus for gas-works, Mr. Dickenson Gair's and Mr. John Hornby's apparatus for the analysis of gas, and the Wanner optical pyrometer, by Messrs. Townson and Mercer.

IMPROVEMENTS IN THE TREATMENT OF GASES.

It will be remembered that some time ago* we published an illustrated description of new tar-extracting appliances which Professor F. W. Burstall worked out at Birmingham University; and when noticing last week the recent visit of the members of the Midland Junior Gas Engineering Association to the University, it was stated that Professor Burstall then showed in operation some further plants.

One of the devices is to be used in connection with the rotary extractor, which, it may be recalled, is formed by a large number of wires rotating at a high velocity. It is found that water injected into this machine is divided into very fine particles by the beating action of the wires—so fine that the water will travel a considerable distance along the main before it condenses, and carry with it finely-divided tarry matters. To remove this, what is called the "screen" washer is placed immediately on the outlet of the tar-extractor. It consists simply of a short length of pipe, in the centre of which are square openings. At the top of these openings there is a slot formed in a water-pipe, so that the whole of the gas has to pass through a water sheet which is formed by the water falling under a head of 30 to 40 feet. In this manner, the whole of the water and tarry matters are carried away, and the gas issues from the other side free from excess moisture.

Another machine shown in operation cooling some 30,000 cubic feet of gas per hour was what is called a "static" washer—an appliance mainly intended for cooling hot gases. This consists of a rectangular iron box, which is entirely filled with wires. These wires are fixed at their upper ends, and lie at an angle to the stream of gas. On the top of the wires is discharged water, through fine holes or slits; so that the gas, in travelling from one end of the box to the other, is brought into contact with the water lying upon the wires. Under the combined action of the flowing of the gas and the impact of the water, the wires are kept in a constant state of vibration, sufficient to prevent any tar from clogging up into the machine. This apparatus was one of the appliances referred to (and illustrated) in the paper read by Mr. W. H. Johns, at the November meeting of the Midland Junior Gas Engineering Association—see *ante*, p. 495.

We understand that Professor Burstall is now engaged in experimenting on the application of the rotary principle to the direct recovery of ammonia from gases by means of washing with dilute acid; and the plant for this purpose is small, cheap in first cost, and will, if successful, materially alter the present practice of working with the liquors. The acid used will be comparatively weak; and it is not expected that there will be any material alteration in the candle power of the gas owing to the acid absorbing some of the higher hydrocarbons.

As mentioned in the last issue, the Licensees for the whole of Professor Burstall's gas apparatus are Messrs. W. C. Holmes and Co., of Huddersfield.

* See "Journal," Vol. CVII., pp. 818-820.

Mr. George James Brown, a Director of the Folkestone Water-Works Company, whose death was recently reported, left estate valued at £18,428 gross, with net personalty of £16,156

LIGHTING OF THE CITY OF LONDON.

It will be fresh in the memory of readers of the "Journal" that in the spring of last year the Corporation of London sent a deputation from the Streets Committee to inspect the public lighting in the various cities of the Continent with a view to the improved lighting of the City of London. The deputation visited, among other places, Brussels, Paris, Cologne, Dresden, Munich, and Berlin, and presented the results of their investigations in a lengthy report (given in the "Journal" for July 20), in which they made the following observations and recommendations:

Having very carefully considered the various systems, we are of opinion that the public lighting in the City of London can be materially improved; and we have come to the following conclusions:

(1) That, wherever possible, streets should be lighted by means of centrally hung lamps with lowering gear. This we think particularly important in the City of London where the number of obstructions upon the footways in the form of lamp-posts, bins, letter-boxes, &c., is so large.

(2) That open spaces should be lighted by means of lamps upon standards, fitted with lowering gear.

(3) That high-pressure incandescent gas-lamps with inverted burners should be adopted as the illuminant; but where gas is impracticable, electricity with open arc and flame arc lamps should be installed.

We think, however, before suggesting any drastic alterations in the general lighting of the City, that the Streets Committee should be authorized to arrange for some further experimental lighting of the City thoroughfares; and we recommend accordingly.

The Court of Common Council having agreed to the report, the Streets Committee next invited and received proposals from the Gaslight and Coke Company and the City of London Electric Lighting Company, Limited, to experimentally light various areas of the City by the most improved methods and appliances, having special regard to the terms of the first recommendation as to the lighting of the streets "by means of centrally hung lamps with lowering gear," to obviate the necessity of bringing large tower ladders into crowded thoroughfares to attend to the carboning and maintenance of this special kind of lighting.

Among the proposals of the Gaslight and Coke Company was a scheme of centrally hung high-power gas-lamps fitted with the latest method of gear for drawing the lamps from the centre of the roadway to the fronts of the houses, and lowering them to the footpath for the purpose of cleaning and remantling; the winches being fixed on the walls of the buildings in the side streets for preference, to prevent any obstruction in the main thoroughfares. The lamps were to be fixed, whenever possible, at the intersections of the side streets with the main roads, so as to light both thoroughfares, and extinguish the smaller lamps in the side streets.

Having decided upon the eastern portion of Cannon Street, between Dowgate Hill and King William Street (a length of about 300 yards of street), the Company proceeded to instal compressing plant in one of the arches under the latter thoroughfare, and erect seven centrally hung high-power gas-lamps of 1500-candle power of the Keith-Blackman type, with new pattern lattern; a 6-inch main being specially laid for the purpose, and the gas being compressed to between 70 and 80 inches (water gauge). The height of the lamps is about 26 ft. 6 in. above the centre of the roadway, which is some 50 feet in width; their average distance apart being about 105 feet. Two additional lamps have had to be fixed on posts on refuges at either end of the thoroughfare; making nine lamps in all. The height of the light in the two refuge lamps is about 22 feet. In New Bridge Street, the Company have put up six high-pressure gas-lamps of 1500-candle power on standards without lowering gear. The columns are on the footpath, with one small traffic lamp on the refuge in the roadway; the light being about 16 feet from the ground. The lamps are of the Keith-Blackman type, supplied with gas at about 70 inches (water pressure) from an adjoining compressor-house recently constructed in Tudor Street. The following diagram shows the general arrangement of the central suspension in Cannon Street.

The Company also gave a demonstration of low-pressure gas lighting with inverted burners at the western end of Cheapside and the Poultry, by erecting eleven bracket lamps, suspended over the footway 7 ft. 6 in. from the house fronts, to which they are attached; the light sources being about 13 feet from the pavement, at an average distance apart of a little more than 50 feet. The lanterns contain five burners, giving an illuminating power of 375 candles per lamp. Two additional lamps are fixed upon posts on the street rests; making thirteen in all.

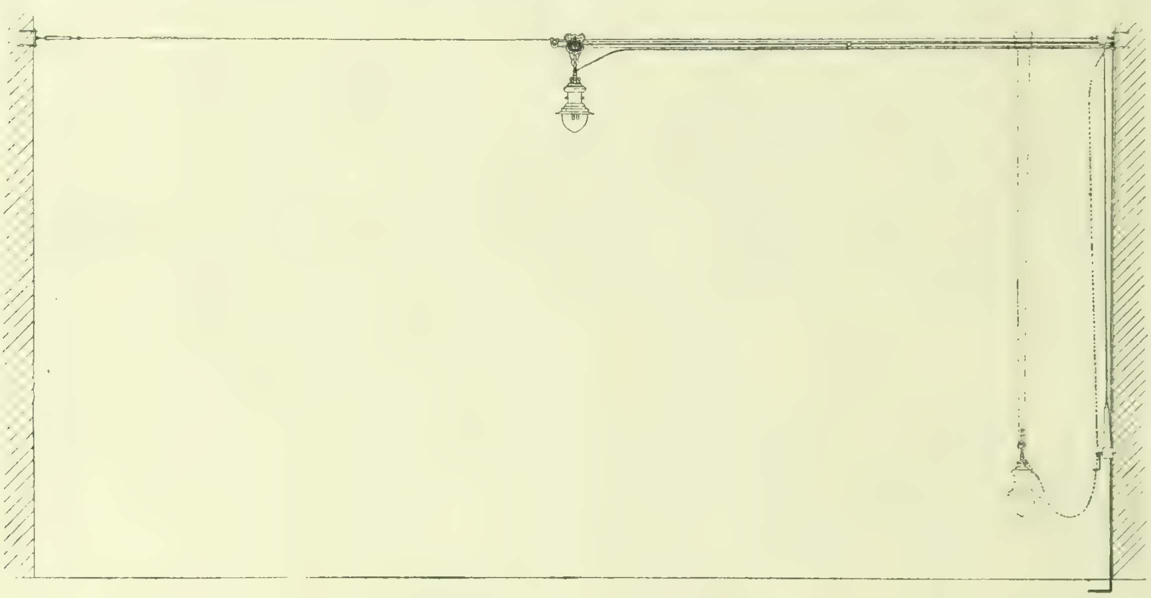
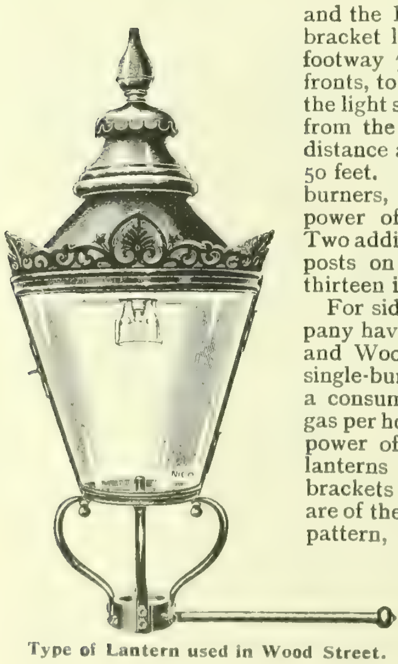


Diagram of Cannon Street Lighting.

For side-street lighting, the Company have erected in London Wall and Wood Street 26 low-pressure single-burner inverted lamps, with a consumption of $3\frac{1}{2}$ cubic feet of gas per hour; giving an illuminating power of about 90 candles. The lanterns are fixed principally on brackets on the house fronts, and are of the latest type of the "Nico" pattern, as used in Westminster; being the production of the New Inverted Incandescent Gas-Lamp Company, Limited. In Wood Street, the lamps are of the cylindrical pattern, as shown in the accompanying illustration; while in London Wall they are of the square type. The lamps are about 12 feet above the footpath, and some 90 feet apart; the width of the roadway varying from 25 to 40 feet. The lamps take the place of the upright Kern burner, consuming $4\frac{1}{4}$ cubic feet of gas per hour.



Type of Lantern used in Wood Street.

Awards at the Buenos Ayres Exhibition.—In the provisional list of awards at the Railway and Land Transport Exhibition at Buenos Ayres, the names of the following firms appear: Messrs. Chance Bros., and Pintsch's Patent Lighting Company, grand prizes; Messrs. Ashmore, Benson, Pease, and Co., Messrs. Henry Pooley and Sons, the Stanton Iron-Works Company, and the Foreign and Colonial Lighting Company, silver medals; and Messrs. Hayward, Tyler, and Co., and Messrs. Thomas Piggott and Co., diplomas of honour.

The "Bamag" Distance Lighter.—We have received from the Distance Lighting Company, of Farringdon Road, an illustrated pamphlet on their "Bamag" patent distance pressure lighters. It opens with a chapter dealing generally with the subject, followed by reports by Herr F. Göhrum, of Stuttgart, and Herr H. Dobert, of Geestemünde, translated from the "Journal für Gasbeleuchtung." There are a large number of well-executed illustrations of the appliance, series of views of the factory in which it is manufactured, and a list of the towns and districts in which it has been installed. Interesting features of Herr Göhrum's article are views of Stuttgart in 1827, showing the oil lighting, and in 1909 and 1910, showing the lighting of the public lamps by torch and the "Bamag" lighter respectively.

INSTITUTION OF GAS ENGINEERS—STANDARD SPECIFICATION FOR THE MANUFACTURE AND TESTING OF RETORT MATERIAL.

THE Refractory Materials Committee submit herewith a specification which has been drawn up by a Joint Sub-Committee formed of five representatives elected by the Retort and Fire-Brick Section of the Society of British Gas Industries, and an equal number of the Refractory Materials Committee.

The Sub-Committee appointed Dr. J. W. Mellor, of the Staffordshire County Pottery Laboratory, Stoke-on-Trent, to act as their Technical Adviser.

The specification has been drawn up with as little reference as possible to details of manufacture, in which it is thought those responsible should be allowed considerable freedom to employ any methods or mixtures they think desirable.

It appears that, for resisting the rapid changes of temperature to which retorts are subjected, the material should have an open porous texture, and should at the same time show little expansion or contraction when heated to a high temperature; it being, of course, understood that the fire-clays employed are of a sufficiently refractory character. Investigations have been carried out for the Committee by Dr. Mellor on pieces of representative British and Foreign retort material, for the purpose of ascertaining the porosity and contraction or expansion on heating of the material now being supplied; and the tests relating thereto have been decided upon as the result of these investigations.

It is not suggested that finality has been reached with these tests; those given being less than an average obtained from the best quality material now available, rather than marking any great departure in this respect. This particularly applies to the test for contraction or expansion, which has been placed so low (in deference to the wishes of the manufacturers) that it is thought to be of scarcely sufficient severity to ensure good material.

The tests now specified, however, are rather intended to give a lead to development in these hitherto somewhat neglected features; and it is hoped that they will be interpreted for a little time with some latitude on both sides, as it is confidently expected that if the "grog," or burnt clay, employed be that specified in clause 1, and this material and the finished product be fired at a high temperature, no difficulty will be experienced in obtaining retort material of even a higher standard than that laid down.

The specification for general fire-brick material, blocks, tiles, &c., is now in course of preparation, and will probably be published in the Spring of next year, after which it is proposed to undertake investigations of the thermal conductivity of various kinds of retort material, a quality which is considerably influenced by the texture.

It is intended to revise the specifications, from time to time, as experience shows to be necessary.

The Refractory Materials Committee desire to express their appreciation of the co-operation which they are receiving from the representatives of the manufacturers in this work.

F. J. BYWATER, Hon. Sec.

SPECIFICATION.

CONSTITUENTS.

Clause 1—The retorts or retort tiles shall be made of sufficiently seasoned raw clay and clean burnt clay or "grog." No "grog" shall be used which will pass through a test sieve having 16 meshes to the linear inch.

CHEMICAL ANALYSIS.

Clause 2—A complete chemical analysis of the material is to be provided when required by the engineer (or purchaser), for his personal information only.

REFRACTORINESS.

Clause 3—A piece of the material shall show no signs of fusion when heated to a temperature of not less than Seger cone 28 (about 1630° C.); the heat being increased at the rate of about 50° C. per five minutes, in an oxidizing atmosphere.

[NOTE.—The new scale of Seger cones printed herein is to be used.]

SURFACES AND TEXTURE.

Clause 4—All surfaces shall be reasonably true and free from flaws or winding; and, after burning, no "washing" shall be done without the consent of the engineer (or purchaser). The texture throughout shall be even and regular, containing no holes or flaws, and the "apparent porosity" shall not be less than 18 per cent.

CONTRACTION.

Clause 5—The material shall be evenly burnt throughout, and contain no black core. A test-piece, when heated to a temperature of Seger cone 12, for two hours, shall not show, when cold, more than 1 per cent. contraction or expansion. The test-piece shall be 5 to 6 centimetres long; the ends being ground flat, and the contraction measured by means of Vernier callipers reading to 0·1 m.m.—a suitable mark being made on the test-piece, so that the callipers may be placed in the same position before and after firing.

INSPECTION AND TESTING.

Clause 6.—The engineer (or purchaser) or his agreed representative shall have access to the works of the maker at any reasonable time, and shall be at liberty to inspect the manufacture at any stage, and to reject any material which does not conform to the terms of this specification. Pieces may be selected for the purpose of testing, either before or after delivery; but in either case a representative of the maker shall, if he choose, be present when such selection is made, and shall be supplied with a similar piece of the retort material to that taken for the purpose of testing.

If the engineer (or purchaser) and the maker are not prepared to accept each other's tests, they shall agree to submit the samples for testing to an independent authority to be mutually agreed upon; and the engineer (or purchaser) reserves to himself the right, if the material does not conform to the tests laid down in the specification, to reject any or all the material in the consignment from which the test-pieces were taken.

The cost of these independent tests and of any retort lengths or tiles damaged before delivery for obtaining test-pieces, shall be equally divided between the purchaser and the maker if the test proves satisfactory; and if unsatisfactory, such cost, and that for all other subsequent tests required on this account from the same consignment, shall be borne by the makers.

The cost of any tests or of any material damaged for the purpose of obtaining test-pieces after delivery shall be borne by the purchaser in the event of the test being satisfactory, and if unsatisfactory by the manufacturer, in a similar manner to that specified for the tests prior to delivery.

Appendix and Notes.

CONSTITUENTS.

Clause 1—The sieve to be used is the test-sieve specified by the Institute of Mining and Metallurgy.

CHEMICAL ANALYSIS.

Clause 2—The silica should be determined by two evaporations with an intervening filtration; and the alumina, lime, and magnesia, by two precipitations. The amount of titanic oxide should be indicated, and not confused with alumina and iron. The potash and soda should be separately determined.

REFRACTORINESS.

Clause 3—The Deville furnace, although useful for comparative tests in refractoriness, is not altogether suitable for carrying out those specified in this clause, for which a compressed air-gas furnace of the Méker type, or Hirsch's electric furnace, is recommended. The latter can be obtained from Messrs. Gallenkamps, of London; the former from the Scientific Instrument Company, of Cambridge. The gas-furnace will require an air-pressure of at least 10 lbs. per square inch; and for the electric furnace a current of approximately 90 volts and 90 amps, with a slightly higher voltage at the start, has been found, by means of a carefully standardized Wanner pyrometer, to be sufficient.

Two or more tests are generally required with an unknown material.

A preliminary trial is first made with a piece of the material chipped into the approximate form of a cone. This should be cemented on to a refractory disc or slab with a mixture of alumina and best china clay, together with Seger cones 28, 30, and 32 (small size). These cones are selected because they cover the range of first-grade clays usually employed for retort material. Best china clay fuses between cones 35 and 36; and all British fire-clays fall below this point. If cones 28 and 30 fall, the furnace should be cooled, and the material under investigation examined. If it exhibits no sign of fusion, the trial should be repeated with cones 31, 32, and 33. When cone 32 squats, the piece should be again examined; and if it shows signs of fusion, the trial should be repeated with cones 30, 31, and 32. By this method of approximation, it is possible to decide whether the piece vitrified between cones 30 and 31 or between cones 31 and 32.

SOFTENING POINTS OF SEGER CONES.

Cone No.	Cent.	Fahr.	Cone No.	Cent.	Fahr.
022	600	1112	9	1280	2336
021	650	1202	10	1300	2372
020	670	1238	11	1320	2408
019	690	1274	12	1350	2462
018	710	1310	13	1380	2516
017	730	1346	14	1410	2570
016	750	1382	15	1435	2615
015a	790	1454	16	1460	2660
014a	815	1499	17	1480	2696
013a	835	1535	18	1500	2732
012a	855	1571	19	1520	2768
011a	880	1616	20	1530	2786
010a	900	1652	26	1580	2876
09a	920	1688	27	1610	2930
08a	940	1724	28	1630	2966
07a	960	1760	29	1650	3002
06a	980	1796	30	1670	3038
05a	1000	1832	31	1690	3074
04a	1020	1868	32	1710	3110
03a	1040	1904	33	1730	3146
02a	1060	1940	34	1750	3182
01a	1080	1976	35	1770	3218
1a	1100	2012	36	1790	3254
2a	1120	2048	37	1825	3317
3a	1140	2084	38	1850	3362
4a	1160	2120	39	1880	3416
5a	1180	2156	40	1920	3488
6a	1200	2192	41	1960	3560
7	1230	2246	42	2000	3632
8	1250	2282	—	—	—

APPARENT POROSITY.

Clause 4—The "apparent porosity" tells what fraction of the volume of the whole piece is occupied by air-spaces, and is therefore:—

$$\frac{\text{Volume of pores} \times 100}{\text{Volume of piece (including pores).}}$$

This constant can be determined in one of the numerous voluminometers working with the vacuum process. Messrs. Gallenkamp and Co., of London, make a porosimeter which allows of this determination being made as quickly as is consistent with accuracy. The details of working are supplied with the instrument.

LINEAR CONTRACTION OR EXPANSION.

Clause 5—The term "linear contraction or expansion" indicates the percentage change in length (and by a simple calculation the change in volume) which occurs when a piece is fired under the conditions stated. Consequently the linear contraction or expansion is—

$$\frac{\text{Change in length} \times 100}{\text{Original length of piece.}}$$

A carborundum wheel may be used for grinding the ends of the test-pieces flat; and a mark should be made across the slab with a steel file. One of the Méker gas-furnaces, with blast if necessary, may be used for carrying out the test. The temperature is difficult to regulate without a pyrometer. The test-piece should be supported horizontally, and fired along with cones 11, 12, and 13.

[NOTE.—*Any information with regard to the specification may be obtained from the Honorary Secretary of the Refractory Materials Committee, Mr.* F. J. BYWATER, *Saltley Gas-Works, Birmingham.*]

THE GLOVER-WEST VERTICAL RETORTS FOR THORNTON ROAD, BRADFORD.

REFERENCE was made in the last issue of the "JOURNAL" to the fact that the Gas Committee of the Bradford Corporation, on the recommendation of their Engineer, Mr. Charles Wood, had decided to instal the Glover-West system of vertical retorts at their Thornton Road works. The City Council confirmed this decision last Tuesday; and we have since received the following particulars as to the proposed installation, and the illustrations, from West's Gas Improvement Company, Limited.

The contract comprises a plant capable of carbonizing 160 to 180 tons per 24 hours. Two batteries of retort-benches are to be erected, each battery containing four retort-settings, eight retorts in each setting. The new retorts are to be erected, together with a suitable new retort-house building, on a portion of the site occupied by the present retort-houses; and the accompanying block plan illustrates the area which will be occupied by the vertical retorts—the area of the existing plant being shown in dotted lines. The present retort-houses produce approximately $1\frac{3}{4}$ million cubic feet of gas per day; and the vertical retorts will only occupy about one-third of the site of the existing plant.

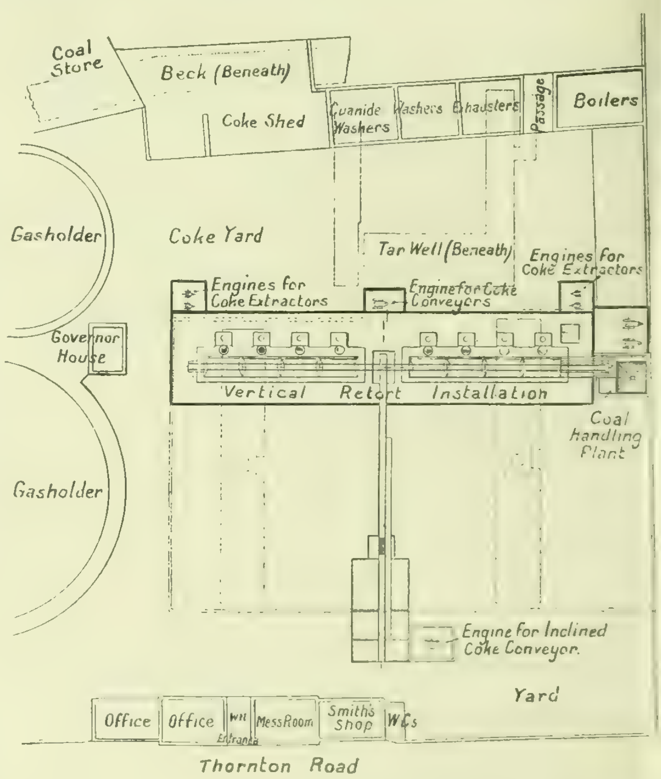
The cross section and the longitudinal views show the proposed arrangement of coal and coke handling machinery. The coal-handling machinery includes an automatic feeder and coal-breaker, with bye-pass for small coal, and a gravity bucket conveyor for delivering the coal into the coal-bunkers. The latter are arranged to contain 48 hours' supply of coal, so that at the week-end it will be unnecessary to resort to wheeling coal from the coal-store when the ordinary daily supply ceases. The coke plant comprises West's coke-conveyors, delivering to the centre of the new retort-house on to a cross-conveyor, which will carry the coke to the storage-hoppers, or to the coke-yard.

The contract comprises the largest installation of vertical retorts ordered so far for this country.

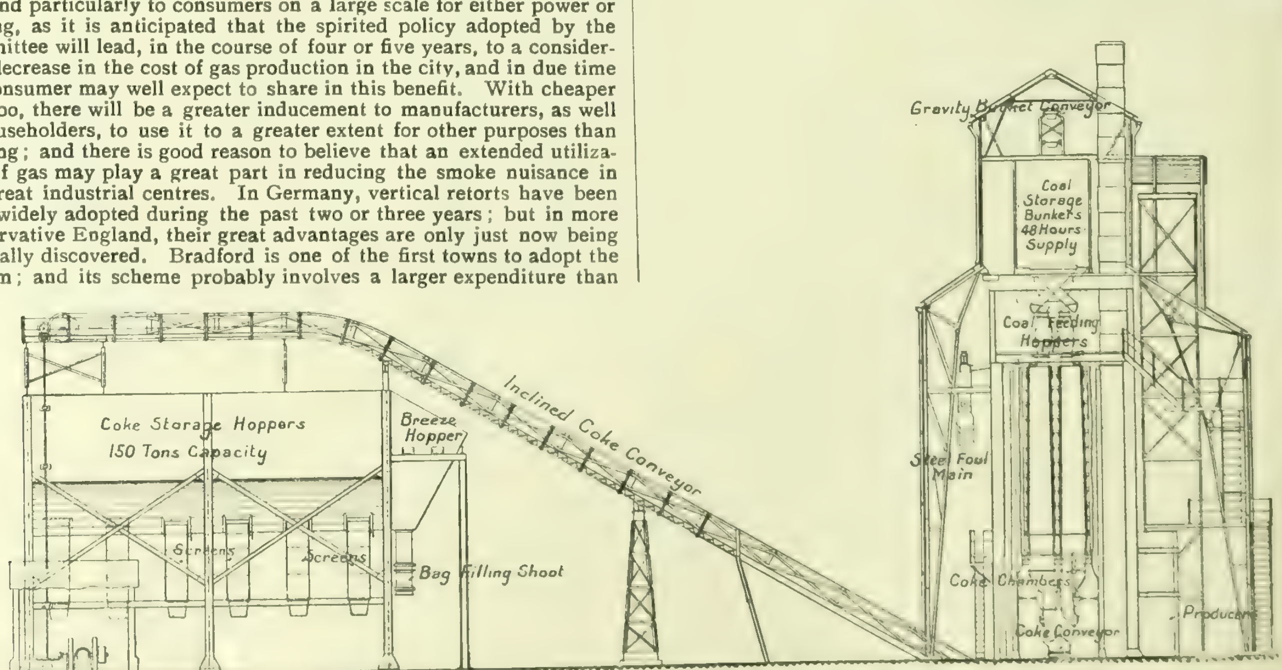
In the course of an article headed "Revolution in Gas Production," the "Yorkshire Observer" says:

The Bradford City Council on Tuesday approved the minutes of the Gas Committee, which recommended that a sum of £31,980 should be expended on an installation of vertical retorts at the Thornton Road Gas-Works. This decision is of considerable interest to all who use gas, and particularly to consumers on a large scale for either power or heating, as it is anticipated that the spirited policy adopted by the Committee will lead, in the course of four or five years, to a considerable decrease in the cost of gas production in the city, and in due time the consumer may well expect to share in this benefit. With cheaper gas, too, there will be a greater inducement to manufacturers, as well as householders, to use it to a greater extent for other purposes than lighting; and there is good reason to believe that an extended utilization of gas may play a great part in reducing the smoke nuisance in our great industrial centres. In Germany, vertical retorts have been very widely adopted during the past two or three years; but in more conservative England, their great advantages are only just now being generally discovered. Bradford is one of the first towns to adopt the system; and its scheme probably involves a larger expenditure than any yet put forward in this country. The Leeds Corporation Gas Committee are at present investigating the matter with a view to the purchase of an experimental installation; and gas authorities in other West Riding towns are watching these developments with considerable interest.

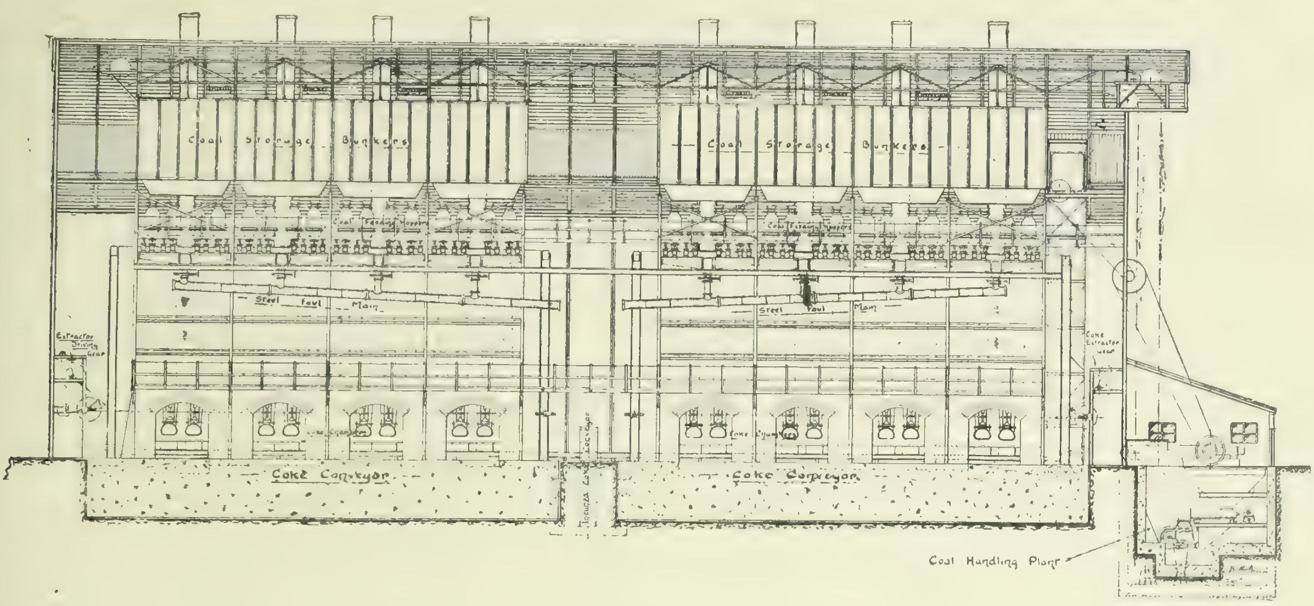
It will be readily understood that the question of cheap production



General Plan of the Glover-West Vertical Retort Installation at Bradford.



Cross Section of the New Coal-Handling Plant at Bradford Gas-Works.



Longitudinal Section of the Glover-West Vertical Retort-House at Bradford.

of gas is one of the most vital which directors of gas companies and the responsible committees of corporations owning gas undertakings have to consider. Unless the consumer can be supplied with gas at a price which will be economically satisfactory, producers will contend in vain against competitors in other fields. These circumstances account for the fact that in no department of the gas industry has more thought been exercised in recent years than in that concerned with the primary operation—the process of carbonizing the coal. Before the era of electrical competition, when the price of gas could be regulated according to the cost of production without much concern as to the possibility of a substitute being adopted by the consumer, there was no urgent need for the exercise of the inventive faculty. When the necessity did arise, however, men were soon found with the capacity to adapt the equipment of gas-works to the requirements of a new and more strenuous era.

The latest development in the design and construction of retorts promises to result in something like a revolution in the industry, so far as cost and efficiency of production are concerned. It is the outcome of investigations and experiments which have been proceeding for some time both in Germany and Great Britain, though the application of the results has been carried very much farther in Germany than here.

Gas committees in all parts of the kingdom are rapidly discovering the great merits of the new system; and though only a few instalments have been put down so far in England, many schemes are in course of preparation for the substitution of vertical for existing horizontal or inclined retorts. Not the least important are the projects which the Leeds and Bradford Corporation Gas Committees have in view. Though the Leeds Committee was the first to turn its attention to vertical retorts, greater dispatch has been shown by Bradford in arriving at a decision. The resolution which the Council adopted on Tuesday provides for a complete installation by an English firm for the Thornton Road works to replace the present plant, which requires extending and renewing.

REFRACTORY MATERIALS AND THEIR TESTING.

By Dr. Rudolf Lessing.

[A Paper read before the Liverpool Engineering Society, Dec. 14.]

The choice of the materials which are employed in the construction of the receptacles and carriers of energy, is one of the most important factors which determine the successful execution of any engineering problem; for however ingenious and promising the design for a certain piece of machinery or apparatus may appear, its final success will largely depend on the absolute suitability of all the materials used in carrying the idea into practice for the specific purpose to which it is put. The study of the properties of building and engineering materials has become a most important science; and with the greater knowledge gained, enormous advances have been made, and are being made, in the application of the new facts and principles discovered. Great strides have been made in the production of metals and alloys, of which the physical properties can be accurately predetermined by giving them a definite chemical composition. One need hardly be reminded of the changes wrought in the methods of building construction by the advent of that peculiar combination "ferro-concrete," and its scientific exploitation.

There is one group of materials, however, the "refractory materials," which, though widely employed in nearly all classes of engineering, have not yet found that recognition as a field of scientific and technical research which they deserve, and which their importance as constructional elements amply justifies. Considering that nearly all the primary energy which is employed in the industries is thermal energy, and that its transformation almost invariably involves the application of high temperatures, it is obvious that materials capable of resisting these temperatures must be used to a greater or smaller extent in every branch of engineering. The fact that the study of refractory materials has not up to now been a very general one, is evidently due to the difficulties of their examination under the conditions under which they are used in practice—at high temperature.

On turning to the dictionary, the general definition for refractory is given as "difficult of fusion." Not specifying a definite range of temperature, this leaves the determination of at least the lower limit to arbitrary judgment. Generally speaking, refractoriness can only be a relative term; and advances lately made in the means of producing very high temperatures—notably by regenerative gas firing and the electric arc—have caused materials up to then regarded as refractory to be looked upon as "readily fusible" at these temperatures, and incidentally made it necessary to improve the properties of the products to meet the new and more stringent demands.

The most important of raw materials which by their chemical composition are particularly capable of withstanding the influence of high temperature, and which at the same time can be moulded or pressed into the required shape, are fire-clay and quartz. There are quite a number of other materials of very highly refractory properties which can be, and are being, used for special purposes. Some of the metallic oxides, such as magnesia and alumina, the latter in its natural state as bauxite, or in artificial form as a bye-product of the thermite treatment (dynamidon), chromium oxide, zirconia carbon, and a number of artifical products of carbon and silicon mixtures, such as carborundum and silundum, all come under this heading. As most of these are only used for special purposes, it will suffice to deal here with the two principal materials named, of which the application by far exceeds in quantity and importance that of all the other materials together. Again, of fire-clay and quartz, the former is of wider application on account of its neutral character, while the latter can only be used where acidity is not injurious, or even where it is required.

All clays are the products of a secondary decomposition of volcanic rocks, such as granite, consisting of conglomerates of quartz, felspar, and mica; this decomposition being caused by the chemical action of water and carbon dioxide, the physical influence of changes of temperature, and possibly mechanical disintegration. According to the original composition of the parent rock, the degree of decomposition or "kaolinization," and the degree to which products soluble in water have been washed out, a clay deposit would contain more or less clay substance (kaolinite), together with the remainder of unattacked rock-particles and chance impurities. The clay substance proper is a hydrated aluminium silicate, $Al_2O_3\ 2SiO_2\ 2H_2O$, holding its water in chemical combination. This water cannot be removed by drying, but only on raising the temperature to a dull red heat.

China clay consists, especially after washing, to a large extent, of pure clay substance. It is extremely refractory, burns to a pure white porous ware, but yields to less pure clays in point of plasticity. Plasticity is the peculiar property of clays to retain, when mixed with a certain quantity of water, any shape given to them, and which is irretrievably lost on burning the clay. The scientific explanation of the cause of the plasticity in clays has been for years the subject of research and controversy; but it seems more than likely that the advances in the knowledge of the chemistry of colloidal bodies will, before long, throw some light on this most intricate problem. As indicated before, the plasticity of the clays depends on their impurities. It may be said that generally the character of a clay is determined by the amount and kind of its impurities. This is more particularly the case as regards refractoriness. The behaviour of the various kinds of clay in this respect differs widely, and is, in general, dependent on their chemical composition.

If chemically pure alumina is exposed on the one hand, and pure silica on the other, to the temperature of fusing platinum—*i.e.*, 1710° C. (3110° Fahr.), the former does not show any signs of

melting, while the latter is partly fused to a transparent, glass-like mass. If a mixture of both substances is then prepared, in the ratio of $1Al_2O_3 : 2SiO_2$, as it exists in pure clay substance, this will show signs of fusion at 1500° C. (2730° Fahr.), the melting-point of iron, and therefore at a temperature below the fusing-point of either of the components. The fusing-point of the mixture is still further lowered by adding more silica than corresponds to the above proportion. By adding to such a mixture substances commonly called fluxes, which always accompany the clays as impurities, the fusing-point is again lowered.

In 1868, Richters found that equivalent quantities of the various fluxes have the same effect in reducing the fusibility of clay. Thus, 40 parts of magnesia (MgO), 56 parts of lime (CaO), 62 parts of soda (Na_2O), 72 parts of ferrous oxide (FeO), 80 parts of ferric oxide $\frac{1}{2}$ (Fe_2O_3), and 94 parts of potash (K_2O), would be of equal value; or, in other words, if equal parts by weight of these substances be added to the mixtures, magnesia with the lowest combining weight would have the strongest, and potash the weakest, effect in the series. Richter's law of the influence of fluxes was tested by Bischof and others. The older researches were made on the assumption that, on fusing, the aluminium silicate of the clay combined with the fluxes, forming double silicates. In the light of modern physical chemistry, it is known that the action of the fluxing agents on clays consists in the formation of solutions, and follows the general law for dilute solutions that an equal number of molecules of different substances, in an equal quantity of solvent, lowers the melting (solidifying) point by equal amounts. A proof of this was given in an exhaustive research by Ludwig, in 1904, who investigated some 80 different clays for this purpose. He demonstrated, on the basis of his analytical results, the connection of chemical composition and fusing-point.

A clay of the following composition may serve as an example.

	Per Cent.		Per Cent.
Al_2O_3	= 38·15	Fe_2O_3	= 0·77
SiO_2	= 47·69	CaO	= 0·21
TiO_2	= 0·12	K_2O	= 1·26

To obtain the proportion of molecules, the percentage figures are divided by the molecular weights.

$Al_2O_3 = 38·15 \div 102 = 0·37402$
$SiO_2 = 47·69 \div 60 = 0·79484$
$TiO_2 = 0·12 \div 80 = 0·00150$
$Fe_2O_3 = 0·77 \div 80 = 0·00963$
$CaO = 0·21 \div 56 = 0·00374$
$K_2O = 1·26 \div 94 = 0·01340$

To obtain comparative figures, the value for alumina is reduced to unity by dividing all figures by 0·37402.

$Al_2O_3 = 0·37402 \div 0·37402 = 1$
$SiO_2 = 0·79484 \div 0·37402 = 2·125$
$TiO_2 = 0·00150 \div 0·37402 = 0·004$
$Fe_2O_3 = 0·00963 \div 0·37402 = 0·0257$
$CaO = 0·00374 \div 0·37402 = 0·0100$
$K_2O = 0·01340 \div 0·37402 = 0·0358$

The figures for the fluxes obtained are now molecular values; and their sum (F) represents the whole fluxing influence. The composition of this clay may therefore be summed up thus—

$$Al_2O_3 + 2·125\ SiO + 0·0755\ F.$$

expressing for purposes of comparison the total composition in two figures.

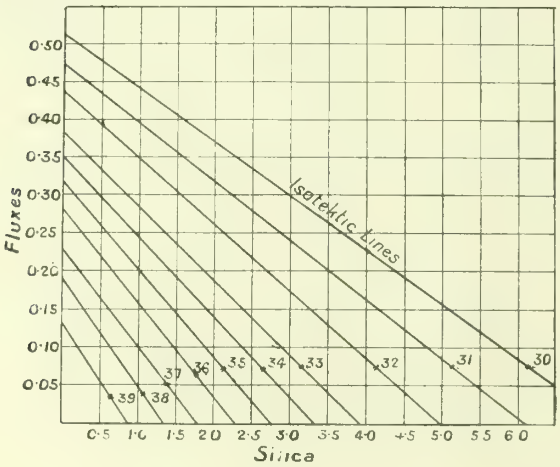


Fig. 1.

On plotting these two figures on a chart (fig. 1), the silica on the abscissæ and the fluxes (for convenience multiplied by 10) on the ordinate, and repeating this for all the clays analyzed, as well as for artificial mixtures of equal fusibility, Ludwig found that clays of equal fusing-point occupy "isotectic" lines. If the known composition of Seger cones, denoting definite temperatures, is calculated in a similar way and entered in the chart, direct comparison with actually determined fusing-points will be possible. The fusing-point of the clay which has been given as an example would correspond to Seger cone 35.

This method may, at first glance, appear somewhat complicated; but it is in fact of extreme simplicity, and offers ready means of expressing analytical results in a useful manner, of indicating the nature of the clay, and of comparing it clearly with others. It may be added that the method seems to apply fairly generally; but it must be understood that the actual melting-point is given, and not the temperature at which incipient fusion takes place. It must further be understood that the knowledge of the chemical composition of a clay makes the actual determination of refractoriness by no means superfluous, as the difference between these two points varies considerably with different clays. On the other hand, this method of expressing results should be abundant evidence to show the usefulness, and even the necessity, of chemical analysis in the examination of clay or clay goods. This analysis should comprise all data required to give the ratio of alumina to silica and to the fluxing agents. It would not do, however, to rely on analytical results only in the examination of refractoriness. The softening or fusing point must be actually determined by experiment; and the behaviour below this point should be observed, since materials differ greatly in respect of the period during which the softening process occurs.

The fusing-point of refractory goods is determined in special furnaces in which the high temperatures required (up to 2000° C.) can be obtained. Among these, the old type originally designed by Deville enjoys a wide application to this date (fig. 2). In it a highly refractory crucible, containing a small piece of the material to be tested, is packed in incandescent retort carbon, which is raised to white heat by air from a pressure-blower. As indicators of the temperature obtained, Seger cones are used. These are little pyramids of varying but still definite composition, the fusing-points of which form a range of temperatures from 600° C. (1112° Fahr.) up to 2000° C. (3632° Fahr.). They were devised by Seger, the founder of the science of ceramics; but their composition has been altered from time to time to bring their accuracy up to date. Two or three of these cones are placed in the crucible, together with the test-piece; and by comparing the state of fusion of the test-piece with that of the cones, the temperature denoted by the cones showing corresponding signs of fusion is taken as the measure of refractoriness.

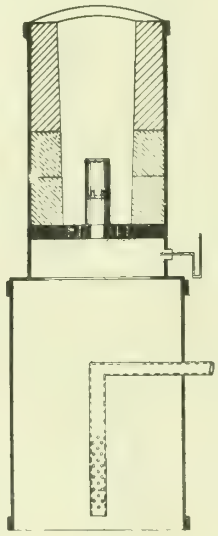


Fig. 2.

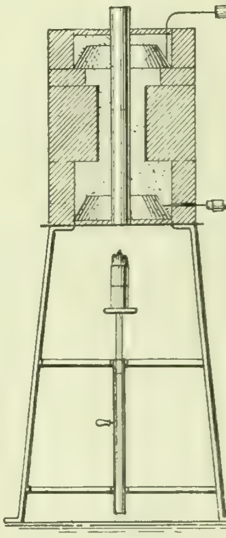


Fig. 3.

Fig. 3 gives a diagrammatic view of a more modern type of furnace—an electric resistance furnace. The high temperature is obtained by passing an electric current through loosely-packed granulated carbon, which surrounds a highly refractory vertical tube. The cones, which need not be protected by a closed crucible, are inserted into this tube by an axial shaft, for raising or lowering with a bayonet fixing attachment. This furnace permits of convenient observation during the whole testing period. It requires a current of 70 to 80 volts and 130 amps.; and the current usually available must be transformed accordingly.

It must not, however, be supposed that the refractoriness (say) of a fire-brick is solely dependent on the fusion-point pure and simple. This rather indicates the extreme temperature up to which it remains solid. Apart from conditions of testing—such as raising the temperature faster or slower, maintaining an oxidizing or reducing atmosphere, &c.—it largely depends on the physical structure of the material. Fusion does not take place suddenly throughout the mass. It commences by the softening of the thinner parts of the granules of which the body is made up. This will liquefy, and attack the inner parts by way of solution. This process is therefore a far more rapid one with very dense bodies than with fairly porous ones—the former offering much more intimate contact. It is consequently possible, by using the same clay, but moulding and burning it in a manner that will ensure a difference in density, to obtain articles which will, for practical purposes at any rate, show quite an appreciable difference in refractoriness.

This consideration leads on to the all-important question of physical texture in refractory materials; for it follows that differences in this respect must have a great influence on their behaviour when in actual use. Fire-clay goods are not generally made of "green" clay only; but a very large proportion of the raw material consists of burnt clay, either specially prepared for this purpose or in the form of broken bricks or blocks. In certain goods, up to two-thirds of the mass is made up of burnt material; the unburnt plastic clay simply serving as a binder before burning.

By crushing the burnt material or "grog" to certain sizes, and carefully grading it, the grain and texture of the goods may be varied and suited to the special purpose. The "grog" forms the skeleton of the refractory body; and the shrinkage, both during the drying and the firing process, depends a good deal on the amount of "grog" incorporated into the plastic clay. Articles which have to stand frequent and rapid changes of temperature should be of coarse grain; and the fine dust obtained on grinding the "grog" should be removed, as it would otherwise fill the interstices between the coarser particles and counteract their good effect. The coarser the grain, the greater the porosity; and the determination of the latter gives a good idea of the density and inner texture.

The principle of the method usually employed for the estimation of porosity is to determine the total "volume" of a test-piece and the volume of the pores or interstices, and to express its porosity as the "ratio" of the volume of the pores to the total volume. Incidentally, knowing the weight of the piece or slab, its "volume weight" and the true specific gravity of the material can be determined.

The apparatus used to advantage by the author is shown in fig. 4. It is a slight modification of similar contrivances devised by Seger and others. The glass vessel, containing about 3 litres of water, or else a suitable light hydrocarbon (*e.g.*, naphtha), is filled up to the two-way stopcock, below the funnel. The tap leading to the graduated tube being open, the level in this tube is read off. A quantity of liquid is then sucked into this tube by means of the rubber tubing, the lid removed, and a test-piece of known weight, which has previously been dried at 110° C., placed in the vessel. The lid is replaced, and the vessel, through the two-way tap, is connected to a good vacuum pump. By this means, the air is removed from the pores, and rises in bubbles to the surface. On opening the vessel again to the atmosphere, the water penetrates into the pores, filling them completely. Connection with the graduated tube is then re-established, and now the increase in volume is equal to the volume occupied by the solid mass of the test-piece. This is then removed from the vessel, the new level taken, and, after wiping the surface, the piece is put back again. The new difference in volume corresponds to the volume of solid mass *plus* pores, and the desired ratio can be directly calculated by dividing the second difference into the first.

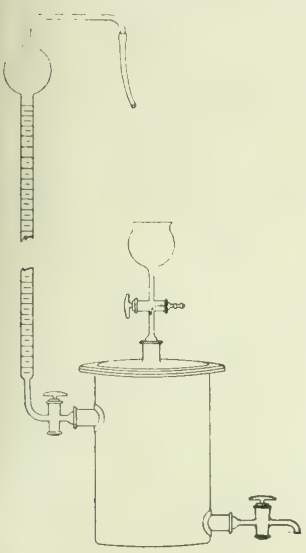


Fig. 4.

$$\text{Porosity} = \frac{\text{Volume of pores}}{\text{Volume of solid mass} + \text{pores}}.$$

From the known absolute weight and either volume, the specific gravity and volume weight may be obtained.

The question of porosity is important, not only in its relation to refractoriness and resistance to changes of temperature, but in various other respects. Where smelting operations are carried out, the material should be dense enough to prevent its getting soaked with the molten metal; but where low heat conductivity is required, a more porous mass will answer best. For special purposes, such as the manufacture of "fuel" for domestic gas-fires or for porous slabs for filtering purposes, the porosity must be artificially increased by adding, before burning, sawdust or other combustible material. On the other hand, higher density—where it is required, as in the case of bricks, which have to stand high compression strains—may be imparted by passing the hand-moulded brick through special presses.

Another most necessary physical test is that for stability of volume, or, as it is more commonly called, for contraction and expansion after heating. In its physical foundation, the property of refractory materials of shrinking or expanding after repeated firing is, to a certain extent, connected with the refractoriness and density, and largely depends on the plasticity of the raw material employed. It may be said that generally fire-clay goods contract and silica goods expand on heating, and that only after being kept at a certain temperature a sufficiently long time do they assume constancy in volume. For the safety of structures, it is therefore of the utmost importance that the material should not alter its volume unduly or irregularly; and the maximum percentage of linear contraction or expansion should be tested for. This is done by exposing a test-slab, with two sides ground parallel, to a definite temperature for a definite period of time, and taking the measurements between two marks by means of a micrometer gauge before and after heating.

Due regard should be paid not only to the physical but also to the chemical behaviour of the material. For in many cases chemical actions combine with the physical influences in the destruction of refractoriness. The most common of these is the action of ashes and flue-dust, which form slag with the acid constituents. Clays differ widely in this respect, and a careful selection must be made for each particular purpose. Where chemical operations are carried out, as in steel furnaces, Bessemer converters, glass furnaces, electric furnaces, in various parts of the blast-furnace, &c., the special circumstances must be taken into consideration. It is hardly necessary to dwell on the necessity of selecting acid, basic, or neutral material where required.

The question now arises as to which points manufacturers should aim at in the production of their ware. To answer this question satisfactorily, the purpose to which the material is to be put must be known and taken into consideration. High porosity tends to make for high refractoriness—which, of course, depends on the raw material in the first instance—and imparts to the material the power of resistance to frequent and rapid changes of temperature. High density, on the other hand, increases its mechanical strength and obviously its thermal conductivity.

A setting of retorts for coal-gas making offers an example for the various demands refractory materials have to satisfy. The arches and walls of the combustion chamber have to withstand the highest temperature of the producer-gas flame—cutting heat which asks principally for high refractoriness. No considerable changes of temperature occur during the working of the setting. Silica bricks, or the peculiar refractory sand found at Ewell, near Epsom, are here used to advantage. They should be fairly porous and non-conducting, in order to concentrate the heat upon the retorts, and should not slag on contact with flue-dust. The division-walls of the settings need not be so highly refractory, as, in properly-designed settings, they are not in direct contact with the flame. They should be of great mechanical strength, having to bear the whole burden of the superstructure. The regenerator blocks have not to stand very high temperatures, and may therefore be of fairly close texture, which, on account of the conductivity, gives the additional advantage of a ready exchange of heat. The producer lining must be chosen largely with a view to its resistance to the slagging action of the ashes and clinker; for the inorganic constituents of the coke belong largely to the class of "fluxes" following the laws explained before. The outer walls of the setting are mostly also built of fire-brick. The author ventures to suggest that for this purpose ordinary building bricks of high porosity and low thermal conductivity should be more generally used, in order to reduce, as far as possible, losses by radiation to the atmosphere of the retort-house.

Attention should be paid to the mortar which is used for building the setting. It must, of course, be as refractory as the bricks and blocks which it has to cement together, and must satisfy all the requirements of these. It should be a good binding agent when applied, and should burn to a neat and long-lasting joint. How important a factor this fire-cement may constitute, becomes apparent from some comparative tests which the author has had occasion to carry out recently. Two kinds of fire cement, both made from the same raw material, but prepared in different ways, showed remarkable difference in linear contraction, amounting in the case of air and fire shrinkage to about 40 per cent. and 30 per cent. respectively.

As to the retorts themselves, they should comprise all the good qualities enumerated above, and none of the evil qualities of the other materials. They should be highly refractory, as they are enveloped in the flame, and should not expand or contract, since they are rigidly fixed in the setting, and are fitted with iron mouthpieces, the joint of which should never leak. They must be capable of suffering rapid changes of temperature, since every few hours they receive a fresh charge of up to half-a-ton or more of cold coal. The difference in temperature, before discharging and after recharging, may amount to 600° C. (1100° Fahr.). This requires a very robust texture and high porosity. They should be good carriers of heat, and transfer it speedily, and without loss, to their charge. This, again, would call for well-conducting material of close texture, which would also answer the further demand for gas tightness; for the walls should not allow any coal gas to pass from, or combustion gases to pass into, the retort. They should further be strong enough to stand any assault from the rake of a burly stoker or the ram of a modern charging-machine. Their outside should not allow any flue-dust to collect and form a non-conducting coating, and they should, finally, have a life of something like 2000 working days without getting unduly cracked.

It is obvious that an article of so complicated a manufacture as a gas-retort cannot be ideal in every one of these points without thereby failing in another direction. The manufacturer must therefore, if he wishes to supply a satisfactory article, compromise all these requirements; and the engineer using the appliances will have to decide, on the strength of carefully dissected statistics, to what extent one of these requirements should be enforced, and another be foregone, in order to produce the most profitable result from a commercial point of view.

In this connection, it is gratifying to be able to record an instance of industrial co-operation between manufacturers and users of a class of products which should be calculated to produce most beneficial results in the near future. The gas industry depends to a very large extent on the employment of refractory materials for the primary separation of the gaseous constituents from coal—the most important step in the whole series of operations carried out in a gas-works, for the old saying that "Dividends are made or lost in the retort-house" has come to be regarded by the profession as almost an axiom.

Realizing the importance which must be attached to the plant and material which constitutes the greater part of the capital

outlay of any gas undertaking, the Institution of Gas Engineers have taken the lead in an endeavour to investigate and improve the quality of refractory material used for the purposes of the industries, and the conditions of its employment. With this object in view, they have formed a Special Committee whose work has already, after a comparatively short time, borne fruit. First, material was collected from a number of works as to the average conditions under which refractory materials are being used. Then manufacturers were approached, and the Fire-Clay Section of the Society of British Gas Industries readily came forward; and, by mutual consent, a Joint Committee was formed with a view to drawing up standard specifications for the materials to be supplied.*

One of the first results of this hearty co-operation between seller and purchaser is that the manufacturer is informed of the requirements his article has to satisfy, and he is in a position to take the steps necessary to achieve this object. The user of the article, on the other hand, will test more closely the quality of the goods supplied. At the same time he is forced to pay more attention to the circumstances under which he employs the ware. Such co-operation must of necessity be of mutual benefit, and should prove a most important factor in the development of an industry. In other industries—as in the iron and steel trade—preliminary steps have been taken to set a similar movement on foot; and it is to be hoped that it will be accompanied by a similar success, and that it will serve to promote the progress and welfare of the industries concerned.

* The report and specification here referred to were issued last week, after Dr. Lessing's paper had been read. They appear to-day in the "JOURNAL," *ante*, p. 839.—ED. J.G.L.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Conferences on technical matters often yield their most fruitful results from the informal gatherings and conversations that occur in the intervals of the reported proceedings. Probably this holds good in nearly all gatherings; but with few is it so emphatically true as with the Junior Gas Associations. Most of these now recognize this, and provide occasional informal and private meetings, in which information is freely asked for, experiences are exchanged, and incidents recited that are hardly meant for full publicity. Experiences with consumers and their complaints, with work done by gas-fitters, plumbers, &c., and with sudden emergencies, and how these were dealt with, suggest themselves at once as topics of this kind.

The Yorkshire Junior Gas Association held such a meeting on Saturday at the Leeds Institute, under the chairmanship of Mr. F. Scholefield, the President. A large attendance of members, who followed with close interest an animated and well-maintained discussion, justified the form of the meeting and the choice of subjects, and afforded gratifying testimony to the success of the openers' efforts. Mr. C. D. Cawthra, of Halifax, gave a very interesting and well-written paper on certain "Gas-Works Emergencies" in which he had been concerned. The paper amply merited preservation in permanent form in the printed proceedings, both for the sake of the subject-matter and its treatment. Still, it was thought best to adhere to the general rule of privacy for such subjects as breakdowns and emergencies.

One of the most gratifying features of the work of the Junior Associations has been the evidence they have afforded that the members may be fully trusted to exercise a wise discretion as to what they venture to tell of their experiences and the methods of the works they are connected with. Fears sometimes expressed on this score some years ago have been laid to rest; and those who know most of the working and proceedings of these Associations are most proud of the tactfulness and trustworthiness of the speakers, and of the *esprit de corps* manifested in the welfare of the gas undertakings with which they are connected. On the present occasion, even in the privacy of an unreported meeting, nothing was told or said that might not with perfect propriety have been fully communicated to the Press.

Mr. R. Halkett, of Leeds, followed with "Remarks on the Organization of the Outside Department," a subject he has made peculiarly his own, and on which he is always heard with interest. To the vigorous discussion that followed, Mr. W. Hole, the Superintendent of the Leeds Outside Department, contributed a warmly welcomed and characteristically helpful speech.

Advertising Gas.—The general public are still being kept informed on the subject of the advantages and capabilities of gas by means of well-written articles in local papers in different parts of the country. To some of these attention has already been called; and two which appeared last week in Manchester deserve notice. On Wednesday, the "Courier" contained an article on "How to Combine Powerful Lighting with Economy," by "A Gas Expert;" while "The Comfort of Gas" was the subject of another in the "Guardian" on Friday. They are both written in popular style, suitable for the ordinary reader, who has only to look at the advertisements accompanying the articles to find how and where he can procure both the "comfort" and the "economy" he is assured are so easy of attainment.

GAS FOR INDUSTRIAL PURPOSES.

By L. F. TOOTH, of the Commercial Gas Company.

[An Address to the London and Southern District Junior Gas Association, Dec. 16.]

For my address I have chosen the application of gas for industrial purposes, with special reference to metal smelting. I am convinced that gas undertakings in manufacturing districts are on the eve of a field of supply unparalleled by any previous introduction. Having the good fortune to serve the Commercial Gas Company, whose area of supply is largely one of a manufacturing character, it enables one to obtain a knowledge of the conditions and methods of many industries, and how to adapt gas to any particular requirement.

There are two methods of application—viz., gas by pressure or the bunsen flame, and gas by air pressure or the blow-pipe flame. In my early experiments, I observed that furnaces fired with gas by air pressure behaved in a most erratic manner; there being continual variations of temperature, and incomplete combustion. In obtaining a certain result, the time has been found to vary more than 100 per cent. As constant temperature and time, apart from cost, are of the utmost importance in all furnace work—particularly in the melting of precious metals—many difficulties arose. Employing a series of high-pressure bunsen burners, instead of one air-pressure burner, good results were obtained; but the attention, manipulation, and upkeep would not render this system commercial. Not being successful in obtaining a high-pressure gas-burner to deal with a volume of gas of (say) 500 to 600 cubic feet, and to give the same flame temperature as one with compressed air, I devised a burner on which the results of metal melting, given later, are based.

I now propose making a few remarks upon the relative merits of the two systems. In ordinary conditions of gas supply, it is impossible to keep the density, calorific value, and pressure absolutely uniform. The proportion of air for combustion depends upon the composition or pressure. With air pressure burners, both gas and air require regulation; and when a furnace is working, I fail to see how even the most skilled workman can adjust minutely, or judge the colour of flame from the intensity of the furnace. At very high heats, owing to expansion, an increased supply of air for combustion is required; and repeatedly temperature falls owing to an excess of air being admitted to the burner. In processes where varied or increasing temperatures are required, the difficulties in regulation may well be imagined. With the high-pressure gas-burner, I find that the difficulties I have just mentioned are overcome. For example, to increase or decrease the temperature of a furnace, the operator need only adjust the gas pressure by a valve, without alteration to the air supply of the burner, and can do so to an extent of 30° per cent. from any given temperature. On the other hand, a constant and even temperature can be maintained throughout the whole day within 5° C., with a minimum of attention.

A large number of tests were carried out—the temperatures being taken by means of a pyrometer; and complete control was obtained in a furnace, up to 1400° C., by the manipulation of pressure only. Beyond this temperature, a larger volume of air for combustion is required (due to expansion); this being drawn into the furnace by opening a flue-valve—in other words, increasing the draught. In the possible event of a change in the composition of the gas, this is also dealt with by an increase or decrease of pressure, as the case may be.

The maximum temperature of a furnace fired by high-pressure gas has not been determined absolutely, as the pyrometer at disposal, with a thermo-couple junction, only registers up to 1600° C.; and Seger cones are very difficult to place in position at a blinding white heat of over 1700° C., such as is required for the melting of nickel.

In research work of this description, the pyrometer is invaluable, and will be more so when a reliable instrument can be obtained to record higher temperatures. Efforts are now being made to supply much cheaper pyrometers; and when these have achieved success, the pyrometer will come into universal use. In placing pyrometers in position in a gas-fired furnace, care should be taken not to put the point of the thermo-couple junction in the flame, as this would mean a record of flame temperature, and not furnace temperature. The subject of pyrometry has recently been dealt with at length by Mr. C. R. Darling, before the Society of Arts; and I would recommend those interested to consult the Society's "Journal" when Mr. Darling's lectures appear.

In the early stages of my experiments, furnaces were built to a given size; and immediately the pot was inserted, the temperature fell, leading me to think that the furnace was too small for this size of pot. Even after reversing the order of things, this proved not to be the case; but the contact of the flame with the furnace-walls and pot-surfaces acted as a reducing agent to combustion. This led me to build a furnace in which flame contact did not, to any great extent, exist. In order to illustrate this point, the pyrometer tests are indicated on Chart No. 1, where the broken line shows temperatures with surface contact, the full line temperatures with the flame not in surface contact.

In furnaces for metal-melting, better results are obtained by entering the burner on the side, at a tangent. The outlet of the flue should be placed about one-sixth of the circumference at the top of the furnace past the burner entrance; the suction at that

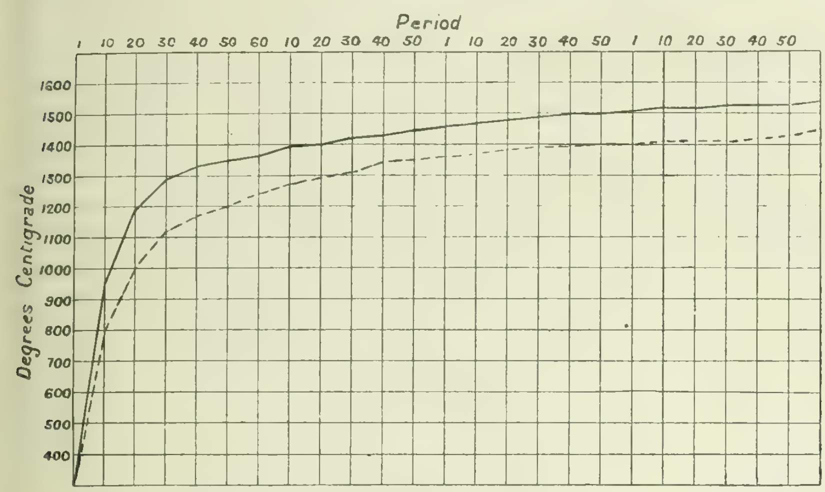


Chart 1.—Pyrometer Tests. Ten-Minute Readings. Four Hours' Duration.
Broken Line—Flame in Surface Contact. Full Line—Flame not in Surface Contact.

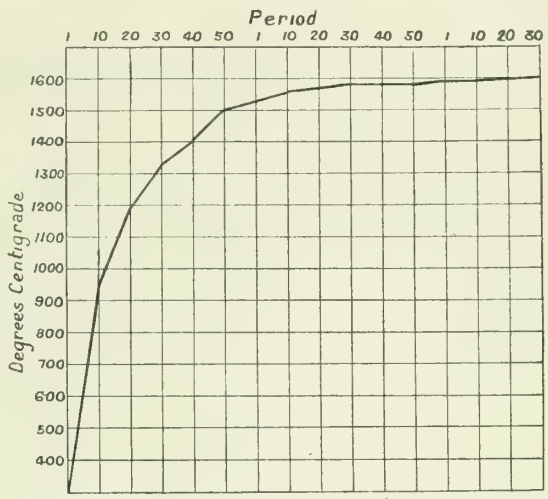


Chart 2.—Regenerative Cupola Furnace. Comparative Pyrometer Tests. Ten-Minute Readings.

point assisting the flame to complete its cycle. When very high temperatures are required, it is advisable to use fire-bricks of the most refractory nature; also cupola furnaces should be lined with ganister or magnite, as this not only prevents the surface of the bricks running into a molten state, but gathers the heat more readily. The outer wall of the furnace should be packed with 3 to 4 inches of slag wool, and should be sheet-iron bound.

Chart No. 2 shows the advantages gained in increasing temperature by regeneration, as compared with Chart No. 1. In this particular furnace, when at over 1600° C., the flue temperature is only 450° C., and the sheet-iron casing just warm.

With reference to practical applications, I am enabled to give some comparative figures for coke and gas firing in brass foundries. The figures for coke are obtained from brassfounders and manufacturers in various parts of the country, who have in use the ordinary draught pit-furnace. Those for gas are obtained from actual working conditions at the works of the Commercial Gas Company, where we have a small foundry, making our own castings, not only for gas-fittings, but for many other purposes. These are not laboratory figures, but actual commercial results. The table shows gas has the advantage from beginning to end.

The number of charges by coke are less, owing to the continual banking-up of the furnace; and I have taken the maximum output per day by this system. The weight of metal melted per furnace entails, in the case of gas, less capital cost. It will be seen that first heating takes much less time in the case of the gas-furnace, which is an important advantage, and prevents moulders having to wait for metal. The space occupied for the storing of fuel presents a further advantage; and, apart from labour, there is a saving in the cost of tools for firing. The cost of metal melted needs no remark, beyond this—that it can be materially reduced, as it is possible, in a nine hours' day, to turn out eleven melts, if desired. The longer life of the pots should also be considered. The price of these being 6s. 9d. each, the average cost per cwt. of metal melted would be 4d. by coke, compared with 3d. by gas This shows a further saving of 1d. per cwt. Cost of repairs would naturally be less for gas; no stoking being required.

With a gas cupola-furnace, a very great drawback in brass foundries is overcome, as in the event of moulds not being ready (which is a common thing), the metal can be kept on the melt, without wasting and burning away, by reducing the pressure only. In the ordinary coke-furnace, this is generally gauged by removing the cover, which is also the method of keeping a constant temperature.

The more modern coke-tilting furnaces deal with larger quantities of metal; but even here the melting cost is in the same ratio in favour of gas.

COMPARATIVE RESULTS IN BRASS FOUNDRY.

	Coke-Fired.	Gas-Fired.
Size of pots	60 lbs.	60 lbs.
No. of charges per day per furnace (9 hours)	5	9
Weight of metal melted per day	300 lbs.	540 lbs.
Time of first heat	1½–2 hours	1 hour
Time of subsequent heats (average)	¾–1 hour	½ hour
Fuel used per day	2½ cwt.	1780 cubic feet
Price of fuel (gas includes cost of compression)	11d. per cwt.	1s. 11d. per 1000 c. ft.
Total cost of fuel	2s. 3½d.	3s. 5d.
Cost of labour for fireman	1s.	*nil*
Cost of metal melted	1s. 2·6d. per cwt.	8·4d. per cwt.
Average life of pots (charges)	30	39
Cost of repairs (twelve months)	£2–£3	£1 10s.

The following table, showing the various metals that can be melted by gas, may prove of interest. Each individual metal was placed in the furnace when at the temperature of the respective melting-points. The time required to reach the necessary temperature can be calculated from Chart No. 2.

Material.	Weight of Charge. Pounds.	Time. Minutes.	Gas Consumed. Cubic Feet.	Cubic Feet of Gas Per Pound.	Cost per Cwt.	Melting Point. ° C.	Required Temperature of Furnace. ° C.	Pressure in Inches of Mercury.
Lead	100	4	28	0·28	0·7d.	326	500	10
White metal	60	5	30	0·5	1·2d.	420	650	10
Aluminium	63	30	174	2·8	7·1d.	628	750 to 800	12
Glass	64	40	235	3·6	9·2d.	1,100	1,450	14
Brass	60	28	168	2·8	7·1d.	900	1,340	14
Gun metal	60	34	192	3·2	8·2d.	1,000	1,400	14
Copper	60	40	224	3·7	9·5d.	1,054	1,420	14
Cast-iron	56	59	350	6·6	16·9d.	1,075	1,450	14
Nickel	40	150	1230	30·7	6s. 7d.	1,550	1,750	24
Silver	720 oz.	30	176	2·9	7·2d.	954	1,380	14
Gold	720 oz.	38	215	3·6	9·2d.	1,045	1,415	14

The cost of fuel per cwt. of metal melted, with charges in excess of the weights stated in the table, can be reduced by upwards of 33 per cent. The pressure for reducing lead and white metal rapidly is 10 inches mercury. When desired to retain in a molten state for use, the pressure should be reduced to 3 inches mercury. The figures for glass are not as they would appear commercially. This method of reducing should be looked upon as a point of interest only. I am of opinion that, in a suitable furnace, glass can be reduced in quantities of 5 to 10 cwt., as is usual, at much less cost than with coke. I estimate the figure for keeping glass in a working molten state at less than 6d. per cwt.; and I hope, before very long, to realize my expectation.

Aluminium is a metal with a specific gravity of 2·56; being one-third that of brass. The cost per cwt. is not in the same proportion, owing to the increased capacity required for the same weight of metal. If you will refer back to lead, this is the reverse; the specific gravity being 11·37. Brass, gun-metal, and copper, being composed of similar metals, the cost of reducing is in ratio to the melting-point. Cast iron from the pig contains about 10 per cent. of foreign substance, known as slag; and this increases the cost of reduction. Nickel being a metal of high melting-point (upon which authorities differ), requiring practically the maximum temperature at present obtained in a gas-fired furnace, the reducing cost is considerably in excess of other metals in proportion. Even so, the use of gas is commercial, as there are many difficulties experienced with coke-fired furnaces for this purpose. The figures given in the table are for nickel of 99·99 per cent. purity. The difficulties in nickel-melting may be understood by reference to Chart No. 2, showing how gradually the temperature increases after 1550° C. In the event of gas being adopted for the melting of nickel, this country may reap a benefit, as, owing to the difficulties mentioned, and the excessive cost of reducing, the whole of the rolled nickel is now imported from abroad.

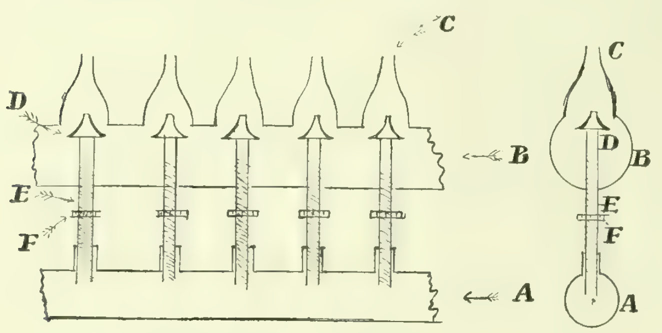
The figures quoted for silver and gold are obtained from outside sources, as I am not fortunate enough to have an outlet for precious metals. But they may be taken as correct, as the melting compares with other metals; hence the consistent result. In reducing precious metals, gas has been a huge success, as the volatilization is reduced to a minimum. Hence the recovery is less costly. In refineries, the recovery by distillation amounts to many thousands of pounds. This illustrates the absolute necessity of constant temperature and regular heats.

In shipbuilding and repairing, a small muffle or open-hearth furnace can be supplied with gas from shore by flexible tube for the purpose of rivet heating, instead of the old method of throwing the heated rivet from the dockside to the ship, or temporary

furnaces can easily be built for plate, bar, or stanchion bending. Also brazing tubes, jointing, &c., can be dealt with on the spot. The heating of large steel plates, $\frac{3}{4}$-inch thick, for pressing into any desired shape by hydraulic power, is an application that is proving most successful.

For enamelling and japanning purposes, gas has a very big future. I have a few samples of tin-plates printed by lithography and then baked in high-pressure gas-ovens at a temperature of 300° to 350° Fahr. As many as 490 tin-plate sheets are baked in 15 minutes, for the fixing of each colour, for a consumption of 25 cubic feet. I have also a further interesting process of shell finish. The plain tin-plates are placed over a series of very fine bunsen jets, causing the coating of tin to become molten; then immediately immersed in acids, which fixes the wavy or crystallized appearance of the metal. The plates are afterwards coloured, varnished, and baked.

In the recovery of useful material from rubbish, gas plays its part. Pure tin from old pots and cans is removed by a series of burners playing on a perforated cylindrical drum revolving obliquely inside a square casing; the tin afterwards being removed from the refuse that has fallen through the perforations on to the floor of the casing. About 5 tons of this old material is treated and passed through the furnace in an hour.



A.—High Pressure Gas Supply.
B.—Air Supply, drawn in at each end by gas pressure.
C.—Ignition Point.
D.—Regulation of Air Supply.
E.—Longscrew Coupling.
F.—Locking Nut.

Furnace Burner for the Recovery of Tin from Old Material.

I have some interesting specimens of photographic process work, and have brought them to your notice to illustrate that uniform temperature and perfect heating surface can be obtained in a high-pressure gas-furnace, and work of a most delicate nature performed. The picture or pattern is first impressed on to a sheet of opal glass, and placed in a muffle furnace specially constructed, with a top crown heating surface. The temperature required to bake the impression is 50° Fahr. less than the melting-point of glass; so you can imagine that this requires to be very carefully and delicately manipulated. There is also an appliance here for polishing and stretching to shape bottle sealing wax. The flames play on ordinary grilled frets placed on either side; the heat being deflected to the wax held through the opening.

The uses of gas in various industrial processes appear to me unlimited; and I feel sure that coke and other solid fuels have a very short life generally—the advantages of gas being so numerous that they cannot be overlooked by a progressive manufacturer. The immediate readiness, and greater rapidity of gas, the saving in the cost of fuel, labour, space, establishment charges, and upkeep, will bring us nearer the ideal conditions now sought after—smoke and dust abatement, and reduction in coal consumption. Should the order of things rapidly change, as it has every appearance of doing, we must look for competition from producer gas and oil. But each of these has disadvantages, the low calorific value of the former requiring greater furnace and flue space, and the constantly changing character of the latter presenting the same difficulty as the compressed-air burner, producing irregular temperatures.

Discussion.

The Hon. Secretary (Mr. S. A. Carpenter, of Mill Hill) said they had listened to an interesting address on a subject of the first importance; and it was now open to discussion.

Mr. S. Adams remarked that he would like to know the price of gas on which the President based his calculations.

Mr. J. G. Clark, referring to the question of regeneration, asked Mr. Tooth if he would explain exactly how regeneration had been brought about, because this could be accomplished in various ways. If they referred to the figures on the charts, they would find that to attain a temperature of 1200° C. the times required were equal with or without regeneration. But for 1400° there was a saving of 30 minutes in favour of regeneration; and for 1500° there was an advantage of 110 minutes. To attain 1600°, they were bound to have regeneration. It was interesting to note that the question of regeneration became of greater importance as one desired to reach the higher temperatures. The President did not, however, tell them the effect of regeneration on the gas consumption. What economy was to be expected in the gas consumption over the full period? That was to say, having attained the required temperature by regeneration, would he maintain it with less gas than would be required without regeneration? Then the President spoke of the tangential heating of crucibles. One of the diagrams showed a distinct advantage in favour of the prevention of flame-contact. Did he have flame-contact when using crucibles? He noticed the President made a remark as to the necessity, in placing a pyrometer in position in a gas-fired furnace, for taking care not to place it in the flame. Again, he would like to ask whether Mr. Tooth had ever made systematic observations on the relations between flame temperature and furnace temperature. As to the baking of impressions on glass, considering that one had to work within a limit of 50° Fahr., to prevent melting of the glass and at the same time to ensure perfect baking, this not only indicated the maintenance of a fairly constant temperature, but of a uniform temperature throughout the furnace, which was a different thing.

Mr. F. C. Briggs remarked that a case came under his notice at one time in which, as far as he remembered, a firm instituted gold smelting by gas, and found afterwards the metal was extremely "short." The only reason that could be given for this was that the sulphur in the gas had affected the gold.

Mr. E. G. Stewart asked what was the opinion of the President with regard to the Féry pyrometer. Alluding to melting metals by gas, he took it that they must use a crucible; and if they were going to melt cast iron by gas, they would want a pretty big crucible for a 4 or 5 ton charge, whereas a cupola did not present any difficulty at all.

Mr. G. R. Bullwinkle pointed out that in the comparative results in a brass foundry, Mr. Tooth put 1s. down as the cost of labour for coke, and nothing for gas. He took it that there would be a number of furnaces, and that there would be men to look after them, so as to see that a constant temperature was maintained. Then as to the item for cost of repairs, did this include new burner parts, which would have to be supplied from time to time?

The President, in reply, said that, of course, where gas could be obtained at 1s. or 1s. 6d. per 1000 cubic feet, there would be a corresponding advantage when compared with London; but at the same time, in districts which were supplied at these prices, it must be remembered that solid fuel also cost much less than in London. As to Mr. Clark's questions regarding regenerative furnaces, he purposely avoided dealing with the construction of the furnaces and of the method by which he prevented flame-contact with the pot surfaces, because the Association would be paying a visit to the Commercial Gas-Works in February, and then they would see the whole thing in operation. For the moment, he was not at liberty to give details. Of course, in the case of running, they required much less consumption of gas to keep up a given heat by regeneration.

Mr. Clark: There is a saving in gas in running a furnace over a long period? That is to say, to maintain a given temperature, the regenerative furnace requires less gas.

The President said to turn out the same amount of work in one day by a non-regenerative furnace, the consumption of gas would be 2650 cubic feet, and in a regenerative furnace 1780 cubic feet. Thus there was, roughly speaking, a saving of 900 cubic feet in favour of the latter. With regard to the question of flame-temperature, he had no definite figures with him. However, in actual working the flame-temperature was about 15 per cent. more than the furnace temperature; and this brought them back to the old theory that 15 per cent. of the flame heat was taken up by the refractory materials. As to keeping the temperature of a furnace constant, it was possible to maintain a furnace a whole day at any one temperature by proper manipulation. Mention had been made of gold that was affected by sulphur from the gas; but if this was so, it would probably not have been pure gold. However, in the melting of precious metals it was usual to have a cover on the pot. The Féry pyrometer was certainly an exceedingly good one. With regard to crucibles and the melting of iron, he did not mean to say that if gas was applied to this purpose crucibles would be used. They would simply employ cupola furnaces as iron founders would do, but adapt them to gas. The cost of labour 1s. under coke was for firing simply—not attention to the furnaces. There was no labour in turning on a gas-valve, which would be undertaken by the moulder. In a foundry there would generally be about five furnaces; and one fireman attended to the lot. Therefore 1s. would be a fifth of his wages. The cost of repairs included burner parts.

Mr. F. G. Barber asked what was the calorific power of the gas.

Mr. Bullwinkle said in the item for price of fuel it was stated that the figure for gas included cost of compression. What proportion of the amount was for compression?

Mr. Adams inquired whether gas was applicable for steel welding.

The President replied that the calorific power of the gas was about 500 B.Th.U. The cost of compression was 0·7d. per 1000 cubic feet. He was afraid steel welding could not be carried out by the bunsen or the blow-pipe flame. It was, of course, possible to do it with oxy-hydrogen.

The proceedings then closed.

It was Mr. William Wallin, of Newcastle-on-Tyne (not Mr. Waddingham, as reported last week), who was transferred from the class of associate member to that of member, at the recent meeting of the Association of Water Engineers.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Meeting of the London and Southern District Junior Gas Association was held on Friday evening, at the Westminster Technical Institute, Vincent Square, S.W.—Mr. L. F. Tooth, of the Outdoor Department of the Commercial Gas Company (the President), in the chair.

A Vote of Sympathy.

The President, at the opening of the proceedings, remarked that he had a very regrettable announcement to make. Mr. H. Rothwell, a member of the Council, had recently had a fall and broken his thigh. It was during a demonstration in connection with his classes at the Institute that he met with the accident, of which they were all so sorry to hear. In Mr. Rothwell the Council had an energetic member, who never left anything undone in furthering the welfare of the Association.

Mr. F. Ainsworth proposed a vote of sympathy with Mr. Rothwell and his family in their trouble.

This was passed; and it was agreed that a letter should be written embodying the resolution.

The Industrial Applications of Gas.

The Hon. Secretary (Mr. S. A. Carpenter) remarked that those who were interested in the Sales Department were always on the look-out for fresh outlets for gas, and were pleased to have addresses and papers that would be likely to assist them in their search. The President was going to tell them how gas was superseding coke for metal smelting; and it was a subject with which he was well able to deal, as he had lately made many experiments in this direction.

Mr. Tooth then delivered an address on the "Industrial Applications of Gas;" and this, together with a report of the discussion, will be found on p. 844.

Mr. J. G. Clark, at the conclusion of the address, said it was clear that the President had had great experience in the matter with which he had just dealt; and they ought to feel indebted to him for the information he had given them and the specimens shown of apparatus and of work that had been carried out by means of gas in his district. He proposed a hearty vote of thanks to Mr. Tooth.

Mr. Ainsworth, in seconding, remarked that they would have to look in the future for every means they could possibly secure for assisting the consumption of gas; and going into the industrial field was a step in the right direction. A great advantage of gas in this connection was that it could be so easily regulated.

The vote was carried with applause; and Mr. Tooth briefly acknowledged it.

A Presentation.

The President said he had now the most pleasurable duty of the evening to perform—namely, to present to the late President, Mr. Liberty, the following framed resolution which was passed at the annual general meeting on May 27, 1910.

> The London and Southern District Junior Gas Association desires to record its hearty appreciation of the valuable services rendered by Mr. W. J. Liberty during his presidency for the past two years, and hereby conveys to him its thanks for the interest he has displayed and for the time and energy he has at all times given for the benefit of the members, and especially for the yeoman work he has accomplished in raising the Association to the high standing it has now attained, and is gratified at the increase of membership and the progress that has been made during his tenure of office. The Association thanks him on his retirement from the office of President, which he has filled so admirably, and sincerely trusts that it will still be privileged for many years to come to number him among its members.

This small token of their appreciation really hardly met the case, because Mr. Liberty's loyal work, and the energy he had displayed during his two years of office, had brought the Association to high-water mark.

Mr. W. J. Liberty thanked the members for the tangible form in which they had given expression to their feelings towards him. During his term of office, he said, he experienced a good deal of pleasure and made a great many friends. With regard to the Association and its growth, he was extremely gratified at the end of his presidency to find there were so many strong members; and if he had wanted any reward, he would have had it when he saw the large number who assembled to hear Dr. Harold G. Colman give his two lectures on "Gaseous Combustion." He had endeavoured, with some little success, to secure additions to the roll of the Association from among men engaged a little outside the London area, so as if possible to somewhat strengthen the manufacturing side. It was an old saying that London people did not put the interest or backbone into a thing that persons from other districts did. He could only put this down to the fact that in London there were so many other attractions, and people led such a busy life. His idea was that if they could broaden the basis of the Association and secure more country members, who perhaps would be less fickle, it would be a good thing. His services would always be at the disposal of the Association, in which he would not cease to take a keen interest.

CONTROLLING THE WORKING OF GAS-WORKS.

By Dr. Knublauch, of Ehrenfeld, Cologne.

The following observations were made by Dr. Knublauch, of Ehrenfeld, Cologne, in the course of a discussion on this subject at the forty-seventh annual meeting of the Mid-Rhenish Association of Gas and Water Engineers in September last—initiated by the paper read by Dr. Karl Bunte, as given in last week's "Journal," p. 785.

He thought that, after his many years' experience, he might contribute something to the discussion of the question of the control of the working of gas-works and the great value of tests in regard to same; and, in particular, he would go somewhat more closely into the economical result which, according to his observations, was attainable.

It must be well known to many of his hearers that, after he had resigned his position at the Municipal Gas and Water Works at Cologne, where he had been engaged for nearly fourteen years, he had conducted in his own laboratory researches on gas and water supply, and for nearly twenty years past had had the chemical supervision of the working of a large number of gas-works in Germany and abroad—in Belgium, England, France, Holland, and Luxembourg. This had given him the opportunity to study various types of apparatus (particularly for the condensation and washing of gas and for the working up of ammoniacal liquor), and to control in a rational manner the quantitative recovery of ammonia.

Unfortunately, it had to be admitted that in a very large number of gas-works, due importance had not been attached to this point, which was a matter which could easily be attained after chemical investigation of the working had been once for all carried out and the simple control apparatus constructed by him had been thereafter used.

The yield of ammonia from different coals varied in a very high degree. He was frequently in the position to determine the yield of gas, coke, tar, ammonia, and benzol according to a laboratory method which he had worked out, and which—a matter of some importance—gave results coinciding with those obtained in working. These investigations related especially to recovery coke-ovens, for which the calculation of the yield according to these figures had been made, showing that differences in the yield of 1 : 2 and more frequently occurred (for instance) in regard to tar and ammonia. It was particularly important when considering an expenditure of (say) £35,000 to £40,000 for a large battery of ovens, to obtain information as to the products.

Of the many coals, including some non-European, which had passed through his hands, he would only mention that the yield of ammonia in the distillation of coal in horizontal ovens amounted, in pounds of sulphate per ton of coal, for Saar and Lower Silesian coals, approximately to 17·9; for Westphalian coals, to about 22·4; for many Upper Silesian coals, on the average, to 30·2; while most English coals gave very much more ammonia, rising, according to his observations, to as much as 42·6 lbs. of sulphate per ton. The many coals examined by him from different fields in North and South America showed yields varying similarly to those of the German coals, while the Scotch cannel coal produced less ammonia, and the Australian coal—formerly frequently used for the enrichment of gas—less than 4·48 lbs. of sulphate per ton. It might be mentioned that for gas-works which produced concentrated ammoniacal liquor, the weight of ammonia (NH_3) might be found sufficiently exactly by dividing the quantity of sulphate named by 4—thus making it for Saar coals 4·48 lbs. of ammonia per ton, for Westphalian coal 5·6 lbs., and for English coal for the most part appreciably more.

It would be seen from the annual statistics published by the German Association that the quantity of sulphate obtained was frequently very much less than was indicated by these results; and the disadvantage accruing through direct loss of ammonia was often very great. Not uncommonly two-thirds or less of the ammonia formed in the retorts was recovered. If a gas-works having the make of that of the City of Cologne brought on to the market only two-thirds of the ammonia produced, there would ensue, at present prices of ammonia, a fall in net profit of about £4500, as the works must produce approximately 1500 tons of sulphate; while there were also very great indirect disadvantages which would be briefly indicated shortly.

That the yield of ammonia represented could be easily and surely attained had been proved thirty years ago at the Cologne Gas-Works, when, according to annual reports which had been printed and published, 22·22 lbs. of sulphate were recovered per ton of coal in the working year 1879-80, and 22·29 lbs. in 1880-81. This was after the wet purification and the ammonia works had been rationally regulated according to the speaker's chemical control tests. Previously, notwithstanding that the make of gas was only so little as 400 million cubic feet at these works (which were then new), very much ammonia was lost, and the dry purifying material did very little work. The results of recovery coke-ovens also showed that the figures presented for the yield could easily be obtained. In this case the yield was certainly somewhat higher, because, on the one hand, the coal used for coking, though drawn from the same pits, yielded a little more ammonia on distillation, and, on the other hand, the large quantity of water—

viz., 8 to 14 per cent.—which passed into the ovens with the coal increased the production of ammonia. Thus, for instance, the 22·4 lbs. of sulphate per ton of Westphalian gas coal obtained in horizontal retorts corresponded with 24·64 to 26·88 lbs. of sulphate from similar coking coal in coke-ovens.

But that a proper chemical supervision of the working was, in fact, attended by such considerable advantages might be shown by the utterance of the manager of one of the largest gas-works in Belgium, who had told the speaker he was responsible for the works producing the most ammonia of any in Belgium—namely, nearly 22·4 lbs. of sulphate per ton of Westphalian coal.

The direct disadvantage of the loss of ammonia was by no means the only disadvantage, as the incomplete abstraction of the ammonia from the gas resulted in very considerable indirect harm. A great disadvantage connected therewith was that in such cases the purifying material (oxide) contained little prussian blue and very much sulphocyanide, because the cyanogen (hydrogen cyanide) of the gas combined for the most part with sulphur to form sulphocyanide instead of with iron to form ferrocyanide (prussian blue). Thus good spent oxide contained 14 per cent. of prussian blue and only 0·07 per cent. of sulphocyanide, whereas a bad spent oxide contained only 3·4 per cent. of prussian blue and 13·8 per cent. of sulphocyanide.

The gas-works at Cologne had been the first to sell its spent oxide for the prussian blue which it contained. This was in March, 1882, after material containing a high proportion of blue had been produced through the speaker's method of control, and a method of determination of ferrocyanide had been worked out. The material in the year 1882 contained on the average 10 to 12 per cent. of prussian blue on the wet basis, corresponding to 12·5 to 16·3 per cent. on the dry material.

Whereas the spent material up to that time had been a valueless and troublesome bye-product, the receipts obtained from it, after proper chemical supervision of this part of the working had been introduced, suddenly became unprecedentedly high. Consequently in the annual report of the Cologne Gas-Works for the year 1882-83, it was stated that by good apparatus (to which must be added proper working of the apparatus) the dry purification no longer entailed expense but had become a source of income.

In the middle of the Nineties, the price of prussian blue had risen about five-fold; so that in Cologne £5 to £6 were obtained per ton of spent oxide. Further, with imperfect wet purification, the oxide contained a great deal of soluble salts in which were large quantities of ammonia. The particles of iron were enveloped thereby and much less sulphur was absorbed and little prussian blue; so that the oxide produced small receipts and the expenditure on new oxide and on wages was high. Spent oxide containing 10 per cent. of ammonium sulphate was unfortunately not uncommon, and the proportion sometimes reached 28 per cent. Frequently, the loss through ammonia in the oxide was more than was paid for the prussian blue. That the selling of spent oxide according to the amount of nitrogen it contained was an economically unsound proceeding could only be shortly indicated, on account of the limited time at the speaker's disposal. In good spent oxide the nitrogen present was almost solely that equivalent to the prussian blue; and blue, even at low prices, paid best. If the material were contaminated with sulphocyanide and ammonium salts, it was desirable in some cases to sell it according to its content of nitrogen; but the total receipts from the extraction of ammonia prior to the oxide purifiers and the larger proportion of prussian blue thus obtained were appreciably higher when the working was properly controlled. If the manager of a gas-works wished to obtain information as to the state of his wet purification, it would be sufficient at first for him to send a sample of spent purifying material, of which an exhaustive examination would enable the speaker to form an opinion, without instituting experiments on the working, as to whether, or to what extent, the wet purification was proceeding properly and as to the indirect disadvantages which have been indicated. Experiments would naturally have to be carried out if the investigations of the purifying material disclosed faults, with a view to rectifying the latter according to the works' equipment in the particular case.

The view might well be held that small gas-works were not in the position to extract ammonia quantitatively and at the same time to obtain the highest possible return from the dry purification. There was, however, absolutely no ground for this view, provided that when the small gas-works were erected regard was paid to the necessity for complete condensation, and that the washers used were not too large and especially not of large cross-section, if they were of the scrubber or large vessel type. It was better to use at least three small washers in place of two large ones. The speaker had witnessed the mistake of employing only two washers which were too large, when the quantity of clean water necessary for the last scrubber was too small for efficient sprinkling, so that it became essential to supplement it in order not to obtain too dilute liquor.

This last point ought to be kept in view, as well as the complete extraction of ammonia, in order to reduce as far as possible the expenses for carriage in the case of small works and for working up the liquor in the case of large works. For instance, if in one case an ammoniacal liquor contained 1·75 per cent. of ammonia and in another 2·25 per cent., the quantities of water to be handled were in the ratio of 7 : 9; so that the freight charges, or the expenditure for steam and wages in distillation, and for repairs, &c., would amount with the strong liquor to only seven-ninths of the corresponding charges for the dilute liquor.

The concentration attainable naturally depended on the works' apparatus. Frequently, a strong liquor with its attendant advantages could be produced as a result of investigations; but very often liquor that was too concentrated was met with, and this carried with it various disadvantages for the works where it was made.

Special attention was needed in controlling the working-up of the ammoniacal liquor according to which product had to be made—namely, whether sulphate of ammonia, concentrated liquor, or liquor ammoniæ. Frequently there were quite large losses in such cases if two conditions were not implicitly fulfilled. In the first place, the proper proportion of steam to the inflowing liquor should be exactly right, as a needless excess of steam was costly; and, further, the proper quantity of lime had to be added. The latter was frequently assumed to be the same for ammoniacal liquors from different works, though it varied not only according to the proportion of ammonia but also according to the description of coal carbonized and the construction of the liquor-distilling plant. The quantity of lime depended on the non-volatile salts of ammonia, or more correctly on the quantity of ammonia which was present in the part of the apparatus in which the lime was introduced. If the amount of lime added was insufficient, no excess of steam, however great, would be adequate, as the ammonia combined in a non-volatile condition could not be converted into a volatile condition. With apparatus working with direct steam, it could be concluded that if the effluent liquor contained only 0·005 to 0·008 per cent. of non-volatile ammonia further distillation would not result in a profit being obtained from the small increase in ammonia equivalent to the cost of the steam, &c., expended.

If the working was to be controlled from the start by proper chemical regulation, it ought to be constantly kept up to the mark by the simple apparatus constructed by the speaker for the use of those who were not trained as chemists.

It only remained for him to point out that the manager of a gas-works if he did not happen to be versed in gas chemistry, apart from the question of the time at his disposal, was not in a position to regulate the working in the manner indicated. This was the function of a specialist familiar throughout with working, theory, and analysis. He had often heard it said that the condensing plant, and more especially the washers, would not suffice for the complete extraction of the ammonia, while all that was really needed was to change the method of working the existing apparatus on the basis of the results of investigations. At times, gas and liquor were passed quietly together into the middle washer without the liquor taking up any more ammonia; while at a higher temperature, or at a greater velocity, it would give up ammonia again to the gas. The points to be primarily observed were the exclusion of ammoniacal liquor of a certain strength from the washer, the use of liquor of not too great strength at a proper point, the avoidance of mixing clean water with weak liquor, and, above all, thorough condensation, by which more than one-half of the ammonia could be extracted without passing into the washer. It followed that general rules were not applicable to these points, but that each case must be differentiated according to the works' apparatus and the results of the investigation with it.

If he had the management of a gas-works, he would not rest content until, with the assistance of a specialist, he had obtained the yield of ammonia indicated for the particular coal, and at the same time had secured the maximum return from the spent oxide with the lowest possible expenditure on oxide and wages. It was an easy matter to obtain at least 12 per cent. of prussian blue on the damp spent oxide, or about 15 per cent. on the dry material; whereas, unfortunately, materials with only 5 per cent. or even 3 to 4 per cent. occurred, and the majority contained only about 8 per cent. Why should gas-works remain behind recovery coke-ovens, which had been in existence for only some thirty years, in the quantitative recovery of bye-products, especially as the coke-ovens had not to consider the indirect disadvantages on the purifying material? The speaker had often pointed out that for the most part they worked quantitatively. Whether the gas or coke formed the chief source of revenue, in recent years proper attention had been directed from the economical standpoint to the rational recovery of bye-products.

Finally, the speaker drew attention to the exhaustive treatment which had been given to these questions in his lectures and papers which had been published in the "Journal für Gasbeleuchtung." (1) On "Gas Purification and Ammonia Recovery," 1883; (2) On "The Influence of Lime and Other Mineral Substances on the Distillation of Coal" 1887 ("JOURNAL" Vol. L., p., 411); (3) On "Nitrogen and the Nitrogen Products Derived from Coal," 1895 ("JOURNAL," Vol. LXVI., pp. 1242, 1294).

Society of Engineers (Incorporated).—At the first annual general meeting of the Society, held on Monday last week, the result of the postal ballot for the election of Council and officers for the ensuing year was announced. The new President is Mr. F. G. Bloyd; one of the Vice-Presidents is Mr. Arthur Valon; and among the members of the Council are Mr. Percy Griffith, Mr. T. E. Bower, and Mr. H. P. Maybury. The Chairman (Mr. Diogo A. Symons, M.Inst.C.E., the outgoing President) presented the report of the Council, which showed that the formation of the Society, by the amalgamation of the Society of Engineers and the Civil and Mechanical Engineers' Society, had been fully justified by the success of the first year's work.

MANCHESTER JUNIOR GAS ASSOCIATION.

Visit to the Southport Gas-Works.

At the invitation of Mr. John Bond, the Corporation Gas Engineer, about fifty members of the Manchester and District Junior Gas Association inspected the Southport Gas-Works on Saturday afternoon. The party included Mr. F. Thorp, the President, and Mr. J. Alsop, the Hon. Secretary.

On arriving at the works, the members of the party were received by Mr. Bond and his staff. A visit was first paid to the fine laboratories; and before leaving this portion of the works, Mr. Bond explained at length the thermopile he had built up there for determining radiant heat; also other special apparatus for ascertaining the radiant energy of gas-fires, &c. He described the radiation of light; and the members of the party had an opportunity of comparing by means of the spectroscope the light of an electric flame arc lamp with that given by an incandescent gas-light.

Following the inspection of the laboratories, the visitors formed into groups and were conducted over the works; the guides being Mr. Bond, Mr. R. Walmsley (the Deputy-Engineer), and Mr. J. Blundell (the Distributing Superintendent). The following are some particulars of the

SOUTHPORT CORPORATION GAS UNDERTAKING.

In the year 1850, the Southport Corporation built gas-works in Eastbank Street, at a capital expenditure of £3528. During this year the make of gas was 578,000 cubic feet, and the gas sold to 69 consumers amounted to 295,000 cubic feet. There were 79 public lamps which consumed 230,700 cubic feet of gas. The price charged was 7s. 6d. per 1000 cubic feet; but this was reduced on Nov. 12, 1850, to 6s. 8d. Gas making continued at Eastbank Street until June 20, 1878, after which date the whole of the gas was manufactured at the Crowlands works. Gas manufacture commenced at these works on July 16, 1872; and from this date to 1878, both the Eastbank Street and Crowlands works supplied gas to the consumers of Southport and Birkdale. At the present time, the Southport Corporation Gas Estate has an area of about 12 acres.

The plant is capable of producing 3½ million cubic feet of gas per day. There is also plant for the manufacture of sulphate of ammonia, the distillation of coal tar, and the working-up of clinker, &c., into mortar. The Corporation have power to supply gas to all places within a radius of six miles from the Southport Town Hall. Gas is supplied to consumers within the borough at 2s. 8d. per 1000 cubic feet, with a discount of 5 per cent. if the account is paid within one month of the receipt of same. Special prices at the following rates are charged for gas for power purposes in Southport: Consumers of more than 250,000 cubic feet per quarter, 2s.; 125,000 to 250,000 feet, 2s. 2d.; 62,500 to 125,000 feet, 2s. 4d.; and less than 62,500 feet, 2s. 6d.—less 5 per cent. discount if the account is paid within a month of its receipt.

The make of gas for the year ended March 31 last amounted to 535,121,000 cubic feet; and the gas sold for cooking, lighting, heating, and power purposes (including street lighting) was 515,461,600 cubic feet. The make of residual products for the year was: Coke, 17,556 tons; breeze, 3759 tons; tar, 2631 tons; and sulphate of ammonia, 383 tons. The quantity of coal and oil carbonized was 45,028 tons.

The total capital expended to March 31 last amounted to £298,428; and the capital on mortgage was £197,725. This works out at 11s. 6d. and 7s. 8d. respectively per 1000 cubic feet of gas consumed.

Retort-House.

The retort-house which contained the direct-fired settings has been raised 13 feet to receive others on the regenerative principle. Four additional settings have been erected on the site of the old water-gas plant in an entirely new building adjoining the old retort-house. There are in all 144 through retorts working on the regenerative system. The retorts are 20 feet long, and made in two lengths, having a cross section of 22 in. by 16 in. At either side of the retort-bench is a stage flooring 11 ft. 6 in. above the ground level and 25 feet wide, the framework of which is made of steel joists supported on the retort-bench side by buckstays and columns, and on the outside by cast-iron columns. Running throughout the whole length are steel rails on which the stoking machinery travels.

Stoking Machinery.

This machinery, which comprises two drawing and two charging machines, was made by West's Gas Improvement Company. The machines work with compressed air at 60 lbs. pressure per square inch, and are capable of drawing and charging 90 retorts per hour. The air is compressed first in a low-pressure cylinder to about 25 lbs., and is then forced through a tubular cooler, to take out the heat developed by compression, to a high-pressure cylinder, after which it passes into a cylindrical receiver at a pressure of 70 lbs. per square inch, and is conveyed by means of wrought-iron pipes to the hollow shafts of four drums fitted overhead and in the middle of the retort-house. These drums carry a smaller drum, round which chains are fitted to counterpoise weights. The drums revolve automatically, and wind up or let out the hose piping as the machines travel from one retort to another.

Coal Elevators and Coke Machinery.

Coal is brought into the works by means of waggons, tipped into the breakers, and then elevated into hoppers fixed in the roof of the retort-house to supply the charging-machines. Fixed underneath the stage flooring, and close to the retort-benches, are shoots, which allow the coke drawn from the retorts to fall into coke-bogies, which travel on lines fixed on the ground floor, and convey the coke to the elevator by means of compressed air motors. After being slaked, the coke is conveyed to screening-plant, and then passes along into different bunkers of the overhead hopper, which holds 100 tons. By elevating the coke into this hopper, the loading of carts and waggons is greatly facilitated.

Purifying and Storage Plant.

There are four purifiers, each 24 feet long, 38 ft. 6 in. wide, and 5 ft. 6 in. deep; each box being filled with 60 tons of oxide of iron. There are in addition two oxide catch-boxes 34 feet long, 14 feet wide, and 4 feet deep. The storage capacity is 1,600,000 cubic feet. Two small holders have a capacity of 300,000 cubic feet each; and the larger one will contain 1,000,000 cubic feet. There are two station governors, one 36-inch, the other 20-inch.

Carburetted Water-Gas Plant.

There are three complete sets of carburetted water-gas apparatus, each capable of making between 500,000 and 600,000 cubic feet of gas per day. The two blowers in connection with this plant are driven by two 30 H.P. De Laval turbines, working at 1800 revolutions per minute.

Engine and Boiler Houses.

On the site of the old gas-enriching plant has been erected a new engine-house, 50 feet square, in which have been installed the air-compressor, two gas-exhausters used in connection with the carburetted water-gas plant, and a steam turbine blower. The coal-gas exhausters and engines have been placed in this house, with the result that considerable saving has been effected in the fuel used for steam-generating purposes. The boiler-house is 51 feet by 55 feet, and contains four boilers, two of which are 30 feet long and 8 feet diameter, and work at a pressure of 110 lbs. per square inch. Two smaller boilers, which are 28 feet long and 7 feet in diameter, work at a pressure of 100 lbs. per square inch. The boilers are of the Lancashire type, and fitted with Wilton's forced-draught furnaces; and they supply the whole of the steam required.

Sulphate of Ammonia Plant.

This plant is capable of producing 4 tons of sulphate of ammonia per day, and containing about 25 per cent. of ammonia.

Offices, Etc.

In connection with the works are a suite of offices, photometer-room, chemical and physical laboratory, and complete testing-plant. The Eastbank Street rooms are fitted for the repairing and cleaning of stoves, meters, lamps, &c. At the show-room, in Lord Street, there are exhibited appliances for cooking, lighting, &c.; the uses of which are demonstrated to the public on application. In a room adjoining the show-room, free lectures are given on cooking by gas by fully qualified lecturers.

Street Lighting.

The old method of lighting the streets by means of flat-flame burners has been superseded by the incandescent system; No. 3 Kern and "C" gas-burners having been adopted in most cases. There are also fixed a number of Welsbach and Lucas high-pressure lamps in some of the principal streets. The total number of lamps in use is 2428.

At the conclusion of the inspection, the party were taken to the spacious dining-room, which had been decorated for the occasion, where tea was served. Subsequently there was a little speech-making.

Mr. F. Thorp, in calling upon Mr. Allen to move a resolution, said he was sure all present had spent an instructive and enjoyable afternoon. They had been shown many things which were of particular interest to them, and had had an opportunity of seeing how Mr. Bond carried out his research work. Incidentally, he mentioned that Mr. Bond was one of the Lecturers at the Leeds University. Proceeding, Mr. Thorp said the dream of the gas engineer, that the gas-engine would displace the steam-engine, had been realized; and he hoped that those connected with the gas profession would exert themselves, and see that gas displaced electricity more than it had done. What the visitors had seen would stimulate them in this direction, and whet their appetite for further research.

Mr. E. Allen (Liverpool), in moving a vote of thanks to Mr. Bond, said there was no doubt as to the Southport Corporation having in him a valuable servant; and it was also a fact that the gas industry had in him a leading figure. It was more than ever necessary in these days that they should not only be good gas engineers but good chemists; and Mr. Bond had shown them that he had both qualifications. Referring to the work of the Manchester Junior Gas Association, Mr. Allen congratulated the President, officers, and members on the excellent results achieved. He alluded particularly to the course of lectures arranged to be

delivered at the Manchester University, and the classes established there for students in gas engineering.

Mr. R. H. GINMAN (Birkenhead), in seconding the motion, said he was sure that all present had greatly appreciated what they had seen. They were particularly indebted to Mr. Bond for the way he had explained the work carried on in the physical and scientific laboratories connected with the gas-works.

The resolution having been heartily carried,

Mr. BOND, in responding, said it had been a pleasure to him to take the members of the Association round the works; and he added that he would be glad to see them again at some future date. It was always difficult, in the short time available on such a visit, to show and explain everything in gas-works like those at Southport; but if the members of the party desired to see more, he would be willing at any time to give them another day. He had read with interest in the Technical Press of the work being done by the Association; and he hoped good results would accrue from the University scheme for the advancement of the gas industry. He was satisfied that the more they studied the scientific side of their work, the more would the industry prosper; and he was of opinion that the Research Committees on Refractory Materials and Carbonization, appointed by the Institution of Gas Engineers, had done good service.

This concluded the proceedings.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Prizes for the Past Session's Work.

The Fourth Annual Social Gathering of this Association was held on Saturday, in the Corn Exchange Restaurant, Glasgow. Mr. J. FRAZER, of Provan (the President), occupied the chair. Tea was served, after which there was a concert, interspersed with a good deal of speaking.

The toast of "The Scottish Junior Gas Association" was proposed by Mr. T. WILSON, of Coatbridge, who said he regretted exceedingly that Mr. G. R. Hislop, of Paisley, who was to have been associated with him in proposing the toast, should not have been present, as he was undoubtedly the father of the profession in Scotland. The members of the Junior Association were to be complimented, firstly, on their numbers; secondly, on their earnestness in everything they appeared to turn their hands to; and, lastly, on the success which had attended their labours. The Junior Association was a fine training college for a gas manager or a gas engineer.

The PRESIDENT, in returning thanks, referred to the fact that their membership, which, at the institution of the Association, numbered a little over 100, was now 140. He reminded them that they had a big country district round about; and he thought that if their good friends of the North British Association of Gas Managers would try to do a little for them, in the way of advising the young men to join their Association, it would be for the benefit of the juniors, and also for the managers themselves. He held that, if the Junior Association was an advantage to the juniors, it was also a happy hunting ground for the managers. He begged to thank the donors of medals, and intimated that next year they were to receive a medal from Mr. J. Dunlop Smith, of Belfast. As the members already knew, the prizes for the best two papers read during last session had been awarded to Messrs. F. L. MacLaren, of Dumbarton, for his paper on "Producers and Internal Combustion Engines;" and Mr. J. M. Smith, of Dumfries, now of Stirling, for his paper on the "Manufacture of Sulphate of Ammonia." The first prize—a handsome gold medal—had been awarded to Mr. MacLaren. The medal was presented by one of their worthy honorary members—Mr. A. Smith, of Tradeston. Mr. MacLaren had been an able member and a willing worker since he joined the Association two years ago. His paper was one apart from anything which they, as workers in gas-works generally, had ever had anything to do with; but a careful study of it would show that the gas-engineer would ultimately be required at sea. The second prize was presented by Mr. Walter Grafton, of Glasgow, who also gave, along with his book entitled "A Handbook of Practical Gas Fitting," a sum of money to form the nucleus of a prize fund. He had much pleasure in presenting the medal to Mr. MacLaren. Mr. Smith was unable to be present.

Mr. MACLAREN briefly returned thanks for the medal.

Bailie PAXTON, the Convener of the Gas Committee of the Glasgow Town Council, proposed "Kindred Associations." He said he was not, until the other day, aware of the existence of such an Association. He was sure that the Gas Committee would be pleased to hear of their existence; and he thought they would give a very great deal of encouragement to all young men in their employment to further their knowledge regarding the manufacture of gas. Perhaps he might remind them that in the Gas Department of their city they employed between 3000 and 4000 men; and he was sure they would agree with him that some little encouragement should be given by the department to such strenuous efforts on the part of young men in their employment to improve themselves. He did his best to get the Lord Provost to come to this gathering, but his lordship could not. The Gas Committee were willing at all times to spend money for the purpose of developing the great undertaking in which they were engaged. Some time ago, as they were aware, they had a Smoke Abatement Exhibition, got up, in great measure, by their able and worthy Manager (Mr. Alex. Wilson); and it was common knowledge that it was a remarkable success—financial and otherwise. He would like to emphasize the great success it was, in having increased enormously the sale of gas appliances. He was told that from Ayr to Edinburgh every gas undertaking had recently increased their sales immensely, and had benefited greatly by the Glasgow exhibition. To the young men he would like to say that it was very good to increase their knowledge by book-learning. It was all very good to get up the science of gas producing, to know all the intricacies of gas-works and of gas-producing plant; but this knowledge, in many cases, without some energy on the part of the individuals themselves, became latent. They were in a very happy position in Glasgow, in having such an institution as the Technical College, where a great deal of information could be obtained at little cost. He was going to say that in another department of the Corporation, young men joined the service who were able to pass a certain examination in education. These men were all but compelled to attend the schools. They did not pay for the education, but the Corporation of Glasgow paid for it. He could not see why some inducement should not be offered by the Gas Department to young men; and he promised them, as Convener of the Committee, that if any such proposal were made he should give it all the influence in his power to see it put forward and brought to a finish. A short time ago their revenue was over a million sterling. How was this secured? By efficient management; by an efficient staff, a devoted staff—an army of men who were doing their very best, and who were spending their leisure hours in attending classes, to fit them for their work. He had to couple the toast with the name of their Manager, in whom every member of the Committee had the utmost confidence. It said a very great deal for Glasgow that, with so many private and public gas undertakings in Great Britain, their Manager should have been appointed President of the Institution of Gas Engineers.

Mr. ALEX. WILSON, in responding, congratulated the Association on the way it was improving, and the success which was attending all its business. He had a good deal to do with the inception of the Junior Association in the West of Scotland; and he had never regretted it. The Junior Association was not only a great benefit to the members, but also to the managers; and it was also a great benefit to companies and corporations to have young men equipping themselves for their work in the way they were doing. The Junior Associations were going to benefit the gas industry. There were strenuous times before them; but they had sufficient grit in them to take them and keep them to the front. He was glad to have his Convener there that night, so that he might learn something of what they were doing. He was going to take the Convener at his word, and it would not be his fault if they did not secure benefit in some way from the Convener's promises. The Institution of Gas Engineers were to meet in Glasgow next year; and they hoped to be able to show them something in their works, as to how they managed their business in Glasgow—a business which, he made bold to say, was as successful as that of any other gas-works in the kingdom. The undertaking had been well managed in the past by the Gas Committee; it was well managed at the present time; and it was not their fault if the gas undertaking of Glasgow was not in the forefront.

Mr. J. NAPIER MYERS (Saltcoats) proposed "The Chairman," who briefly responded.

Society of Chemical Industry.—At the meeting of the London Section of the Society on the 2nd prox., three papers will be submitted on subjects in which readers of the "JOURNAL" are interested. They are: "The Testing of Incandescent Mantles," by Messrs. J. H. Coste and W. E. F. Powney; and "Radiation Errors in Flow Calorimeters" and "A New Still Water-Gas Calorimeter" by the first-named gentleman in association with Mr. B. R. James.

Book-Keeping for Gas-Works.—We have received from Mr. Charles Sandell a copy of the second edition of his "Book-keeping for Gas-Works," which has lately been published by Messrs. Eden Fisher and Co., Limited. In his preface, the author says that though he has no intention of claiming the great merit of novelty for his system, he ventures to offer it again in the light of a useful model, guide, and assistant, requiring no apology for its appearance; and he trusts that the book, which contains new matter evolved in the lapse of time, will be found useful to all who may be induced to consult its pages.

Industrial Pyrometry.—The concluding lecture of the series announced to be delivered at the Royal Society of Arts on this subject by Mr. C. R. Darling, F.I.C., was given on Monday evening last week, when attention was directed to the Féry radiation pyrometer, the Holborn-Kurlbaum and other optical pyrometers, and the Wanner pyrometer. The lecture closed with some observations on the special uses of radiation pyrometers in pottery manufacture and works at high temperatures. On the motion of Sir Henry Trueman Wood, the Secretary of the Society, who presided, a vote of thanks was accorded to Mr. Darling, who is one of the teaching staff of the Finsbury Technical College. The lectures are to be published in the Society's "Journal" during the Christmas recess.

EXTRACTING CYANOGEN FROM COAL GAS.

By M. E. MUELLER, of New York.

[A Paper read before the American Gas Institute.]

Before describing in detail the method used for the extraction of cyanogen at the Astoria works, the writer will mention the theory of the formation of cyanogen in the process of carbonization, the reasons for removing it from the gas, and the principles involved in the different methods of extraction.

Gas coals contain from 1 to 2 per cent. of nitrogen. In the process of carbonization, roughly one-half of this nitrogen remains with the coke; about one-third appears as free nitrogen in the gas; and approximately one-sixth is converted into ammonia. Besides these three principal outlets for the nitrogen, small amounts are found in the tar and in the form of hydrocyanic or prussic acid (HCN) which passes off with the gas.

Foster ["JOURNAL," Vol. XL., p. 1124] found with coal containing 1·73 per cent. of nitrogen that this became distributed as follows:—

In coke	49·90 per cent.
In gas	31·04 ,,
As ammonia	14·50 ,,
As cyanogen	1·56 ,,

M'Leod ["JOURNAL," Vol. XCVII., p. 748] reports the percentage of total nitrogen retained by the coke as varying from 30·2 to 89·6 per cent., with an average of 58·3 per cent. on eighty coals tested; nitrogen as ammonia, 17·1 per cent.; in tar, 3·9 per cent.; in cyanogen, 1·7 per cent.; and in the gas, 19·5 per cent.

Knublauch ["JOURNAL," Vol. LXVI., p. 1242] found that in the gas-works at Cologne 1·8 per cent. of the total nitrogen is converted into cyanogen.

The coal used at Astoria averages 1·35 per cent. of nitrogen, which is equivalent to 30 lbs. per ton. Of this, slightly over 5 lbs. (equivalent to 24 lbs. of sulphate) is converted into ammonia. The amount of cyanogen in the gas averages 110 grains per 100 cubic feet, or 1·73 lbs. per ton of coal carbonized. This is equivalent to 0·93 lb. of nitrogen, or 3·1 per cent. of the total nitrogen of the coal.

The commonly accepted theory regarding the formation of hydrocyanic acid is that it is a decomposition product of ammonia with the hot coke in the retort. This transformation takes place as follows:

$$\underset{\text{Carbon.}}{C} + \underset{\text{Ammonia.}}{NH_3} = \underset{\text{Hydrocyanic acid.}}{HCN} + \underset{\text{Hydrogen.}}{H_2}.$$

By passing ammonia over heated charcoal in a porcelain tube, Bueb ["JOURNAL," Vol. LXVII., p. 1033] found that hydrocyanic acid was formed, and that at temperatures ranging from 1472° to 2156° Fahr. the amount of cyanogen produced increased with the temperature. At the same time the decomposition of the ammonia into nitrogen and hydrogen increased with the temperature.

Bergmann, continuing the above investigation, found that diluting the ammonia with coal gas, and passing the mixture over heated charcoal, increases the cyanogen formed, and decreases the amount of ammonia broken up into nitrogen and hydrogen; and the most favourable temperature for the formation of cyanogen is in the neighbourhood of 1100° C. (2012° Fahr.). He also found that only negligible amounts of cyanogen are produced from the interaction of ammonia and carbonic oxide.

$$NH_3 + CO = HCN + H_2O.$$

The fact that cyanogen is a high-temperature decomposition product of ammonia, indicates that a high yield of cyanogen would be accompanied by a low yield of ammonia. This, however, is not necessarily true; nor do the results obtained at Astoria bear out this conclusion. The facts of the case probably are that a great deal of the ammonia formed during carbonization is decomposed before the gas leaves the retort—most of it into free hydrogen and nitrogen. If such conditions could be approached in the retort that only a small part of the ammonia formed would be decomposed, and all of this converted into cyanogen, high yields of both of these products would result. As a matter of fact, in the plants at Astoria, simultaneous high or low yields of both of these products have more frequently been the case than a high yield of one at the expense of the other.

There are two reasons for removing cyanogen from gas. In the first place, it is an objectionable impurity, and, secondly, if recovered in a suitable form it becomes a valuable bye-product. Cyanogen, if allowed to remain in the gas, becomes objectionable first in the purifiers. Here it combines with the oxide of iron to form ferrocyanide compounds; and the iron so combined becomes unavailable for the extraction of hydrogen sulphide. The purification records at Astoria show a great improvement in the amount of gas purified, per bushel per charge, after the extraction of cyanogen was begun. But, on account of the varying conditions in the purifying houses, some of this improvement may be due to other causes. The absorption of cyanogen by the oxide, although it has a detrimental effect on hydrogen sulphide purification, is beneficial in another direction. Spent oxide containing much ferrocyanide becomes valuable as a raw material for the manufacture of cyanogen compounds, and has a better sale than other spent oxide.

The purifiers, however, generally allow a considerable portion of the cyanogen to pass forward with the gas. When this happens, the cyanogen exerts a corrosive action on iron and steel with which the gas comes in contact. The blue colour, often noticeable on the outside of gasholder sheets—especially around leaky rivets—is due to cyanogen corrosion. The same corrosion takes place in service and house pipes, frequently resulting in a stoppage of the pipe.

The profit to be derived from the extraction of cyanogen depends on the market for ferrocyanides, as it is to these compounds into which the cyanogen is converted. The "Census Report" of 1905 gives the production of potassium ferrocyanide as 5,027,264 lbs., valued at $683,277, or about 13½ c. per pound. The importation from Europe of sodium and potassium ferrocyanide combined, for the two years 1908 and 1909, averages about 3,100,000 lbs.; bringing the total consumption in this country to about 8,000,000 lbs. Another authority estimates the consumption at 6,000,000 lbs. annually, with the production in this country somewhat over half this amount. Assuming a demand of 8,000,000 lbs. of potassium ferrocyanide, equivalent to about 3,000,000 lbs. of cyanogen, this, on a yield of 1¼ lbs. per ton of coal, could be supplied from the carbonization of 2,400,000 tons. If the recovery of cyanogen in gas-works and coke-ovens became general, the supply would be far in excess of the demand. Besides, there are other sources of ferrocyanides which must be taken into consideration. The old pot process, by which ferrocyanides were made by heating refuse animal matter (principally scrap leather) in iron pots with potash, is becoming obsolete; but large quantities of ferrocyanides are now being obtained from the residue of the beet sugar factories in Europe, which process is about to be introduced in this country. One of the principal uses of potassium ferrocyanide formerly was for the manufacture of potassium cyanide, which is used extensively in gold mining; but the manufacture of potassium cyanide from the ferrocyanide has been superseded almost entirely by synthetic processes. The prospect of the extraction of cyanogen becoming a very profitable operation for gas-works is not very good unless new uses for ferrocyanides are found. The principal use at present is for the manufacture of prussian blue, in dyeing and textile printing.

In order to understand the extraction of cyanogen from coal gas, it is necessary to know something of the chemistry of cyanogen compounds. Hydrocyanic or prussic acid (HCN), which is the form in which the cyanogen probably exists in the gas, is a very weak acid; its acidic properties being even less than those of carbon dioxide or hydrogen sulphide. This means that its power for combining with bases is less than that of the other two acids. A current of carbon dioxide passed through a solution of potassium cyanide will liberate hydrocyanic acid and form potassium carbonate. It is because hydrocyanic acid is such a weak acid that very little of it is absorbed in the ammonia washers as ammonium cyanide. Any ammonium cyanide formed would be decomposed by the carbonic acid and sulphuretted hydrogen in the gas, and hydrocyanic acid again set free.

Hydrocyanic acid in combining with iron, however, forms hydroferrocyanide acid, which is a stronger acid than either carbonic acid or sulphuretted hydrogen. If a solution of potassium cyanide is added to a solution of ferrous salt, there is first found a precipitate of ferrous cyanide—

$$\underset{\text{Potassium cyanide.}}{2KCN} + \underset{\text{Ferrous sulphate.}}{FeSO_4} = \underset{\text{Ferrous cyanide.}}{\underline{Fe(CN)_2}} + \underset{\text{Potassium sulphate.}}{K_2SO_4}{}^{*}$$

On adding an excess of potassium cyanide, the ferrous cyanide is dissolved, with the formation of potassium ferrocyanide—

$$\underset{\text{Ferrous cyanide.}}{\underline{Fe(CN)_2}} + \underset{\text{Potassium cyanide.}}{4KCN} = \underset{\text{Potassium ferrocyanide.}}{K_4Fe(CN)_6}$$

Potassium ferrocyanide is not a salt of hydrocyanic acid, but of hydroferrocyanic acid, which acid is formed as a white crystalline precipitate when hydrochloric acid is added to a solution of potassium ferrocyanide. Nor does potassium ferrocyanide possess the characteristics of hydrocyanic acid and its salts, the most pronounced of which is their extremely poisonous nature. Hydroferrocyanic acid being a stronger acid than carbonic acid or sulphuretted hydrogen, its salts are not decomposed by these two gases; and if conditions are such that salts of hydroferrocyanic acid can be formed, the hydrocyanic acid can be extracted from the gas, even in the presence of carbonic acid or sulphuretted hydrogen. This requires the presence of a ferrous salt with excess of alkali.

Another acid of cyanogen, that is stronger than either sulphuretted hydrogen or carbonic acid, is sulphocyanic acid (HCNS). In the presence of an alkali and free sulphur, hydrocyanic acid is converted into sulphocyanic acid, which, combining with the alkali, forms a sulphocyanic salt. It is on this principle that the process of the British Cyanides Company for the extraction of cyanogen from gas depends—

$$(NH_4)_2S + 2S + 2HCN = 2NH_4CNS + \overline{H_2S}.$$

* To distinguish between the insoluble and gaseous bodies in chemical formulæ, the following system is often used:—

A line over the formula indicates a gas—*e.g.*, $\overline{CO_2}$, $\overline{H_2S}$.

A line under the formula indicates an insoluble substance—*e.g.*, $\underline{Fe(CN)_2}$, $\underline{FeS}$.

A formula written without a line indicates a liquid or soluble substance—*e.g.*, KCN, $Fe(CN)_6$.

In the ordinary process of gas purification, a considerable portion of the hydrocyanic acid is absorbed in the purifiers. In the spent oxide cyanogen is found both as ferrocyanide and sulphocyanide. The amount of the latter compound, which is of little value, increases with the amount of ammonia in the gas; so that, in order to obtain spent oxide as rich as possible in the more valuable ferrocyanides, the ammonia should be removed completely. [See "JOURNAL," Vol. LXVI., p. 1294.] To extract the ferrocyanide from the spent material, the oxide is lixiviated with water to remove the soluble salts. The oxide is then treated with lime to convert the ferrocyanide present into calcium ferrocyanide, which is soluble and is separated from the oxide by filtration. From the solution, the ferrocyanide is precipitated by ammonium salts in the form of an insoluble double ferrocyanide of calcium and ammonium, which is converted into potassium ferrocyanide by treating with potassium carbonate.

The methods for the extraction of hydrocyanic acid from the gas in the wet may be divided into two general classes, according to whether the cyanogen is converted into a ferrocyanide or sulphocyanide. The latter process is that of the British Cyanides Company, and has made considerable headway in England. It consists in washing the gas with ammoniacal liquor to which sulphur has been added. The ammonium sulphide present in the liquor dissolves the sulphur to form a polysulphide $(NH_4)_2S_2$, which, reacting with the hydrocyanic acid of the gas, forms ammonium sulphocyanide (NH_4CNS).

$$(NH_4)_2S_2 + \overline{2HCN} = 2NH_4CNS + \overline{H_2S}.$$

The ammonium sulphocyanide is converted into either potassium cyanide or potassium ferrocyanide.

A great many different methods have been patented for the extraction of hydrocyanic acid from the gas in the form of ferrocyanide. All of them have this in common—namely, that the gas is scrubbed with an alkaline solution containing an oxide, hydrate, or salt of iron. These methods may be grouped under two classes, according to whether a fixed alkali, such as potash, sodium, carbonate, or lime, is used, or whether the gas itself supplies the alkali in the form of ammonia. Of the former class, only brief mention will be made. In this, according to the method of Foulis, the gas after being freed from ammonia is scrubbed with a solution of potassium of sodium carbonate containing oxide or carbonate of iron in suspension. The chemical reaction taking place is as follows:

$$2K_2CO_3 + Fe\underline{CO_3} + \overline{6HCN} = K_3Fe(CN)_6 + \overline{3CO_2} + 3H_2O$$

Potassium carbonate.	Ferrous carbonate.	Hydrocyanic acid.	Potassium ferrocyanide.	Carbon dioxide.	Water.

The cyanogen is directly obtained as a solution of potassium ferrocyanide, from which the salt is obtained by evaporation.

One of the first processes using the ammonia of the gas as an alkali for the extraction of hydrocyanic acid is that of Rowland. According to his method, an iron salt is added to the water used in the ammonia scrubbers. The cyanogen is absorbed as ammonium ferrocyanide, which remains in solution. Before distilling the ammoniacal liquor thus obtained, more iron salt is added, which, upon distillation of the liquor, combines to form an insoluble double ferrocyanide of iron and ammonia similar to the product obtained in the Bueb process.

The Bueb process, which is the one in use at Astoria, differs from Rowland's in that only a portion of the ammonia in the gas is absorbed with the cyanogen, the remainder being absorbed in the usual manner, and in that most of the cyanogen is obtained directly in an insoluble form. Briefly, the process consists in scrubbing the gas before the removal of the ammonia with a solution of ferrous sulphate (copperas). The reactions which take place are as follows:

First, the ammonia and hydrogen sulphide of the gas convert the copperas into ferrous sulphide (FeS)—

$$FeSO_4 + \overline{2NH_3} + \overline{H_2S} = \underline{FeS} + (NH_4)_2SO_4.$$

Ferrous sulphate.	Ammonia.	Hydrogen sulphide.	Ferrous sulphide.	Ammonium sulphate.

The ammonium sulphate formed remains in solution while the ferrous sulphide is in suspension. After the above reaction has taken place the hydrocyanic acid is absorbed, together with more ammonia by the ferrous sulphide, with the formation of an insoluble double ferrocyanide of ammonia and iron $[(NH_4)_2FeFe(CN)_6]$; hydrogen sulphide being liberated.

$$\underline{2FeS} + \overline{2NH_3} + \overline{6HCN} = \underline{(NH_4)_2FeFe(CN)_6} + \overline{2H_2S}.$$

Most of the cyanogen is converted into this insoluble double ferrocyanide, which is light yellow in colour. The double ferrocyanide is, however, partly decomposed by the ammonia and sulphuretted hydrogen in the gas into ammonium ferrocyanide (which is soluble) and ferrous sulphide. The black colour of the ferrous sulphide hides the yellow of the double ferrocyanide, so that the mud in the washer, instead of becoming yellow, is almost black. This decomposing of the double ferrocyanide may be expressed by the following equation:

$$\underline{(NH_4)_2FeFe(CN)_6} + \overline{2NH_3} + \overline{H_3S} = (NH_4)_4Fe(CN)_6 + \underline{FeS}.$$

Ammonium ferrocyanide.	Ferrous sulphide.

The ferrous sulphide thus formed can extract more hydrocyanic acid. The longer the material is left in the washer, the more soluble ammonium ferrocyanide is formed; but as it is the insoluble compound which is the final product desired, the material is left in the washer only long enough until it has absorbed sufficient cyanogen to combine with all the iron present in the form of the insoluble compound.

The mud as it is drawn from the washer consists, therefore, of insoluble ammonium, ferrocyanide, and insoluble ferrous sulphide; while in solution are ammonium sulphate, from the decomposition of the copperas and ammonium ferrocyanide, together with the compounds occurring in crude ammoniacal liquor. To convert the soluble ferrocyanide into the insoluble form, the mud is either boiled or made slightly acid with sulphuric acid. On boiling, the ammonium ferrocyanide reacts with the ferrous sulphide, as follows:

$$(NH_4)_4Fe(CN)_6 + \underline{FeS} = \underline{(NH_4)_2FeFe(CN)_6} + \overline{2NH_3} + \overline{H_2S},$$

while the action of the sulphuric acid accomplishes the same result, except that more ammonium sulphate is formed:

$$(NH_2)_4Fe(CN)_6 + FeS + H_2SO_4 = \underline{(NH_4)_2FeFe(CN)_6} + (NH_4)_2SO_4 + \overline{H_2S}.$$

In both cases the insoluble double ferrocyanide is formed and the mud changes colour from almost black to light yellow. The final products are, therefore, an insoluble, double ferrocyanide, and a solution of ammonium sulphate, which are separated from each other by filtration.

Only two raw materials are used for the process—viz., ferrous sulphate (copperas) and sulphuric acid. On a yield of 1·75 lbs. of cyanogen per ton of coal, there would be required theoretically 6·3 lbs. of copperas. The actual amount used for three months was 5·66 lbs., which is 90 per cent. of the theoretical. As the efficiency of the washers is about 85 per cent., the amount of copperas used is practically what would be theoretically expected. The quantity of sulphuric acid (oil of vitriol) used for neutralizing the mud is somewhat less than 1 lb. per ton of coal carbonized. The ammonia absorbed in the process is equivalent to from 4·8 lbs. of ammonium sulphate per ton of coal. About two-thirds of this appears as ammonium sulphate and one-third as insoluble ammonia in the press cake.

The cyanogen scrubbers at Astoria are placed after the naphthalene washer but before the condensers. They are 12 feet in diameter, and divided into five compartments. Four of these are filled with rotating wooden bundles, and are used for the extraction of cyanogen; while the fifth, at the gas outlet end of the washer, contains twelve perforated iron plates spaced about 3 inches apart. These plates also rotate with the shaft of the washer. The function of this compartment is to convert the ferrous sulphate into ferrous sulphide and ammonium sulphate. Experience has shown that this bay, which we call the agitator, is hardly ample for the work. With only twelve plates, and these not arranged so that the gas must pass between them, the copperas solution is not exposed to the gas sufficiently to convert it entirely into ferrous sulphide, in case it is necessary to empty more than two bays from the washer on the same day, and if the copperas solution is pumped forward into the bays filled with wooden bundles before this conversion is complete, it is almost sure to cause a stoppage.

At the side of the washer are two pumps driven from the engine which turns the bundles. The suction and discharge pipes of these pumps are arranged so that all the necessary operations of pumping the copperas solution into the washer, advancing it from one compartment to another, and discharging the mud after it has become saturated, can be done with them.

When the cyanogen washers were first put in use, it was found that the cyanogen absorption was far from being complete. In order to provide greater capacity, the connections on the last four bays of the naphthalene washers, which are placed immediately before the cyanogen washers, were changed, so that they could be used for the extraction of the cyanogen. This practically doubled the absorbing surface available for cyanogen extraction, and improved the efficiency. But even now, with the increased area for absorption, the washers will at times absorb as low as 50 per cent. of the cyanogen. Then, again, for no apparent reason, the efficiency will increase to 95 per cent. On the average, about 85 per cent. of the cyanogen is extracted. The extraction appears to be more complete in the cold weather than in summer, notwithstanding the fact that more gas is passing the washers. This is probably due, to some extent, to the greater condensation of water taking place during the warm weather, and consequent dilution of the absorbing material.

In explaining the operation of the Bueb system, as carried out at Astoria, it will be assumed that the washers are empty and about to be put into use. The copperas solution is made in concrete, waterproofed tanks provided with motor-driven paddles. Fresh water or wash water from the filter presses is put into these tanks and the requisite amount of copperas is run in from graduated hoppers. For every 700 gallons of water, which is the amount required to fill the agitator of the washers, 2400 lbs. of copperas is generally used. During the warm weather a little more copperas is used, to allow for the condensation from the gas, in order that the mud should not become too thin. The solution of copperas is pumped into the agitator bay of the cyanogen washers; the other bays being left empty until the ferrous sulphate has been converted to ferrous sulphide in the agitator by the action of the gas. This

is ascertained by drawing off a little of the liquor from the agitator, filtering, and adding a solution of ammonium sulphide (crude gas liquor) to the filtrate. If the filtrate remains clear, the conversion of sulphate to sulphide has been completed. The mud in the agitator is now pumped into the two preceding bays. The proportions of the washer are such that the capacity of the agitator is equal to two of the bays used for cyanogen absorption. The agitator is filled with a fresh solution of copperas. When this has been converted into ferrous sulphide, the mud in the preceding bays is pumped into the two bays ahead, and the agitator is again emptied into the two preceding bays and filled with fresh copperas solution. This operation is repeated until all the bays of the washer are filled. When the mud in the first two bays has become saturated, it is pumped to the storage tank; and the mud in all the other bays is moved forward, and the agitator again filled with copperas solution. To test whether the mud in the washer has absorbed sufficient cyanogen, a sample is taken and acidified with sulphuric acid. After stirring well, a drop of the mud is put on a piece of white filter-paper. Near it is put a drop of dilute ferric chloride solution, so that the liquid from the two drops as they spread out on the paper will come together. A blue colour occurring at the point where the drops meet is a sign that the mud contains an excess of ferrocyanide over iron, and is therefore ready to be drawn off. This test is very simple, and is made by the man who attends to the other operations of pumping, filling, &c.

In order to simplify the operation, some of the washers have been altered so that the flow of the absorbent liquid through the washer is continuous. The copperas solution is run into the agitator in a small stream, and the saturated mud overflows from the first bay. When the test of the mud in the first bay shows that it has not absorbed sufficient cyanogen, the copperas solution is stopped, and not run in until the material in the first bay is saturated. This makes the operation of the washer much easier, as the only pumping required is the filling of the overhead tank with copperas solution.

The mud from the mud storage tank is pumped into covered, lead-lined neutralizing tanks, provided with paddles, which keep the material agitated, where it is neutralized with sulphuric acid and heated to about 200° Fahr. The acid (oil of vitriol) is stored in a steel tank, from which it is forced by compressed air into small, lead-lined tanks resting on top of the neutralizing tanks. In these tanks, the acid is diluted with about three times its volume of water. The addition of acid changes the colour of the mud to light yellow. During this operation, large quantities of hydrogen sulphide are set free. In order that this does not escape into the room, the tanks are fitted with vent-pipes (connected to a fan) which discharge the gases out of the building. Enough acid is used so that the material is slightly acid to litmus. The mud is again tested for soluble ferrocyanide with ferric chloride solution on a piece of white filter-paper; and if the blue colour results, as it generally does, copperas solution is added (a few pailfuls at a time) until the blue colour no longer appears on testing. The action of the copperas is to precipitate the soluble ferrocyanide—

$$\underset{\text{Ammonium ferrocyanide.}}{(NH_4)_4Fe(CN)_6} + \underset{\text{Copperas.}}{FeSO_4} = \underset{\text{Ammonium-ferro ferrocyanide.}}{(NH_4)_2FeFe(CN)_6} + \underset{\text{Ammonium sulphate.}}{(NH_4)_2So_4}.$$

The mud now consists of insoluble, double ferrocyanide of ammonia and iron and a solution of ammonium sulphate with a little ferrous sulphate and very little free acid. This mud is pumped into filter presses. The pumps used for this are lined with acid bronze. After the press is full, hot water is pumped through, in order to wash out as much as possible of the ammonium sulphate. The wash-water, which is a very dilute solution of ammonium sulphate, is used for making-up the copperas solution. Even with a washing-press it is very difficult to wash out the ammonium sulphate. The best results are obtained by finishing the pressing with mud made by stirring up some of the finished press-cake with water until it disintegrates. The presses are about two-thirds filled with the neutralized mud from the washers, and then finished with the mud made from the finished cake. In this way, the gravity of the liquid coming from the presses is brought down from 8 to 10° Baumé to 1 to 2° before washing with water.

The solution of ammonium sulphate which runs from the filter presses is neutralized with ammonia. For this purpose, some of the mud as it comes from the washers is boiled, and the gases (principally ammonia and hydrogen sulphide) pass into the ammonium sulphate liquor from the presses. This not only neutralizes the free acid, but also precipitates the small amount of iron present. This is necessary to avoid discoloration of the sulphate. The neutralized liquor is allowed to settle and the clear solution evaporated in lead-lined pans. This solution contains approximately 1 lb. of ammonium sulphate per gallon. This sulphate separates out on evaporation, and is dried in a rotary drier by means of a current of air from a small blower heated by passing over steam radiators before going through the drier. About 2·5 to 3 lbs. of sulphate are produced per ton of coal carbonized.

The cyanogen cake from the filter presses is sufficiently firm to be handled with a shovel and bagged. It contains on an average by weight 50 per cent. of water, 20 to 24 per cent. of cyanogen, and 5 to 6 per cent. of ammonia. About 6 lbs. of press-cake are produced per ton of coal carbonized. When the cake first comes from the presses, it is yellow in colour; but on contact with air it rapidly turns deep blue, due to oxidation.

The cake as it comes from the presses is bagged and sold to chemical works, where it is converted into potassium or sodium ferrocyanide. This is done by boiling with a solution of caustic potash or soda, whereupon the ammonia distils off and ferrocyanide of potash or soda is formed. This is filtered from the residue of iron hydrate, evaporated, and purified by recrystallization.

Appendix.

Estimation of Cyanogen in Coal Gas.—To determine the amount of cyanogen in gas, the cyanogen is converted into potassium ferrocyanide by passing the gas through a caustic potash solution, containing freshly precipitated ferrous hydrate in suspension. After filtering the potassium, ferrocyanide is determined in the clear solution by acidifying and titrating with a standard solution of zinc sulphate until all ferrocyanide has been precipitated as zinc ferrocyanide.

The end reaction is determined as follows: A drop of a 1 per cent. solution of ferric chloride is put on a piece of white filter paper absolutely free from iron. A drop of the liquid being tested is then put on the paper, near the drop of ferric chloride, so that the liquor as it spreads out on the paper will come in contact with the ferric chloride. Care must be taken that the precipitate of zinc ferrocyanide does not come in contact with the iron solution. As long as there is any ferrocyanide left in solution, a blue colour will appear where the two drops come in contact, due to the formation of prussian blue. When all ferrocyanide has been precipitated the colour will no longer appear, which indicates the end point of the titration.

The zinc sulphate solution is made by dissolving approximately 5 grammes of c.p. zinc sulphate ($ZnSO_47H_2O$) in 1 litre of water with the addition of 10 cc. of sulphuric acid. This solution is standardized with a potassium ferrocyanide solution (10 grammes c.p.—$K_4Fe\ (CN)_63H_2O$ per litre). Then 25 cc. of the potassium ferrocyanide solution are put into a beaker and titrated with the zinc sulphate solution; the end reaction being determined as above. One cc. of the ferrocyanide solution is equivalent to 0·0570 grain of cyanogen, from which the value of the zinc solution is calculated.

To test for cyanogen in gas, put 15 cc. of a 10 per cent. ferrous sulphate ($FeSO_47H_2O$) solution into each of three wash-bottles. Add 15 cc. of 20 per cent. caustic potash solution to each bottle, and pass about 3 cubic feet of gas through these bottles at the rate of about 1 cubic foot per hour. Rinse the contents of the bottles into a beaker; add 20 cc. more of the caustic potash solution; and heat to boiling. Filter and wash with hot water until a few drops of the filtrate no longer show a blue colour when acidified and tested with a drop of 1 per cent. ferric chloride solution. Transfer the filtrate to a 500 cc. graduated flask, dilute to the mark, and shake well. Take 100 cc. of this solution and transfer to a beaker by means of a pipette. Slowly add dilute sulphuric acid (1·5), stirring constantly until the solution shows slightly acid towards litmus. Then run in the zinc sulphate solution, a few drops at a time, until the drop-test, as explained above, shows that the ferrocyanide has all been precipitated. From the amount of zinc sulphate solution used, the quantity of cyanogen in the gas is calculated.

The method used to determine the percentage of cyanogen in the press-cake is similar. A sample of cake (about 10 grammes) is boiled with caustic potash solution, during which operation the ammonia distils off, and may be estimated by absorbing in standard acid. In this way, the ferrocyanides are converted into potassium ferrocyanide. The solution is made up to 1 litre in a graduated flask, allowing 5 cc. for the solid matter, filtered, and the cyanogen determined in an aliquot part of the filtrate.

GAS AT THE SCOTTISH NATIONAL EXHIBITION

In Glasgow next May.

High-pressure gas lighting at the Exhibition of Scottish History Arts, and Industry, to be opened in May next in Glasgow, will, it is understood, bear a very important part in the general lighting and illumination scheme of the grounds. The general lighting covers the introduction of 130 single-mantle inverted lamps of 1500-candle power. The lamps will be fitted on standards, the design of which will be in keeping with the decorative scheme of the building. The standards are of two designs—one being for a single lamp and fitted with a suitable swan-neck, the other to carry three lamps and fitted with a well-designed bracket. The compressing plant—in a building by itself and situated directly opposite the Industrial Hall—will consist of two compressors coupled direct to two gas-engines. Each set will be capable of dealing with the lighting load by itself. A feature of the plant is the pressure regulating and bye-pass valve which is built directly on the body of the compressor—thus making it very accessible, and the plant exceedingly compact. The entire equipment will in some respects be novel; and it should prove both interesting and instructive. Messrs. James Milne and Son, Limited, of Edinburgh, have been entrusted with the contract for the installation; and the scheme (prepared to the plans and specification of Mr. A. Crighton Freeman, the Chief Engineer to the Exhibition Authorities) is already taking shape on the grounds, and will be finished well up to time for the opening day.

FIRE-BRICKS.

By E. M. Stewart, of the Bonnyside Fire-Brick Works.

[Abstract of Paper read before the Scottish Junior Gas Association, Eastern District, on Dec. 10.]

In my paper to-day, I propose to give some general details, and also to deal with points regarding which definite conclusions have been reached; and in doing so, I shall use the simplest and least technical language possible, so that even those unacquainted with chemical formulæ may understand the points raised.

In some districts—particularly in Wales—fire-clay and silica clay are worked open-cast; but fire-clay is seldom found in sufficiently pure form near the surface in this district to be worked in such a manner, and therefore pits have to be sunk, the depths of which vary considerably. In our Bonnyside and Russell pits, the clay is found at a depth of about 70 feet from the surface. Including coal, fire-clay or aluminous clay, and ganister or silicious clay, the total height of our working face is about 20 feet. A small rib of ironstone or brownstone found immediately below the coal, is the distinguishing feature of the particular deposit of refractory materials which exist in this district. Every precaution has to be exercised underground, so as to prevent the different seams of fire-clay and ganister clay being mixed, and particularly to prevent the admixture of coal with either. During the mining operations, the fire-clay, being soft, is broken up into small pieces, and, as a rule, without further treatment can be filled direct into the grinding-pans in the state in which it arrives at the pit-head. But the ganister clay, being extremely hard, has first of all to be put through stone breakers and crushed into small pieces.

Owing to the diversity of purposes for which the material is required, and the varying conditions it has to withstand, the greatest care has to be taken with the mixture and the selection of the clays. In some parts of furnaces, bricks made of highly aluminous clay have been found most satisfactory; while in others, the very opposite has been found to be the case. Users, therefore, when ordering bricks, should particularly specify for what class of furnace, and for what portion of the furnace, the various sizes are required. With this information before them, fire-brick manufacturers would be in a much better position to supply suitable material. As an illustration, ganister brick has been found, when used in the crowns of puddling-furnaces, and for certain parts of gas-works furnaces, to last very much longer than any quality of fire-clay brick; but this brick would be entirely unsuitable for portions of furnaces in contact with the metal.

The grinding, sifting, picking, and pugging of the clay, before it is ready for milling, should always be one of the most carefully supervised departments. The question of totally displacing hand labour during these operations has been for long a debatable point. Where entirely mechanical methods are adopted, the result is that all the impurities which the seam of clay may contain are ground up with the clay; whereas these are detected and rejected when this part of the manufacture is carried through by hand labour. I have for a long time considered the possibility of introducing machinery which would automatically reject such impurities, but so far have not discovered any method which is so entirely satisfactory as intelligent hand labour. After the material is ground, sifted, and pugged, or milled, into a plastic condition with water, it is carried to the moulder's bench, and subsequently the moulded bricks are deposited on the drying floor, where they remain for a few days, during which period the greater part of the added water, used during the milling process, is expelled. When sufficiently dry, the bricks are taken from the drying floor, and conveyed to the kilns to be burned. This latter process occupies from eight to twelve days, dependent upon the size, quality, and shape of the material which the kiln contains. If, in addition to the ordinary size of brick, the kiln contains large and difficult shaped blocks, the greatest care has to be taken, both in the initial drying stage and also in the subsequent cooling of the kiln. One of the most fruitful sources of failure in gas-works construction is improperly burned material. This very often is not entirely the fault of the brick manufacturer, but of the gas engineer, who, delaying till the last moment ordering his material, wishes delivery so promptly that it is impossible to thoroughly dry and burn the material and meet his views as to delivery. The question of reducing the cost of milling and drying has been one which has received the careful attention of fire-brick manufacturers for a considerable time; and some firms have endeavoured to cheapen the process by manufacturing their bricks by machine, instead of making them by hand. The suitability of the manufactured material, however, has been, and will continue to be, the deciding factor; and at the present time the hand-made article retains its old popularity. The table shows the extent of this industry in the United Kingdom for a considerable number of years.

Year.		Clay Milled. Tons.	Value.
1873	Scotland	232,952	Cannot be stated.
	United Kingdom	1,452,864	do.
1880	Scotland	305,139	do.
	United Kingdom	1,938,539	do.
1890	Scotland	607,865	£116,153
	United Kingdom	2,543,192	546,500
1900	Scotland	783,306	143,364
	United Kingdom	3,136,624	615,951
1905	Scotland	1,650,129	231,291
	United Kingdom	3,261,251	714,886
1909	Scotland	985,171	212,888
	United Kingdom	3,104,627	668,821

Comparisons between the methods adopted in this country and in Germany have recently been frequent; but so far as my own personal knowledge goes, the volume of fire-brick material imported into this country from German sources has been extremely small —in fact, so small that it might be said that it has only been for trial purposes, and that from the strictly commercial point of view imports have been *nil*. There has, however, been one striking exception. I refer to the importing of bricks for lining patent bye-product coke-ovens, of which, owing to the failure of British material in past years, large quantities have been imported. I am pleased to state, however, that, as a result of careful tests and exhaustive experiments, we were able some years ago to manufacture a brick in all respects equal, if not superior, to the best foreign material imported into this country for such purposes.

Before passing from this comparison of British and foreign materials, I may state that I have made exhaustive inquiries, both at home (in large, medium-sized, and small works) and also in Germany itself, as to the relative merits of the two classes of retorts; and I am pleased to state that the consensus of opinion has been strongly in favour of British material. Though personally with a limited experience of retorts, it seems to me that the longer life of the German retort is partly accounted for by the greater stability and protection of the surrounding and supporting brickwork.

The term fire-brick is a comparative one, as all bricks to a less or greater extent are heat-resisting. For commercial purposes, however, bricks which have a fusing point under 2000° Fahr. would not be considered in this class. Those having a higher melting-point might be divided into lower-class fire-bricks, with a fusing-point of 2500° Fahr.; good fire-bricks, with a melting-point up to 2700° Fahr.; and high-class fire-bricks, with a melting-point reaching 3200° to 3300° Fahr. Experiments have shown that, for a really first-class fire-brick, the relationship of silica and alumina should be about two to one, with a total percentage of impurities of not more than 4 to 5.

The following are particulars of the chemical analysis of various classes of bricks.

	Silica.	Alumina.	Iron Peroxide.	Alkalies. Loss, &c.
West of Scotland	55·10	35·76	2·50	2·64
Stourbridge	67·00	25·80	4·90	2·30
Stourbridge	58·48	35·78	[illegible]	0·72
Newcastle	59·80	27·30	6·90	6·00
Local	62·50	34·00	2·70	0·80

When, however, determining the suitability of a high-class fire-brick, in addition to the above chemical analysis, there should be taken into account the physical condition in which the various constituent elements are found. The silica and alumina may be found as a silicate of alumina, or the silica may be found as free silica. Both silica and alumina are only fusible at extremely high temperatures; alumina being capable of resisting a temperature of about 3350° Fahr., and pure silica a temperature of about 3320° Fahr. Commercially speaking, however, neither material is found in an absolutely pure condition. As seen from the foregoing analyses, they usually contain a small percentage of oxide of iron and other impurities. In connection with these impurities, I cannot do better than quote the result of Richter's epoch-making experiments, which established that fluxes, lime, magnesia, &c., decrease the heat-resistance of a fire-clay in inverse proportion to their molecular weights. The most dangerous impurity is found to be magnesia, whose molecular weight is 40, followed (in order) by lime 56, soda 62, iron oxide 80, and potash 94. Titanium is also found in some clays; and its presence even in very small quantities has a most adverse effect on the fusibility of bricks.

As already stated, however, it has for long been recognized that chemical analysis is not an absolutely true index to the refractoriness of a brick, but that the geological or physical condition of the various component parts has also to be taken into account—clays of which the grains are coarse being found to be the best for heat resistance. But the heat-resisting power is not the only point that should be taken into account, as sometimes, even when fire-bricks with an extremely high melting or fusing point are used, serious trouble takes place in gas-works, caused by the shrinkage, softening, or contraction and expansion of the bricks with which such furnaces are built. It may therefore be of interest to refer to some of these points.

Shrinkage on different qualities of clays varies considerably during manufacture. After being moulded, and while lying on the drying floor, the greater part of the added or mechanical moisture is expelled, with a consequent shrinkage; but this contraction is further continued during calcining or burning of the brick in the kiln. The extent of the shrinkage during the calcining process depends entirely on the heat to which the furnace is raised; and unless the bricks are thoroughly and well fired, further contraction will take place in the furnace arch or pillar after the gas engineer has built them in, and thereby cause entire destruction of the brickwork. It should therefore be one of the first conditions laid down by gas engineers that only bricks which are burned at a high temperature should be accepted. Our kilns here are raised to a temperature of about 2700° Fahr., at which they are maintained for a considerable time, thereby entirely

eliminating shrinkage. Some clays which are extremely high in alumina are subject to such a large amount of shrinkage as to be almost unworkable; but this to some extent may be counteracted by the admixture of a large percentage of grog, or calcined ground brick. This admixture of grog is used to a greater or less extent in connection with all clays. Softening takes place very often in furnace-arches, and also in pillars subjected to high heats, where, though the brick shows no signs of fusing or melting, the softening point may have been reached, with the result of the settling down of the arch or the collapse of the boiler. In Scotland, gas engineers do not come much in contact with bricks which show a great expansion while subjected to intense heats. This defect is most plainly seen in bricks made in the Sheffield district, and in Welsh silica bricks. The result is that though having a high fusing and softening point, owing to the extreme variation of expansion or contraction, they are unsuitable for furnaces where rigidity is requisite.

Another point which sometimes causes failure of otherwise suitable material is want of care on the part of the brickmaker in drying and calcining, with the result that only the outside portion of the brick or block is thoroughly calcined—the inside showing a dark coloured mass. This is caused through the mechanical moisture not being completely driven off on the drying floor, or in the initial stage of burning in the kilns, with the result that the outside of the brick becomes calcined and prevents the inside being subjected to an oxidizing heat. Owing to the thinness of ordinary sizes of fire-brick, such a defect is seldom found in hand-made bricks; but it is one of the bad features of machine-made bricks. The danger, however, of such a defect taking place in large blocks is much greater; and gas engineers who require large-sized blocks should order these a considerable time beforehand, so that they may be thoroughly dried previous to being burned. In this connection, it is well to keep in mind that very large sized blocks are neither suitable nor economical from any point of view.

It has been a matter of complaint—especially among gas engineers—that fire-brick manufacturers have not applied themselves to the scientific side of their branch of manufacture so much as might have been done, especially in connection with analysis and tests for heat-resistance. I have no doubt that this aspect would have received greater attention had fire-brick yards been in the happy position of monopolists, such as gas-works are. Another point which has to be remembered is that tests for heat-resistance are of comparatively little value when conducted at lower heats than about 2700° Fahr.; and the trouble with the brick manufacturer in the past has been that scientists have not been able to devise methods for testing such high temperatures which could be continuously and economically used by fire-brick manufacturers. The introduction in recent years of the Féry radiator and similar types of pyrometers has somewhat simplified this matter. In our works, as tests for heat-resisting purposes, we have found it most economical, as well as reliable, to use Seger cones. These are small triangular pyramids of highly infusible earth, with certain graded melting points.

In the paper which Mr. F. J. Bywater read before the Institution of Gas Engineers in 1908, he complained that, while within the last twenty years there has been an increase of the working temperature in gas-works of about 200° Fahr., he did not think that the fire-brick manufacturers had, to a corresponding extent, increased the heat-resistance of their materials. This complaint may have some foundation; and it might be inferred that it is possible for a fire-brick manufacturer to increase the refractoriness of his clay at will, in the same way as the gas engineer during the last twenty years has improved his method of carbonization. Such inference, however, fails to take into account that fire-clay is a product of past ages; and, while differing somewhat from coal deposits in that it can be slightly improved by man (by such processes as weathering), still, like coal, it may be of good, bad, or indifferent quality, and no amount of treatment of a commercial character will make it otherwise.

I await with interest the report of the Refractory Materials Committee, which I suppose will be the results of experiments and tests of a certain number of refractory fire-clays.* If my supposition is correct, I do not think it would be wise for all fire-brick manufacturers to accept such a report, as each particular deposit of clay has its own peculiarities, which can only be discovered by exhaustive and continuous tests.

Discussion.

Mr. Stewart remarked that the subject had been under their notice, because of the communications in the Press upon it. He was there to learn what gas engineers wanted in the way of brick-making. If they did not agree with any of his theories, he should be most happy to hear their views, as he had not arrived at what he might call an ultimate analysis.

The President (Mr. Walter Dunlop, of Kirkcaldy) said one thing which struck him during the reading of the paper was Mr. Stewart's statement about making clear the nature of the work to be performed by the bricks ordered. This was a very reasonable position to take up. Not so many years ago, no account at all was taken of this. Simply, fire-bricks were ordered; and fire-bricks were the same for all purposes. But fire-brick manufacturers were progressive to such an extent that, if users told them the nature of the work to be performed they would produce an article for that special purpose. Another point made by Mr. Stewart was the giving of sufficient time in ordering goods. The best results would be obtained if they gave brick manufacturers plenty of time to get the goods prepared. It must be evident to them all that at least one fire-brick manufactory in Scotland was conducted on scientific lines, and in which their requirements were met in every way. He proposed a vote of thanks to Mr. Stewart for his paper.

Mr. W. Geddes (Granton) thought it was a very reasonable claim which Mr. Stewart made, that orders should be placed well in advance of the material being actually required. He quite agreed that, with bricks for various portions of a setting, it should be specified which particular part they were required for. It stood to reason that a brick needed for a special purpose should be manufactured in a particular way. Mr. Stewart's opinions about hand labour were the general ones.

Mr. H. F. Doran (Granton) asked Mr. Stewart's opinion as to the effect of the high percentage of iron in the Newcastle clays, in comparison with the percentage of oxide in the Scotch clays. With regard to the use of the Féry pyrometer, he had had some experience with this apparatus at Granton; and he would like Mr. Stewart's opinion upon it. He would re-echo the views of the gentlemen who had spoken as to the ordering of bricks in plenty of time. It was most desirable, in connection with the chemical composition of the bricks, that they should have plenty of time to dry. If they were quickly dried, the outside got hardened, which prevented the oxidizing of the material in the interior.

Mr. J. Mitchell (Dundee) thought, with reference to German retorts, that too much had been said about them. If retorts manufactured either in Scotland or in England were put into a proper setting, and the settings properly watched, they would be found to be all that was necessary. Looking after the construction of the producer was a very important point in a gas-works. They should ask for the right kind of brick, and, when they got it, put it into the right place. Fire-clay goods should be ordered at the beginning of the year. If they obtained the material early, they would find that they had the whole summer in which to go ahead with the repairs. Could Mr. Stewart give them a comparison of the Scotch and the German clays?

Mr. Stewart, in reply, said that Newcastle clays were found along with the coal seams which abounded in that district; and the clay was what they called in the fire-brick world weak clay. They would understand the quality of it when he told them that they had, from the Bonnyside works, daily supplies going into the North of England, to users who had intense heats, and who found it profitable to buy first-class Scotch material, even if it cost double the price of local bricks. Iron mixed with potash seemed to him to be one of the greatest and deadliest foes of heat-resistance—at least, they found these two materials having the greatest effect on the heat-resisting power of fire-bricks. As regarded the Féry pyrometer, he was glad to find one in the gas industry who had begun taking—continuous, he hoped—records of the heat generated in his furnaces. The usual complaint received by the fire-brick manufacturer was that his bricks had given way in a certain part of the furnace; but when inquiry was made as to what heat had been generated in this particular portion of the furnace, there was an absolute want of knowledge. Were more careful and more accurate heat measurements taken of the different parts in gas-furnaces, fire-brick manufacturers would be able to supply for these particular parts bricks which would withstand the special conditions which were there found. In their own works, they had made experiments with Féry pyrometers; but, after very careful consideration, they found that their present system of using Seger cones was the best. Their furnaces, of course, differed considerably from those in gas-works. In gas-works furnaces, there was not the large body of material being calcined which there was in a fire-brick kiln. With a Féry radiation pyrometer, they would only ascertain the heat in the particular part of the furnace under observation; whereas Seger cones could be placed all over the kiln which was under fire, and careful examination made after the kiln had been fired. The cones being set with different graded melting-points, gave almost absolutely accurate results. He might say, however, that he was still looking for a perfect heat recorder which would at the same time be sufficiently economical to allow fire-brick manufacturers to adopt it. He quite agreed with Mr. Mitchell regarding German retorts. The *crux* of the question was the setting of the retorts, and the care of the gas engineer in the regulating of the heats. If this part of the work was carefully supervised, it would be found that English or Scotch retorts would last as long as those from anywhere else on the globe.

In the December number of the "Occult Review," Professor W. F. Barrett, F.R.S., has an article on the divining or dowsing rod. He examines at considerable length what evidence there is that will stand the test of strict scientific inquiry to show that the "dowser" is of any use in locating the site for a well. The conclusions the author arrives at after investigating many cases are, briefly, that those who really possess this curious faculty are rare, and that the explanation of the success of good "dowsers" is a matter for physiological and psychological research, though provisionally the working hypothesis of "unconscious clairvoyance" may be entertained.

* The report referred to has been issued since the paper here reproduced was read. See *ante*, p. 839.—Ed. J.G.L.

WELLINGBOROUGH WATER-WORKS AND SOFTENING PLANT.

By E. YOUNG HARRISON, Assoc.M.Inst.C.E.

[Extracts from a Paper read before the Association of Water Engineers, Dec. 9.]

In October, 1870, the Wellingborough District Council purchased an acre of land on the side of a hill at Bushfield, 1½ miles north-west of the town, for a new water supply; and a well 9 feet diameter and 25 feet deep was sunk on the site. This well (No. 1) was never very satisfactory, owing to the large quantity of sand with which it was continually choked. In 1878, another well (No. 2) was sunk about 60 feet to the south of No. 1, when a comparatively abundant supply of pure and wholesome water was immediately obtained. No. 2 well is 35 feet deep, and brick lined; the lining being carried up 5 feet above the surface of the ground and rendered outside with cement mortar. The yield of water from this well is from 16,000 to 21,000 gallons per hour, depending upon the rainfall.

In 1899, with a view to supplementing the supply, new works were constructed at Hardwick, including a new well, catchment tank, and pumping-station. From 6000 to 13,000 gallons per hour are pumped by three-throw pumps, having 6¼-inch rams, 8-inch stroke, driven by a 24-B.H.P. gas-engine with suction-gas plant. The water is delivered to the circular tank at Bushfield to be softened and filtered.

In order to obtain an accurate regulation and measurement of this water on delivery to the new softening plant, a pump was provided in the Bushfield Well pump-house, capable of passing 8000 to 12,000 gallons per hour from the circular tank to the bell-mouth of the softening tanks as reuired.

In his report on the new scheme, the author pointed out the comparative advantages and disadvantages of electricity, town gas, suction gas, and steam respectively for pumping; but the members will be so familiar with these points that it is unnecessary to elaborate them here. The estimated working costs in each case, being, perhaps, peculiar to the locality in which the works are situated, may, however, be of interest for purposes of comparison with those obtained elsewhere. The figures were based upon a maximum output of 45 B.H.P. for an average working day of ten hours. The cost of labour is not included; for whatever power was installed, the wages-sheet would not be materially affected. Electricity, reckoning 0·9 unit per B.H.P. hour, at 1¼d. per unit, equals £2 2s. 2d. per day. Town gas, on the basis of 24 cubic feet (650 B.Th.U.) per B.H.P. hour, at 1s. 10d. per 1000 cubic feet, equals 19s. 10½d. per day. Producer gas, on the basis of 1½ lbs. of anthracite beans per B.H.P. hour, at 30s. 1d. per ton, equals 9s. 0¾d. per day. Steam on the basis of 5 lbs. of coal at 16s. 6d. per ton, per B.H.P. hour, equals 16s. 6d. per day. The figures would be correspondingly lower if it were possible to run the pumps at normal rate with a full and continuous supply of water; but this unfortunately is not the case. During a considerable portion of the year, the pumps and engines are often working at half-load.

The author, in his report, advised the erection of a new pumping plant to include a three-throw pump, capable of pumping 40,000 gallons of softened water per hour to the reservoirs, with gas-engine and suction-gas producer plant of sufficient size to provide motive power also for No. 1 well pump and the water-softening machinery; also that the existing pumps in the No. 2 well, should be kept intact as a duplicate pumping plant. The report was adopted; and in November, 1907, the new installation was completed. It has since given every satisfaction; and the Council's expectations have been fully realized.

The softened water pump is a horizontal three-throw ram pump, having cast-iron rams 10 inches in diameter by 15-inch stroke. The pump is driven by means of a 57-B.H.P. horizontal gas-engine. The gas-producer plant uses Welsh anthracite nuts. The amount of water available being variable, it was necessary to provide that the pumps should be able to pump 20,000 gallons per hour, or half the normal rate as required. This is accomplished by reducing the speed of the gas-engine 25 per cent., and throwing No. 3 ram out of action by closing the suction valve with a screw. The engine is started by compressed air; the apparatus consisting of a belt-driven air compressor, which charges a receiver up to 150 lbs. per square inch, while the engine is at work; the receiver holding sufficient air for some half-dozen charges.

In January, 1906, the author was instructed to report upon the softening works at Bushfield. The report clearly showed that the existing Atkins softening plant and the Soar filters were not only inadequate for the present needs, but were imperfect in mechanical detail, and that a new plant was required. The Council, on the author's advice, adopted the continuous system, with mechanical arrangements, devised and patented by Mr. C. J. Haines—a plant which, while operating on the same principle as the Atkins plant, was more easily adaptable to the existing site, buildings, and machinery, and involved a smaller initial outlay, as well as less maintenance costs, than any other system of water softening. [The author described the process; and then gave details of the filters, three in number, and of the Haines type.] Each filter is capable of dealing with between 10,000 and 12,000 gallons per hour, and contains an effective filtering area of 540 square feet, occupying a floor space of 8 ft. by 4 ft. [Details were next supplied of the cleaning apparatus, in connection with which the information was given that the average life of the filter cloths at Wellingborough is about nine months.] Two sets of cloths are provided for each filter; each set being in use for three months. Before the cloths are removed, they are steamed and left on during the night to thoroughly dry. They are then taken off, well brushed, beaten, and carefully packed away ready for further use.

Two regulating-pumps are fixed in conjunction with the Hardwick pump and well pump respectively; No. 1 being a 3½-inch diameter horizontal double-acting pump, and No. 2 (or well) regulating pump is also a double-acting one, 3¾ inches diameter.

The quantity of lime water required to reduce the hardness of the water from 33° to 14½° is found to be 13 gallons per 100 gallons of water softened.

The wash-outs to the cylinders, filters, and softening tanks are connected to mains discharging into large open pits. The top water when clear is drained off to No. 1 well. The deposit, after drying as far as possible, is barrowed about 20 yards immediately below the site. The accumulation is carted on to adjoining lands once a year at the Council's expense. A more favourable method of disposal might be found if the lime was not so greatly discoloured by the iron present.

The water is regularly tested by means of the soap test, and phenolphthalein is also used for the detection of free lime in the clear-water trough. During the seven days' test under the guarantee of the patentee (Mr. Haines), the hardness of the water at the reservoirs did not vary ½°.

Several appendices accompanied the paper. In the first it is stated that the capital cost of the new works at Bushfield was £5350, divided between softening plant, £3008, new machinery, including clear-water tank, £1700, additions to buildings, foundations, £642. The contract price for the reinforced concrete tank, 40,000 gallons capacity, was £315; the lowest alternative price for the tank in ordinary concrete was £434. The total saving on the two power plants for the first year's working, over the average cost of the two preceding years, amounted to £348; the cost of softening has decreased from 0·79d. to 0·66d. per 1000 gallons, through saving in cloths, lime, &c.; and on the amount pumped last year this equalled £45.

In the second appendix, it is shown that the total cost of softening per 1000 gallons, and reducing the hardness from 33° to 14½° is 0·660d., or ⅝d. Dr. Thresh stated, in his report, "that the quantity of Buxton lime required to soften this water is 2·45 lbs. per 1000 gallons; but as it is impossible to get the whole of the lime in solution, 3 lbs. is about the quantity to use." The figure for lime is therefore satisfactory. If the weight of stones taken out of the lime mill is deducted, the amount per 1000 gallons is 2·73 lbs.

From the third appendix, dealing with power and fuel, it is gathered that the average load equals 36 B.H.P. The coal consumption under this load—*i.e.*, two-thirds full load, averages 0·94 lb. of anthracite per I.H.P., or 1·11 lbs. per B.H.P. hour. On reducing the whole pumping cost for the year to March 31, 1910, to one basis, the cost for fuel alone was 0·14d. per 1000 gallons raised 100 feet; the price of coal being 30s. 11d. per ton at the works.

The fourth appendix contains an analysis of the water by Dr. Thresh. In a note he remarks: The water is efficiently softened and is not deteriorated by its passage through the mains. The only change that has taken place is an increase in the temporary hardness, due to calcareous matters in the mains. The softening has reduced the hardness of the water in the reservoirs to within 2° of the permanent hardness.

Discussion.

Mr. W. MATTHEWS (London) said he knew something of these works; and, in general terms, he was bound to say he congratulated the author of the paper very much on the thorough success he had made of them. The particular water he had to deal with was of an extremely difficult character; and possibly there was nothing like it in the country. He (Mr. Matthews) should have thought that, owing to the considerable quantity of magnesia in the water, and added to that the large amount of carbonate of iron, it would have been next to an impossible water to have filtered out with softening by the process of mechanical filters. However, the problem had been thoroughly tackled; and the result was an eminently good one. The water was over 30° of hardness, and it was brought down to 15½° at the end. The cost came out to about ⅝d., and this was considerably less than he (Mr. Matthews) would have dared to have estimated for if he had been starting the scheme. He should have thought it would have been ¾d., and that it might have run up to 1d. The author told them that the hardness of the water in the reservoirs during the test did not vary ½°. This was a good result, and was not usually obtained with mechanical processes. With regard to the coal consumption, under two-thirds full load it averaged 0·94 lb. of anthracite per indicated horse power. He should think that the anthracite was exceedingly good; and it was certainly an excellent result. The author gave them the amount of saving in coal of the two preceding years as equal to £348. He also showed that repayment and interest only amounted to £135; so that, by scrapping the old plant and putting in this new one, his Authority had saved £150 to £160 a year. This was one of the points of which notice should be particularly taken.

Mr. C. H. ROBERTS (Southampton) asked the reason for putting down the Hardwick pump. It appeared to him that the water in

the circular tank coming from Hardwick was at such an elevation that it would have discharged itself by gravity into the softening tank. It occurred to him that, instead of pumping into the softening tank, some other means might have been arranged for a definite quantity of softened water to go to the lime-water cylinders at the same time; and it also occurred to him that, instead of putting a pump there, a hydraulic motor worked by the difference in head between the circular tank and softening tank would have been sufficient to work the regulating-pump. With reference to the use of electricity, town gas, steam, and suction gas, the author remarked that the members were so familiar with the disadvantages and advantages of these different means of power for pumping, that he would not mention them. He (Mr. Roberts) for one would have liked to have seen some particulars of the disadvantages and advantages. Of course, with a small plant of this kind, steam was at a disadvantage; but he often thought that steam was unjustly compared with (say) suction-gas pumping plant, and for this reason: An old and obsolete pumping plant existed at a station; and it was certainly ready for scrapping, when an advocate of producer gas came along and said that, by adopting his system, there would be such and such a money saving. If, however, modern steam-pumping plant were put down, there would be very nearly the same amount of saving. The author stated that producer gas, on the basis of 1½ lbs. of anthracite beans per brake-horse-power-hour, at 30s. 1d. per ton, equalled 9s. 0¾d. per day, while steam, on the basis of 5 lbs. of coal, at 16s. 8d. per ton per-brake-horse-power hour, equalled 16s. 6d. per day. It would be interesting to know if the author had definite quotations from first-class firms for a steam plant, because it seemed to him (Mr. Roberts) that 5 lbs. of good coal was a large consumption for a first-class modern compound steam engine. He should have thought half this consumption would have been sufficient. In addition, a considerable amount of capital would have been saved. In using a gas-engine, there was always the difficulty, which did not exist with a steam-engine, of varying the speed without loss of efficiency.

Mr. T. Molyneux (Stockport) remarked that some time since he described to the members a softening plant he had put down; and before leaving for the meeting, he got out some of the particulars as to the costs. In the last financial year, he softened about 218 million gallons of water, as compared with Mr. Harrison's 82 millions; and the cost worked out to 0·48d. per 1000 gallons, as compared with Mr. Harrison's 0·66d. Of course, his plant was larger than that at Wellingborough; and this might have something to do with the difference in the costs. On the other hand, his (Mr. Molyneux's) plant was not run to the full extent. If it had been, the cost would work out cheaper still. It was not only due to the plant that it was done so cheaply; but he had adopted certain arrangements which relieved him in regard to the cost of lime. His plant was not a continuous one; but he considered the one he had put in was superior, because of the absolute control of the whole of the work that the man in charge had. It had always struck him that the filter-cloths were a great disadvantage; in his own case, the work was done by sedimentation. Directly filter-cloths became efficient, they began to get inefficient. Using his process without filters, he had no complaints of lime going through; and, tested every morning, the results were practically identical.

Mr. A. B. E. Blackburn (Sunderland) agreed with Mr. Molyneux that there was great difficulty with filter-cloths. The author said they lasted about nine months. About a year ago, he (Mr. Blackburn) had the pleasure of going round the St. Helens Water-Works. When there, he was informed that the filter-cloths only lasted sixty days; and during that period they were taken out and washed three times. He should therefore like to know how it was that the filter-cloths lasted so long at Wellingborough. He also asked about the quantity of magnesia there was in the water (the chemical analysis given in the appendix did not state the amount); and how much of the permanent hardness was due to the magnesia, and how much to sulphite of lime. Another important question in connection with water softening was the sludge disposal. It seemed to him the carriage of the sludge was always a serious item. Some softening works were conveniently situated, with pits or big areas near at hand where they could deposit the sludge. But this was not always the case. He believed that a ton of sludge was made per million gallons of water softened, and the carriage on this would be really a serious item. Was anything included for this in the 0·66d.? It seemed to him the softening plant was much larger than was necessary to deal with the maximum daily consumption of water at Wellingborough. He further inquired how many men were engaged on the plant apart from engine pumping. He noticed that Dr. Thresh said in his report that there was an increase in the temporary hardness due to calcareous matter in the mains; and this suggested the question whether the softening process was really completed before the water entered the mains.

Mr. R. A. Blakeborough (Brighouse) asked, in connection with the question of the reduction of the permanent hardness, what degree of alkalinity the author found in the softened water. He agreed with Mr. Molyneux with regard to filter-cloths, and was rather surprised such good results were obtained at Wellingborough. It seemed to him that with quartz filters, better results still would be realized. After sterilization, they might get better results, as it was a difficult thing to get all the impurities out of the cloths by simply using a jet of water.

Mr. Molyneux observed there was one comparison he had omitted. It was that his softening plant cost £4851, against the author's £3008.

Mr. William Whitaker suggested to the author that a finished mineral analysis would be very useful.

Mr. Harrison, in reply, promised to supply a mineral analysis, as well as information as to the alkalinity. With regard to the Hardwick pump, he was of the same opinion as Mr. Roberts. As the water was delivered at a higher level than the water softening plant, one would have thought it could have been delivered to the latter by gravitation. But the patentees would not be satisfied with anything but pumping if they had to give a guarantee. He had one or two guarantees for particular measuring plant under which the makers would deal with the water under varying heads and in varying quantities. Though at first it seemed to be a foolish thing to pump water from a high level to a lower one, the Local Government Board Inspector saw that it was better to arrange it as required by the patentees; and the working cost of the pump was very small. The cost of the measuring apparatus would have been more than the cost of the pump. The advantages and the disadvantages of the various means of power, he hardly thought came within the scope of the paper. Their existing steam plant was a low-pressure one; and their buildings would not have accommodated steam plant. From the standpoint of building capacity, the plant adopted was the more economical. Mr. Molyneux had answered his own question as to the cost when he spoke of the amount of water with which he had to deal. It was obvious that the reason for softening the water was that without it was a most difficult water to use. As to the filter-cloths, they had just removed some which had been in use twelve months. They were employed three months at a time. After three months, they were taken off, steamed, and cleaned. This was done four times. Some of them shrunk; otherwise he believed they would go for a further three months. The size of the softening plant was accounted for by the fact that they only ran it a ten-hour day. There were three men on the works; and practically the time of one man was given to the water-softening plant. The reason the plant was adopted was that the mains were getting practically blocked up. One of the 4-inch mains became so coated that it had only a 2-inch bore through. The amount of deposit was being gradually done away with in the mains; and there was no new deposit. The bacterial report was not good; but though there was a large number in the water, they were simply water bacteria, and not at all harmful. Reverting to the question of the filter-cloths, they were steamed every week; and this was considered sufficient for sterilization. The water used for washing the cloths was run into the lime-pits, and then the top water was run off, and used over again. The cost of carting the sludge lime to neighbouring land was £30 per annum. This was not included in the figure he had quoted.

GAUGING AND RECORDING FLOW OF STREAMS.

By S. C. Chapman, M.Inst.C.E. (Water Engineer, Torquay).

[Extracts from a Paper read before the Association of Water Engineers on Dec. 9.]

The author presents this paper in the hope that it will promote the more general and systematic collection and tabulation of records relative to the available water resources of the country. That such a record is needed, none will deny; for the demands now being made upon water authorities to provide supplies sufficient for the ever-growing populations, and the more stringent conditions now imposed by Parliament in regard to compensation water, &c., render a wider knowledge of the actual yield of streams a matter of primary importance.

The usual practice of many engineers is to base their calculations upon the rainfall, making arbitrary allowances to cover the "three-dry-years" period, and allowing a further arbitrary amount for evaporation and absorption, with such variations to meet the local conditions as experience may dictate. In some instances, no doubt, a very near approximation to the actual available yield may be obtained in this way; but in most cases, reliance upon such calculations must produce very curious, if not unfortunate, results. The granite formation in Devonshire is an example of this. The rainfall here varies from 40 inches per annum on the east to 60 inches on the south and west, while one or two places in the centre have over 70 inches. The results of many years gaugings show that it is impossible to accurately estimate the flow off any one watershed from that obtained from others.

On the east, the Trenchford and Blackingstone Valleys, which drain the gathering-ground from which the Torquay supply is drawn, yield a minimum of 0·18 cubic foot per second per 1000 acres over the whole gauged area; while one particular stream, with a catchment area of 961 acres, has run as low as 0·12 cubic foot per second per 1000 acres. In this case, the average annual rainfall is 39·42 inches, over a period of 25 years. The intake works are 718 feet above Ordnance datum; and the ground rises therefrom to a maximum of 1127 feet, Ordnance datum—the average elevation being about 900 feet Ordnance datum. On the south-west side of the Moor lies the Plymouth gathering-ground, which covers an area of 5360 acres, and rises from 708 feet to a maximum of 1625 feet; the average elevation being about 1100 feet above Ordnance datum. The rainfall here is about

60 inches. From records extending over many years, the dry-weather flow has been proved beyond doubt to be 2,800,000 gallons per diem, or 1·06 cubic feet per minute per 1000 acres from 4885 acres. In the centre of the Moor lies the source of the Devonport supply. This is drawn from the West Dart, Cowsic, and Blackabrook. The land has an average elevation of about 1400 feet; and the rainfall for 30 years averages 71·47 inches.

From the above figures, it will be seen that in the matter of the dry-weather flow alone, there are some most astonishing returns which are very difficult to reconcile one with another. These differences do not appear to be less marked even in the case of adjoining streams. Both the undermentioned streams run parallel to each other; the geological and climatical conditions are practically identical; and the readings were taken on the same day in the month of June, 1893. River Meavy, with 4885 acres gathering-ground, yielded 1·262 cubic feet per second per 1000 acres. River Cad from 5700 acres yielded 0·392 cubic foot per second per 1000 acres. Taken over a single ordinary year, streams may show a very decided difference in yield even when the rainfall and other conditions are practically identical.

The annual yield of various watersheds and the percentage of the rainfall which reaches the streams are matters which require the most careful scrutiny, and are of vital importance to every water-supply scheme. By the courtesy of Mr. Frank Howarth, M.Inst.C.E., of Plymouth, the returns from the Burrator gathering-ground from 1902 to 1909 are here given. The rainfall is based upon the average returns from eleven gauges scattered over a gathering-ground of 5360 acres.

Year.	Annual Discharge off Watershed. (Gallons.)	Discharge in Inches of Rainfall.	Average Rainfall Recorded on Drainage Area. (Inches.)	Percentage of Discharge to Annual Rainfall Recorded.
1902	5,650,832,055	46·54	46·77	99½
1903	8,760,136,589	72·02	63·47	113½
1904	7,411,496,580	60·94	59·71	102
1905	5,260,648,956	43·25	45·64	94¾
1906	6,186,503,618	50·87	58·77	86½
1907	Incomplete	. .	. .	. .
1908	4,844,161,126	39·83	46·20	86
1909	6,530,485,848	53·70	56·18	95½

The paper next included tables taken from the Torquay gathering-grounds—showing the annual rainfall, the annual discharge, and the discharge in inches of rainfall, together with the percentage of discharge to the rainfall, for the Trenchford, Blackingstone, Clampitt, and Kennick streams. A few figures from the table referring to the Trenchford Stream (gathering-ground, 961 acres) are all we can give here.

Year.	Annual Rainfall in Inches.	Annual Discharge in Gallons.	Discharge in Inches of Rainfall.	Percentage of Discharge to the Rainfall.
1902	35·47	532,360,880	24·68	69·6
1903	50·79	859,472,270	39·61	78·0
1904	38·15	574,143,400	26·78	70·2
1905	33·70	399,491,970	18·50	54·9
1906	35·28	437,129,700	20·07	56·9
1907	41·03	572,951,358	39·77	77·0
1908	32·39	317,038,349	17·49	54·0
1909	41·94	471,705,250	26·04	62·1
Average . .	39·42	499,955,099	23·37	59·3

The averages for the past eight and eleven years are furnished so that comparison may be made with the Plymouth table.

Year.	Annual Rainfall in Inches.	Annual Discharge in Gallons.	Discharge in Inches of Rainfall.	Percentage of Discharge to the Rainfall.
8 years . . .	38·59	520,536,647	25·29	65·3
11 ,, ...	39·18	530,061,534	25·34	64·7

A comparison between the records of rainfall and the flow of streams, both per annum and for the different seasons of the year, reveals many points of interest; while a comparison between the percentage of discharge to the rainfall for the various seasons is very instructive, and reveals the extent to which the flow in one season is influenced by the rainfall of the preceding season.

The effect of evaporation upon the flow of streams is often very marked, and the variations in flow between day and night during the summer months are entirely missed when the stream gaugings are taken at a stated period each day. In a stream which drains a large moorland area, these fluctuations are considerable in their amount, and make a material difference in estimating the dry-weather flow. An automatic recording instrument is absolutely necessary to keep accurate and continuous gaugings of streams. The difference between the returns worked out from readings which are taken at a stated time each day and those calculated from the recorder diagrams, generally agree fairly closely; but in some years there is a variation of as much as 10 per cent.—the recorder returns always being the lower. This is partly due to errors in reading the scale; but the principal reason is that, during the summer, there is a continually lessening stream, and the daily readings are generally taken in the morning when the stream is at its maximum flow. On the other hand, in times of flood, both in summer and in winter, streams often rise and fall very considerably during the 24 hours; and the recorder returns are then very much in excess of the daily readings. The author is of opinion that the records should be taken by means of a float situated in a chamber at one side of the stream, connected therewith by a pipe which can be shut off, if necessary, for adjusting the zero of the float. This would obviate any errors due to capillary attraction and allow of a vernier attachment for fine readings. The cost of gauge chambers and gauging apparatus depends largely on local conditions, and the nature of the work required of them; but, under normal circumstances, it should not be so large as to constitute a serious burden on any water authority.

The question often arises as to how far gaugings can be relied upon. Local circumstances vary so much that it would take a volume to explain and give examples of the many factors which have to be considered in various cases.

Discussion.

Mr. E. SANDEMAN (Derwent Valley Water-Works) pointed to the interest attaching to dry-weather flows from watersheds, in view of the effect on the storage capacity of reservoirs. He also emphasized how the character of the geological formation had a great effect on the dry-weather flow. The excessive dry-weather flow from the Burrator gathering-ground was, he believed, due to the decomposed granite covering the bottoms of the valleys. He was naturally curious when at Plymouth to find out how much water a cubic foot of decomposed granite would hold; and he found it would take up 18 lbs. of water. An interesting point about evaporation was the loss due to the heat of the sun. At one time, he (Mr. Sandeman) hardly thought that it would be noticeable; but, as a matter of fact, it could be both seen and registered. It had been generally imagined that evaporation was greater in dry years than in others; but the fact was that when there was less rain, there was less water evaporated. Speaking quite generally, he thought every water engineer should take all possible means of ascertaining the flow of streams in his vicinity; and personally he looked forward to the time when a central authority would see to these records being taken.

Mr. F. W. HODSON (Loughborough) thought it was an absolute misnomer to call the streams referred to in the paper granite watershed streams, especially after what Mr. Sandeman had told them as to the water receptivity of the disintegrated granite. He was astounded to see from the figures given in respect of the Burrator watershed that practically the whole of the rainfall which precipitated was given off again. During 1902, for instance, the percentage discharge to annual rainfall recorded was 99½; 1903, 113½; and 1904, 102. It was a most extraordinary watershed on which no evaporation, no loss whatever, took place over a period of three years. The figures in the paper all pointed to a watershed on which there must be a considerable amount of porous rock, because in no case was there a figure which went down to less than 45 per cent. of the rainfall. He (Mr. Hodson) had, like the author, found the same variation from day to night on streams gauged. This might be due to the effect of the sun; but he thought there could also be traced another effect due to the barometer. He remembered an interesting set of observations on the daily level of water in a well which had just been completed. When absolutely no water was being taken out of it, the level in the well was gauged, and, comparing with the barometer reading, they were able to find that the extra barometrical pressure sent water out of the strata to springs at a distance, and, when the pressure was reduced, the water-level rose again slightly, but did not attain its original level until there was a period of rainfall again.

Mr. C. CLEMESHA SMITH (Wakefield) believed that the gauging of streams would become of greater importance in the future than it had been in the past. Hitherto the amount of compensation given to streams had been arrived at by a method which, though well tried, was after all purely empirical, and was liable to serious error. He knew of a gathering-ground 5000 acres in extent, partly in limestone and partly in shales and grits. Some 3000 acres was limestone. It was gauged for a particular period; and the rainfall was over 9 inches, with a yield of 2·7 inches. On the remainder of the area (2300 acres), the rainfall was only 7·38 inches, and the yield 4·3 inches. With a smaller rainfall, twice the quantity of water was yielded. Had they arrived at the compensation water by the ordinary method, the millowners would have got a great deal more than their proper proportion of the rainfall. The only way to his mind to get really accurate results was by gauging the streams.

Mr. EASTON DEVONSHIRE (London) remarked that, as a member of the Water Areas Statistics Committee, he thought that the suggestion in the first part of the paper, as to the collection of statistics, was most valuable. He hoped the paper would set an example, and develop the installation of recording apparatus which would enable information from the whole country to be placed at the disposal of the Association, and of water undertakings generally.

Mr. R. H. WYRILL (Swansea) said that in most of the larger water-works, no doubt careful records of the rainfall and of the gaugings of streams were kept. But as these in many cases had entailed considerable time, engineers had generally kept the results as being valuable only for their own works. Again, as considerable expenditure had to be incurred in obtaining the records, it was often held they were the property of the person

or the authority incurring the expenditure. If, however, all the records were published, or were capable of being examined, the subject of the relation of rainfall to the flow of streams would be much advanced. The records given in the paper were valuable, but were restricted to a gathering-ground on granite formation; and this formation was comparatively small in extent. It was to be hoped that other engineers would be induced to produce their gaugings on other geological formations for purposes of comparison; for it was well known that the quantity of rainfall and the fluctuation of the volume or rate of discharge varied very much not only with the elevation, slope, area, and shape of the gathering-ground, but also with the permeability of the geological formation. Some gathering-grounds were largely formed of water-tight material which prevented percolation, and rapidly shed the rainfall into the streams, causing relatively heavy floods. Other formations allowed a considerable percolation which, in the first instance, absorbed and moderated the floods, but were productive of a high dry-weather flow. In his view, it would be much better to form an opinion of the probable yield of a source than rely solely on rainfall returns. It was not the rainfall, but the available rainfall, or the flow of streams, that was of greatest value. He commented on the importance of studying maximum flows, and urged the installation of recording rain-gauges in conjunction with automatic recorders on the stream discharge—the effect of different rates of rainfall being then directly shown in volume on the stream recorder. He had a combination of this kind in operation at the Crays reservoir of the Swansea Water-Works; and the results were most instructive. In regard to the returns for Burrator as given in the paper, in two cases there was more water shown in the stream than was indicated by the rain-gauge. This was probably due to the rain-gauges not representing the actual rainfall over the whole of the gathering-ground. The great variations he observed at the Swansea Water-Works showed the importance of not trusting to rainfall returns only, but the necessity of taking and preserving stream observations.

Mr. T. Molyneux (Stockport) also directed attention to the variable yield of neighbouring gathering-grounds, and said he believed that the compensation water they had to give would not be of the amount it was if they had fuller information.

Mr. R. Askwith (Weardale and Consett Water Company) pointed to another difficulty connected with this question. He said that one was in the habit of speaking of a "gathering-ground;" but very often water passed underground from one gathering area into another, and rose to the surface as springs. This might in some cases account for the yield being greater than the rainfall.

Mr. F. W. M'Cullough (Belfast) also illustrated from his experience how much, in relation to yield, depended upon the character of the gathering-ground—the covering, as well as the subterranean formation—and, if there were hills, their slopes, whether they were precipitous or otherwise.

Mr. H. E. Stilgoe (City Engineer and Surveyor of Birmingham) remarked that he did not think there was any great difference between them as to the quantity of rainfall in any one year not being comparable with the quantity flowing off in the streams. Looking at the table in the paper regarding the Burrator gathering-ground, it would be seen that in the years 1902, 1905, and 1908, the rainfall was much the same, while the percentage discharge to the annual rainfall did not at all compare. Much depended upon the intensity of the rainfall, and the condition of the surface of the ground at the time.

Mr. W. Terrey (Sheffield) emphasized the value of statistics like those in the paper. In a case where he was closely associated, owing to the lack of reliable data, a large quantity of compensation water was granted by Parliament, which they found, now they had recording-gauges, was quite equal to one-half the flow of the available yield of the watershed. Had there been in those days some carefully compiled statistics, such a mistake as this would not have been made; and it was exceedingly difficult to rectify statutory obligations of this kind when once imposed. Not only were there great variations of yield by watersheds owing to their difference in character, but the yield of the same watershed varied greatly one year with another, and one month with another, owing to the prevalence of high winds, sunshine, and other causes. In connection with the Sheffield works, they had not only introduced recorders which gave them the exact quantity of water flowing into the streams, but also the quantity that was lost owing to winter floods. He described the very complete system that his department had established, to furnish information in this connection.

Mr. Chapman, in his reply, instanced the importance of records as a guide in the construction of works. A few years ago, he was interested in the construction of a reservoir. There were no records; and the question at once arose as to the size the culvert should be to take off the flood water during the construction of the works. The only thing he could do was to refer to another gathering-ground where floods had been measured. The only gathering-ground in the neighbourhood was that at Plymouth on the granite formation. But this gave results which their own gathering-ground had never been able to give. He put down recording-gauges in order to test the floods during the construction of the works; and had he known then what he knew now, he would have been able to cut down the size of the culvert to one-half its diameter, and saved from £6000 to £7000. In the construction of works, to have to assure rainfall and discharge was a very uncomfortable position to be in; and it was this uncomfortable position that induced him to bring the paper before the meeting. He had not the slightest doubt as to the correctness of the Burrator gathering-ground figures to which frequent reference had been made during the discussion. Rule-of-thumb methods should no longer obtain among water engineers; and he hoped there would in future be a universal tabulation of actual facts.

REGISTER OF PATENTS.

Locking Cash Receptacles to Coin-Freed Gas Apparatus.

Schönfeldt, F., of Königsberg, Germany.

No. 20,989; Sept. 14, 1909.

This device consists in the cash receptacle being locked on to the meter by means of the mandrel of the lock itself with the aid of a key of the bramah type. By this combination with a stop-device and a tumbler, it is impossible for any unauthorized persons to open the lock without the key or without using violence.

Money Box for Prepayment Gas-Meters.

Ainley, L., of Newcastle-upon-Tyne.

No. 28,644; Dec. 7, 1909.

This invention is intended to provide, "in a simple yet an effective manner," an attachment having for its object "the prevention of robberies from prepayment gas-meters and the diminution of the consequent expense involved after such robberies in the fixing up or repairing of the money box and staple attached to, and forming part of, such gas-meters."

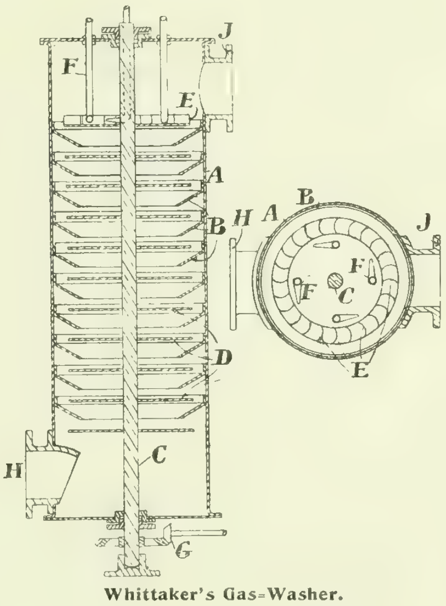
The device consists of a plate about 2 inch by $2\frac{1}{2}$ inch by $\frac{3}{16}$ inch thick, with a vertical slot in it, and a staple attached to the plate on the left side of the slot, approximating in size to the staple attached to the money box. The plate is placed on the front of the money box. The staple attached to it passes through the slot before referred to; the staple of the money box and the staple of the plate being flush. The padlock is passed through both staples, thereby making more difficult the pulling of the staple of the money box from the box. On the underside of the plate is a portion hollowed out to allow the plate to lay flat on the front of the money box.

Cooling and Washing Coal Gases.

Whittaker, E., of Levenshulme, Manchester.

No. 27,158; Nov. 23, 1909.

This invention has for its object to provide means to cool the gas and at the same time to wash out any suspended matter or impurities by providing a cylindrical chamber (fixed, for preference, upright) to the walls of which, on the inside, are attached, at suitable distances apart, a number of plates in the shape of inverted truncated cones or tundishes, having an inclination from the cylinder walls in a downward direction towards the centre or axis of the cylinder, but terminating some distance short of it, so as to leave an opening for the passage of the gas and liquid, as shown.



Whittaker's Gas-Washer.

In operation, water is forced through the jets or nozzles F against the impeller blades E, giving (or assisting in giving) to the rotor, which is formed by the central shaft, and its attached discs D, rotary or revolving motion. After leaving the blades, the water is thrown, by centrifugal action, across the intervening annular space which lies between the outer edge or periphery of the disc and the walls of the cylindrical casing in a thin film or curtain, through which the gas must flow. After striking against the walls of the washer, the water runs by gravitation down and across the upper surface of the succeeding inverted truncated cone-shaped plate B, again forming another film or curtain as it falls across the space that lies between the inner edge of the plate

and the next or following shaft disc. As the water falls on this second disc, it will be again whirled, by the centrifugal action set up by the revolving disc upon which it has fallen, across the intervening annular space lying between the outer edge of this disc and the washer wall in another film or curtain. After striking against the wall, the water will run down and across the upper surface of the next following inverted truncated cone-shaped plate, and so fall on to the next following shaft disc—this action being repeated any required number of times.

The gas enters at H, and then, passing upwards, is made to flow through each successive opening, and the films of water thrown across such openings, until it reaches the outlet pipe J. The water and impurities as carried over are drained away from the bottom of the apparatus in any convenient manner.

Vertical Retort Settings.

GIBBONS BROTHERS, LIMITED, MASTERS, R., and VAN MARLE, M., of Dudley.

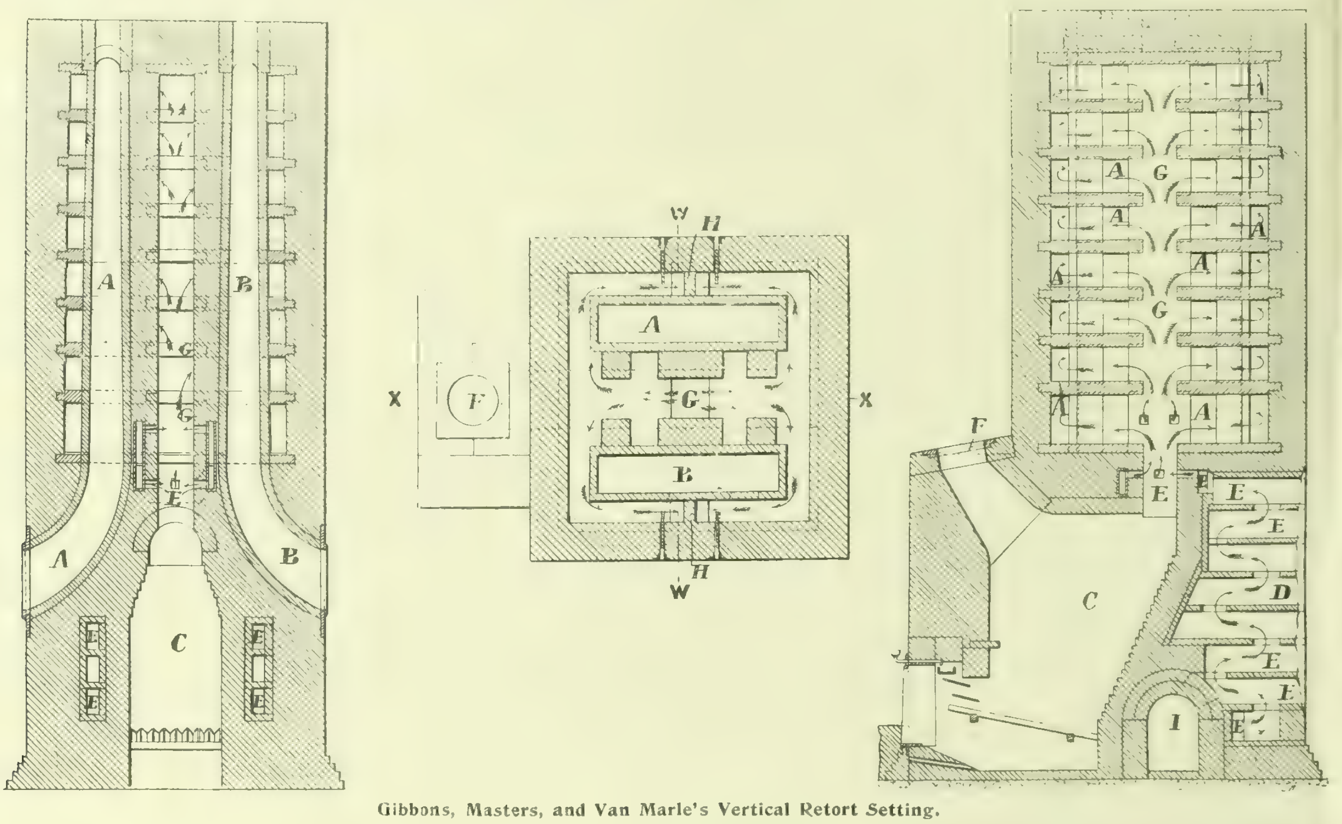
No. 27,291 ; Nov. 23, 1909.

In the type of vertical retorts to which this invention relates, the coal to be distilled is fed into the top (either continuously or intermittently), and the coke remaining after distillation passes away, either continuously or intermittently, from the open bottom of the retort at one side.

Previously, the patentees point out, it has been proposed in connection with vertical retorts that the setting which has a combustion chamber combined in it should be divided into compartments by horizontal partitions and provided with means for delivering and separately controlling the supplies of secondary air and gas to the various parts of the combustion chamber in proximity to the passages leading from the combustion chamber to the compartments ; separate regenerators being provided for the exit of the waste gases from each of the compartments—the setting being also provided with means for separately controlling the draught through the regenerators from each compartment.

It has also been proposed, when settings for vertical retorts comprise a number of superimposed heating chambers isolated from each other by horizontal partitions, that each of the chambers should be supplied with streams of secondary air and producer gas previously mingled and ignited in a separate combustion chamber, into which chamber the producer gas enters through ports of an area adjustable by movable dampers ; the streams of ignited gases travelling horizontally through the heating chamber round two or more retorts in the setting.

According to the present invention, the gas-producer is combined in the same structure as the retorts, and is provided with a vertical upcast shaft between the retorts and up which the gases from the producer rise ; the secondary air meeting the gases as the latter rise out of the producer, " which are thereby thoroughly combusted." The combusted gases then rise straight up the middle of the setting and branch off at each side into and through the various horizontal compartments. In addition, the dampers are so arranged as to control the gases flowing out of the setting ; " the whole ensuring slow combustion and enabling the retorts to be heated uniformly through their length." The heat can also be diminished or increased in parts as may be found necessary in order to obtain the best results.



Gibbons, Masters, and Van Marle's Vertical Retort Setting.

The illustrations show a front sectional elevation of the proposed setting taken on the line W of the plan ; also a sectional side elevation of the setting taken on the line X.

In carrying out the invention, the vertical retorts are (by preference, although not necessarily) arranged in any number of pairs in a setting —say, for instance, one pair as illustrated, lettered A B. They are by preference of large size (say) for instance, 16 feet high and 9 feet wide by 1 foot deep from front to back inside at the bottom and 9 inches deep from front to back at the top, and of rectangular cross section when viewed in plan. The setting also (by preference) comprises the gas-producer C and the regenerator D for heating the retorts, though the gas for heating the retorts may be supplied from a separate source. As stated, the retorts are, as usual, of a gradually increasing area from top to bottom, so as to facilitate the discharge of the coke. The gas-producer C and the regenerator D, when combined with the setting, are arranged underneath the retorts, with the secondary air passages E in the regenerator arranged between, and heated by, the spent-gas flues—of suitable construction.

The pair of retorts are arranged back to back, with the lower parts at opposite sides of the setting. The charging mouth F of the producer can be conveniently on the third side of the setting—that is, the side which is at right angles to the retort outlets. The retorts are arranged at a convenient distance apart ; and the wider walls are supported by vertical brick piers or blocks and by horizontal tiles forming a series of floors or partitions and heat flues between the tiles, at certain distances apart, one above the other between and around the retorts, and between the retorts and the outer walls of the setting. At the centre of the setting between the retorts is an upcast passage G, at the bottom of which the mixed gas and air in combustion enter from the gas-producer and the regenerator, and pass up and into the heat spaces between the floors. At the two opposite sides of the retorts, there are two downcast passages with the divisional vertical wall H between them, so that each of the passages communicates with the heat spaces and leads away the spent gases to the regenerator, and so on through the regenerator to the main spent-gas flue I leading to the chimney stack. Thus, between every pair of floors formed by the tiles, the heat from the flue G passes between the retorts and round both retorts to the opposite sides and then down the outlets to the spent-gas flues. The outlets are each regulated by a separate damper ; so that the heat of the retorts "can be regulated to a nicety as can be found most advantageous for the distillation of the coal." If the various retorts are charged on the continuous system, then, by regulating the dampers, a greater heat is obtained at the upper parts of the retorts than at the lower parts ; but if the retorts are charged on the intermittent system, then the outlet dampers can be so regulated to give uniform heat through the retorts if desired.

Manufacture of Illuminating and Heating Gas.

BURTON, W. A., of New Cleethorpes.

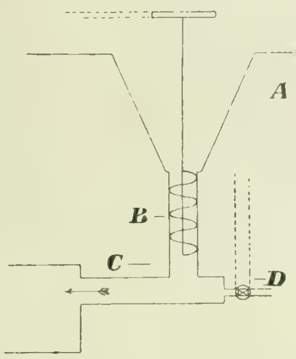
No. 27,517 ; Nov. 26, 1909.

This invention is to provide for the continuous or intermittent introduction of comminuted coal into a gas-retort during the process of carbonization, " in an atmosphere of gas—the necessary force for the introduction being derived solely from gas under pressure, in contact and mingling with the material to be distilled and the gases present in the retort." The gas used for the introduction is " water gas, or any fixed hydro-carbon gas in the absence of steam or air."

The inventor has the knowledge (he says) that it has been previously proposed to provide a jet of steam or gas in the pipe leading from a supply hopper to an inclined retort, in order to assist the pulverized coal in its passage through the retort—see patent No. 915 of 1885.

The apparatus used, as shown in the accompanying sketch, consists of a hopper A to contain the coal to be distilled, provided with a worm feed B, which delivers to a T-piece C, provided with a connection for gas under " high pressure," controlled by a valve D, which is capable

of being revolved by gear in such a manner that a blast of gas may be admitted at long or short intervals "as may be suitable to the material to be distilled." At the opposite end of the T-piece a connection with the retort is provided.



Burton's Continuous or Intermittent Chargers.

A valve (not shown) may be provided on end of the worm feed, and actuated in such a manner that, at period of blast (when high pressure valve is open), the hopper and feed shall not be in open communication with the T-piece, or the hopper may be provided with removable gas-tight lids.

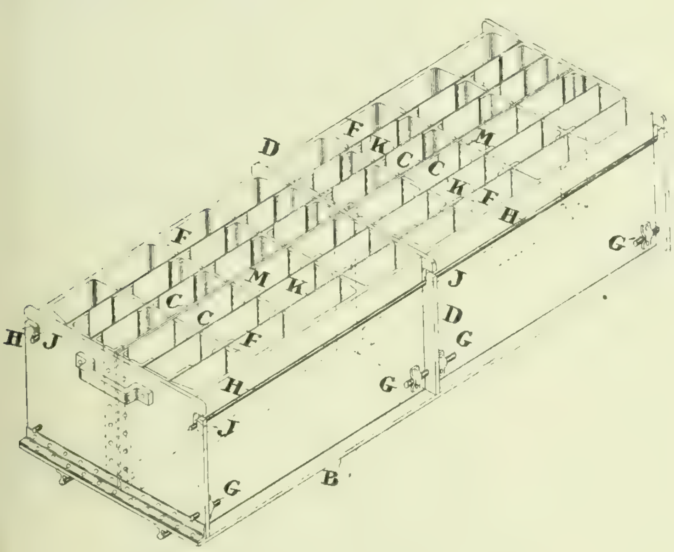
Carbonization of Coal.

Pringle, R. W., of Richmond, and Richards, L. S., of Ravenscourt Park, W.

No. 27,828; Nov. 29, 1909.

This system of carbonization refers to a removable container adapted to be introduced into a retort and to be withdrawn therefrom. The object of the invention is to provide an "improved means for transmitting the necessary heat to the fuel to be carbonized and the consequent reduction of time required for carbonization."

The apparatus employed comprises a coal container provided with side-pieces and partitions or conducting plates adapted to subdivide the charge in such a manner as to allow the heat to be transmitted to every part of the mass by conduction. The thickness of fuel through which the heat has to penetrate is thus reduced to a minimum. The container is open-topped, and is divided by longitudinal ribs or dividing walls into a series of longitudinal open-topped compartments for the material to be treated; and the ribs are so arranged as to form compartments of tapering section to allow the residual coke to be easily discharged. The container may be run into and out of the retort upon rails laid in the retort; and in some cases a plurality of such containers may be disposed in one retort.



Pringle and Richards' Carbonization System.

The ends of the container are (as shown) attached to a bed-plate B. C are the longitudinal division plates, and D is a transverse division plate. The sides, provided with dividing ribs F, are hinged to the end plates and to the division plate D at G. H are rods adapted to lie in bayonet slots J for the purpose of keeping the hinged sides in position. K are movable conducting plates fitted with partition pieces M.

In this way, the coal is subdivided into separate small charges "in such a way that the distance through which the heat has to be transmitted through the material itself is well within the distance which will allow effective distillation to take place in a reasonable time, and, moreover, the time occupied in the operation is materially reduced."

In operation, the material is charged into the container, which is run into the retort. The retort is then sealed, and a temperature maintained within the desired range for a period of time depending on the nature of the products required. The container is then withdrawn, and the charge is cooled or quenched.

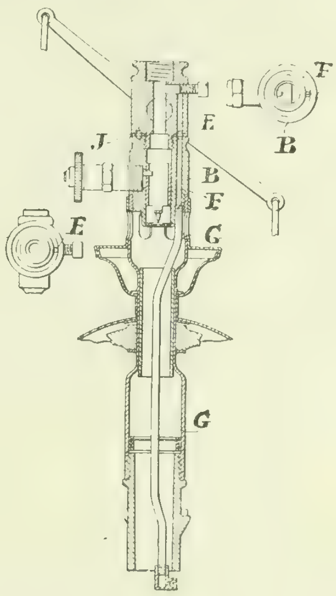
With apparatus thus made (the patentees assert), "the production of a smokeless fuel containing a high percentage of volatile matter becomes practicable in ordinary gas-works settings, whereas with the ordinary method of charging gas-retorts a uniform fuel of this description cannot be produced, as a layer of non-conducting coke is formed next to the retort walls; thus preventing penetration of the heat to the centre of the fuel. With the low temperature required for the production of smokeless fuel, this becomes an insuperable difficulty, as before the centre of the charge has reached the required stage of carbonization, the outer layers are hopelessly over-carbonized. By the introduction of apparatus made in accordance with this invention, which divides the fuel into thin sections, the low heat required to produce smokeless fuel can be successfully employed, and the time required for carbonization is greatly reduced."

Burners for Incandescent Gas Lighting.

Falk, Stadelmann, and Co., Limited, and Elliott, G. W., of Farringdon Road, E.C.

No. 30,066; Dec. 23, 1909.

This invention relates especially to burners of the inverted type provided with a bye-pass arranged within the burner-tube; the object being to provide for such a bye-pass when a regulator is employed.



Falk, Stadelmann, and Co., and G. W. Elliott's Incandescent Burner.

A passage E is formed in the body of the cock through which the gas for supplying the bye-pass flows, and a corresponding passage is formed in the regulator B. G is the pipe which conveys the gas from the passage F to the mantle. Grooves are formed in the adjacent surfaces of the cock (as shown in the underside view of the cock and a plan view of the regulator), which together form between them a channel through which the gas can flow from E to F, notwithstanding that the two passages are not in actual alignment. J is a packing-ring between the cock and regulator, and having formed in it a series of openings to allow the gas to pass from groove to groove.

Controlling the Supply of Gas to Burners.

Keith, J. & G., of Farringdon Avenue, E.C.

No. 30,387; Dec. 29, 1909. No. 11,269; May 6, 1910.

The combined specifications relating to this invention refer to devices for regulating the pressure of the gas supply to burners—more particularly to burners which are used in railway carriages or the like, and which are supplied with gas at high pressure from storage cylinders carried on the carriages. The devices are of the kind in which a casing is provided with a hollow inwardly projecting member affording an inlet connection and provided with a valve seat for the reception of a valve carried by a stirrup secured to a diaphragm which is loaded by an adjustable spring.

Gas-Fires.

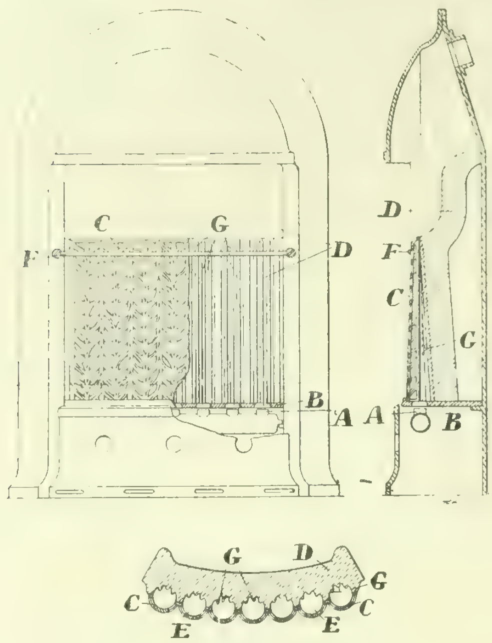
Yates, H. J. (John Wright and Eagle Range, Limited), of Birmingham.

No. 493; Jan. 8, 1910.

To carry this invention into effect (illustrated, p. 862), the burner is constructed as heretofore with a number of nozzles A, and over the nozzles is secured a tray B for supporting the "radiants" C, which are preferably constructed from refractory or incombustible material to "a corrugated or equivalent form with irregular apertures similar to those provided in the ordinary radiants." Each corrugation forms approximately one-half of a flame-enclosure. At the front, the radiants present the appearance of a number of vertical channels corresponding to the positions of the flames from the burner. The fire-brick back D is correspondingly shaped to form the complementary portions of the flame enclosures. As will be seen, the cross section of each flame-enclosure E is of approximately circular form; and a burner-nozzle is provided opposite the lower end of each enclosure. For retaining the radiants in position, a single bar F, secured across their upper edge, or an equivalent device, is preferably employed, so that the front of the radiants is left as completely exposed as possible.

To obtain an increased heating effect from the flames, the portions of the surface of the back exposed to the flames are ribbed or roughened. In the fire-brick back shown, vertical ribs or ridges G are formed on the surface of each groove or corrugation.

The patentee then remarks that "by surrounding each flame with



Yates's Gas-Fire.

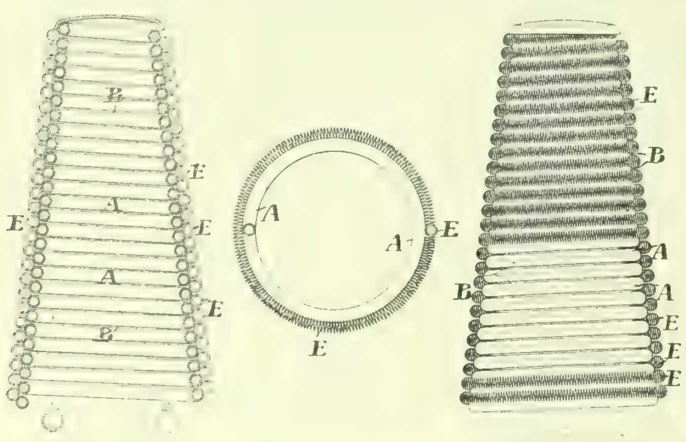
refractory or incombustible material as described—viz., by forming the rear portion of the surface exposed to the flame in or by the back, and the front portion by the detachable radiant which abuts against the back—the occurrence in the fire of parts which do not usefully contribute towards the radiation from the front of the fire is largely reduced, and the heat generated is utilized with greater efficiency than in fires constructed as heretofore."

Water-Heaters.

Parkinson Stove Company and Barralet, T. E., of Birmingham.

No. 4524; Feb. 23, 1910.

This invention relates to water-heaters in which the water to be heated is passed through a spirally-wound coil of piping, which is subjected to the action of the hot gases from the burner passing up through the interior of the coil from the lower open end and being caused to pass out through the spaces between the different convolutions.



Parkinson and Barralet's Gas Water-Heater.

In the illustration, the front elevation of the heater is shown with the heat conductor partly broken away.

The piping A through which the water passes is wound spirally into a conical coil (the smaller end being at the top), and the convolutions are separated from one another by small spaces B. A burner is arranged below the lower open end of the coil, while the upper end is closed by a cap forming a baffle-plate; so that the ascending hot gases are compelled to pass out through the spaces between the different turns of the coil. Over the outside of the latter, a length of coiled wire E is wound spirally, so as to lie between, and make contact with, each pair of adjacent turns or convolutions of the tube A, and thus cover the spaces through which the gases pass out. The issuing gases thus impinge upon, and pass through, the coils of the heat conductor, so as to abstract or absorb a large proportion of the heat, and conduct it to the walls of the adjacent turns of the coil of piping with which the conductor is in contact. The whole arrangement is, of course, enclosed by a suitable casing.

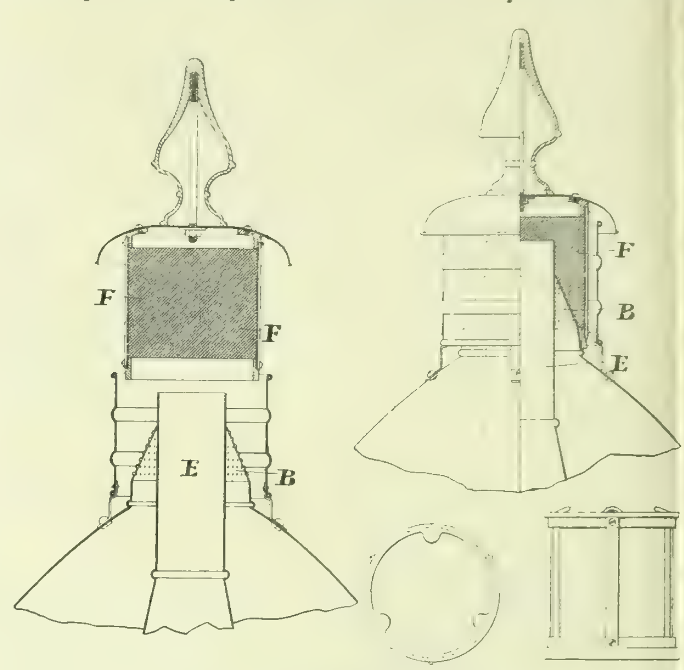
Insect-Proof Gas Lanterns.

Glover, R. B. G., of Edmonton, N.

No. 640; Jan. 10, 1910.

This insect-proof gas-lantern is shown, first, with the hood and gauze cylinder disconnected; then with the parts assembled, and showing a plan and a side elevation of the device for carrying the gauze cylinder.

The top of a lamp has a perforated cone B with parallel or slightly conical walls at the lower part; the perforations being made from the inside and in such a manner that the burrs of metal stand up on the outside of the cone. The cone has an open top in which the chimney E fits tight. A perforated or gauze tube F is positioned in the neck of the lamp and surrounding the cap B; the tube being held between two rings connected by the distancing bars I. The top ring has lugs for connection to the hood of the lamp; and both rings have recesses for receiving the tube F, which is closed at the top by the hood. The bottom ring of the cylinder F fits the bottom of the perforated cone B; and (with the hood) it can be readily removed from within the neck of the lamp, so that the cylinder and cone can be easily cleaned.



Glover's Insect-Proof Gas-Lantern.

The products of combustion pass up the chimney E, and out at the upper part of the cylinder F; while the air to support combustion passes in at the lower part of F, and then through the perforated cone B into the lamp.

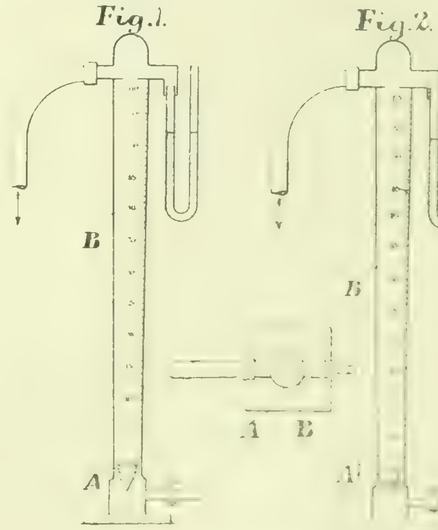
Measuring Gas.

Inhoffen, R., of Aix-la-Chapelle, Germany.

No. 12,857; May 26, 1910. Date claimed under International Convention, Jan. 25, 1910.

In the patent No. 19,767 of 1909, apparatus for measuring gas was described, in which the gas is measured within a vertical, conically expanding, transparent tube (provided with a division scale) by the position of a float, to which rotary movement is imparted by the gas passing through passages of the float. The present invention relates to apparatus of this kind, in which a rotary float is employed within a conically expanding tube; the object being "to obtain an equal distribution and a smooth, steady passage of the gas at the point of the float." According to one form of the invention, this object is attained by employing as the float, or in connection with the float, a cone serving as a guide for the gas; whereas in a second form, a body of globular or (say) oval shape is used as the float.

Fig. 1. Fig. 2.



Inhoffen's Gas-Measurer.

According to fig. 1, a cone A is provided in the circular glass tube B (expanding upwardly); the cone being lifted by the pressure of the issuing gas and serving to obtain an equal distribution of the gas. The tube is provided with a scale by which the amount of the issuing gas can be read off "per unit of time" at any given time, by the position of the floating cone beside a division line.

In fig. 2, the same object (of obtaining a rotary body with equal distribution of the gas) is attained by the provision of a ball A^1 within the interior of the circular upwardly expanding glass tube B.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Carbonization in Vertical Retorts.

Sir,—From time to time I have read the following expressions in the "Journal" on this matter: (1) "Putting a few more ideas into the melting pot." (2) "Carbonization at the present day [June, 1909] is in a condition of flux." (3) "That was the problem; and it would require a great deal of work before they could successfully solve it." (4) "From the point of view of those who wanted to know what was the best plant to adopt for the future, they were all in a state of great perplexity." (5) "Carbonization is now [1909] in the transition stage." (6) "They had not reached that stage of development in which it was thought wise to incur the expense of making very costly tests." And now [1910] (7) "The carbonizing maze." (8) "Constants and variables in the destructive distillation of coal." In view of this, it seems strangely strange that lastly we should have suddenly sprung upon us: (9) "The confirmation of the carbonizing theory, as the outcome of Dr. Colman's lecture recently delivered in Manchester. The able manner in which Dr. Colman discusses carbonization is distinguished by a clearness in exposition peculiarly his own."

To those who have been—or are at present—engaged in vertical retort carbonization (a process "come to stay"), Dr. Colman advances the theory that "half the gas finds its way through the coke." I presume he means the outer crust of already carbonized coal next to, and adhering to, the walls of the retort.

Against this theory, he gives the views of Dr. Bueb as follows: "The gas evolved on carbonization will seek the way of least resistance; and so, passing into the middle of the retort, this core serves as an exit passage."

By long experience and careful observations, I can only repeat that I am in full accord with Dr. Bueb's views; and, by way of confirmation or otherwise, it would be highly interesting at this point of time if Dr. Bueb would give us his observations on his later experiences.

Without at present making any particular reference to either of Dr. Colman's diagrams as shown at his lecture, I am satisfied to repeat an opinion I gave (and published) some four years ago—viz., "The transmission of heat from all points of the circumference towards the centre of the retort tends to maintain a gentle expansion—keeping the coke pressing against the sides of the retort until such time as there was nothing left to expand; then, for a sudden contraction to take place, leaving small spider-web-like bridges across a diameter of what was formerly a plastic bubbling mass giving up its last gases—hastened in so doing by the rapid penetration of heat over, and through, a very small area."

From reading what Dr. Colman said in his lecture regarding the influences temperature—through-and-through—has on the charge and the evolved gases, there is little doubt that Dr. Colman agrees with what has been proved in regard to the penetrating speed of the heat through the charge.

Dr. Bueb, from careful investigation, told us the temperature entering his setting was 1400° C. [Herr Körting's Mariendorf settings gave 1465° C.] Yet with such a high temperature, Dr. Bueb stated in regard to the travel of the gas, "The exit passage is a relatively cold core of coal." And that this was so—and probably remains so yet—is borne out by the temperatures Dr. Bueb gave of the gases evolved and the temperature of the core running together, hour by hour, as the process of carbonization goes on.

These temperatures given by Dr. Bueb will be found to compare favourably with those published from Exeter, and, by long practical experience, careful observations, and many tests (already recorded), I am satisfied the "path of the gas" is never through the coke but in that path always avoiding the annular ring of the charge already carbonized.

It is little use asserting so much without giving some proof. I will leave out altogether figures of my own, and will take a few of those published by Dr. Bueb from Dessau. Remembering that the temperature playing round the outside of the retorts working at Dessau was 1400° C., at the end of the first hour after the charge had been put in the temperature of the core of coal was only 145° C., and that of the evolved gas was 190° C.

Skipping over the recorded temperature from the first to the fifth hour, it becomes difficult to reason out that the temperature of the core of the charge was only raised to 250° C. in five hours. This being so, there surely is—and always is—less resistance to the passage of the gas through the core of the charge rather than through a hard mass of incandescent coke varying in density in proportion to its superincumbent weight.

T. Settle.

Dec. 12, 1910.

Relative Effects of Gas and Electric Lighting on the Purity of the Air of Rooms.

Sir,—I have been interested in the article written by Mr. G. Stanley Cooper, B.Sc., on the "Relative Effects of Gas and Electric Light on the Purity of the Air" (p. 705).

Mr. Cooper's article is devoted solely to an investigation of the percentage of carbon dioxide in the atmosphere of a room when using gas and electricity respectively for lighting. He does not appear to be aware that any similar investigation has taken place, for he opens with the words: "In this article, what to the majority of readers will be a new side to the matter is opened up;" and in concluding the article he uses the words: "A striking feature about the experiments is that there was actually less carbon dioxide in the room when gas was burning than when electric light was employed." I would refer Mr. Cooper to the address which I read before the Manchester District Institution in February, 1906, in which details were given of tests carried out at the Longwood Liberal Club. In this instance, gas and electric light were respectively employed as illuminants; and the results were even more strikingly in favour of gas.

While I make no claim to being the first to present the relative effects of gas and electricity in this form, Mr. Cooper will see that my own tests predated his by about five years; for they were taken on Dec. 12 and 13, 1905.

Jno. Hy. Brearley.

Longwood, Dec. 12, 1910.

LEGAL INTELLIGENCE.

THE LAW AS TO FENCING EXCAVATIONS.

A point of much interest to highway authorities and contractors was raised in an appeal from a decision of Mr. Justice Ridley which came before Lords Justices Vaughan Williams, Buckley, and Kennedy last Tuesday.

The plaintiffs (appellants) were the London General Omnibus Company, and defendants were Messrs. Docwra and Son, the well-known contractors. Mr. Holman Gregory, K.C., who appeared with Mr. Gerard S. Sanders for the plaintiff Company, stated that an excavation had been made by the defendants in Upper Clapton Road, and was fenced off by a rope attached to upright iron standards. At midnight on one occasion a two-horse omnibus belonging to the plaintiffs came along; and one of the horses slipped and fell opposite to the hole. In falling it knocked down the other horse, and both tumbled into the trench—one of them being killed. The action turned upon the question of the liability of the defendants; and in the event agreed damages of £55 were awarded. The appeal was brought on the ground of misdirection by the Judge. Counsel submitted that the words "fence and guard . . . so as to prevent accidents," contained in a Metropolitan Act, dated 1835, as applied to road excavations, meant that the device for protecting such places should be of sufficient strength to withstand such an accident as might ordinarily happen. In answer to Lord Justice Vaughan Williams, Counsel said he did not contend that the fence was to be such that it was absolutely impossible for a horse to fall into the hole, but that it should be reasonably strong. Lord Justice Kennedy put it to Counsel that, supposing a jury found that a person using the road carefully was sufficiently prevented by the notice from tumbling into a hole, he could not go further. Mr. Gregory said it was not a question of notice. His contention was that one had to anticipate an accident similar to that in question, and provide reasonable protection. Lord Justice Buckley: Then your contention practically comes to this, that one ought to build a wall. Is it not the fact that in all these cases you must do the best you can? A horse might rear. Would you say there should be such a fence that it could not get its legs over? Mr. Gregory: No; you would not anticipate that. Lord Justice Buckley: But it might happen. Mr. Gregory: As a rule, that is vice in a horse; and you do not anticipate a vicious horse going through the streets. Without calling upon Mr. J. R. Randolph to argue for the respondents, the Court dismissed the appeal, holding that there had been no misdirection.

GAS AND WATER COMPANIES IN LIQUIDATION.

Mid-Oxfordshire Gaslight and Coke Company.

In the Chancery Division of the High Court of Justice last Friday, before Mr. Justice Neville, Mr. Bovill moved for the appointment of the Liquidator of the above-named Company as Receiver and Manager of a particular business in respect of which the Company had issued first mortgage debentures. Counsel reminded his Lordship that the Company carried on business all over Oxfordshire, and from time to time bought up small gas undertakings, in respect of which they issued debentures creating a first charge on the particular undertaking, and a second charge over the general assets of the Company. Several orders had been made with respect to similar first charges. His Lordship remarked that it was sometimes inconvenient to have the same person acting as Liquidator and as Receiver for the debenture-holders, because there might be a clashing of interests. Mr. Bovill said in this case no difficulty could arise, because the Company was hopelessly insolvent; the debentures being far in excess of anything that could be realized. Mr. Galbraith appeared for the Trustee of the debenture deed, and consented. His Lordship made the order as asked. Mr. Bovill said there was a second action against the Company under like circumstances, but by another plaintiff, on a different set of debentures creating a specific charge on another property, on which he should ask for a similar order.

East Coast Water Company.

In the Chancery Division of the High Court of Justice last Friday, Mr. Justice Warrington was asked to appoint a Receiver and Manager of the above-named Company at the instance of the debenture-holders. Mr. Galbraith said the applicant was the holder of £475 worth of debentures out of a total issue of £6000. The Company did not object to the application. His Lordship made the appointment; limiting it to the 31st of March next.

NATURAL GAS SUPPLY IN CANADA.

The Judicial Committee of the Privy Council, consisting of Lords Macnaghten, Atkinson, Shaw, and Robson, last week gave judgment in two appeals from Canada raising a question in regard to the supply of natural gas. The arguments were heard in July.

Some time in 1889, subterranean gas was discovered in Welland County, Ontario; and it became in large demand both as an illuminant and as fuel. Persons desiring to have the gas obtained from the owners of the land licences or leases to drill for it, and then utilized it. In 1890 and 1891, the respondents, Messrs. Carroll, obtained a

large number of these gas leases for use in their business as limestone and sand quarry proprietors; and they successfully drilled wells from which they obtained the natural gas as fuel. In April 6, 1891, they sold their leases and wells to the Erie County Natural Gas and Fuel Company, but with the stipulation that they (the lessors) should be supplied with gas enough for their own purposes. Between 1891 and 1894 the arrangement worked satisfactorily; but in the latter year the Erie Company transferred their rights to the Provincial Natural Gas and Fuel Company, Limited, who then declined to supply Messrs. Carroll with the gas, as their predecessors had done. Messrs. Carroll thereupon brought an action against the Companies and claimed substantial damages. The Canadian Courts decided in their favour. Meanwhile, Messrs. Carroll acquired other wells in order to obtain elsewhere the gas of which they had been deprived; the cost of doing so being about \$60,000. The Master of the Supreme Court, to whom the question of damages was referred, assessed them at \$113,965; but these were reduced by the Courts to \$54,031. From this latter decision both parties appealed.

In delivering their Lordships' judgment, Lord Atkinson pointed out that as the wells and apparatus, which had cost Messrs. Carroll \$60,000, were subsequently sold by them for \$75,000, they would, if they were awarded the \$113,965, as proposed by the Master, make a profit of upwards of \$120,000 for being deprived of their gas; and this would be a grotesque result. Their Lordships could not permit them to recover more than they had lost. They had sued for the damages occasioned by the temporary deprivation of the gas. They had obtained the substituted article, identical in description and quality; had used it; and had failed to show that it had not, in the result, been obtained by them free of cost. They were, therefore, entitled to merely nominal damages. Their Lordships thought the Companies' appeal to this extent should be allowed, with costs, and Messrs. Carroll's cross-appeal dismissed, with costs.

THE AFFAIRS OF MR. E. O. PRESTON.

At the London Bankruptcy Court last Wednesday, a meeting of the creditors of Mr. Edward Oxenford Preston, financier, carrying on business at 4, Tokenhouse Yard, E.C., was held under the presidency of Mr. E. S. Grey, the Official Receiver. According to a memorandum issued by him to the creditors, it was called for the purpose of appointing a Trustee in place of Mr. Owen Walker, who had resigned. Mr. Barnes appeared for the debtor; Mr. Jarvis for several of the large creditors; and some of the others were represented.

The Chairman read a letter he had received from Mr. Walker, in which he explained that opposition had been raised to his holding the trusteeship on the ground of his being interested in some of the companies originally promoted by the debtor; and though this would not, he said, in any way affect the carrying out of his duty, he should not care to act in any case in which a creditor might think his interests would not be properly safeguarded.

Proofs of debt were then proceeded with. The debtor had filed a statement of affairs showing liabilities amounting to £58,871, of which £24,041 were returned as unsecured, £19,840 as fully secured, and £6852 as partly secured. The securities held were estimated at £6050, of which £352 were returned as due on bills (none of which were expected to rank), £4640 as contingent, of which £660 were expected to rank, and £67 as preferential—altogether a total of £28,503 to rank against the estate for dividend. The assets were returned at a net sum of £2970—bad and doubtful debts £22,125, upon which the debtor placed no value, thus disclosing a deficiency of £25,533.

The first proof to which Mr. Jarvis took objection was one lodged by the Brockenhurst Gas Company, who claimed to be creditors for £388. The representative of the Company produced a guarantee in support of the proof; but it was contended by Mr. Jarvis that it was void for want of consideration. The Chairman, however, decided to admit the proof for voting purposes.

A claim which led to some discussion was one lodged by Messrs. Spencer, Whately, and Co., Limited, whose proof amounted to £1726 in respect of goods sold and delivered to the debtor, and for which he had promised to pay, including goods sold to the Mid-Oxfordshire Gas Company. This proof was objected to by the debtor. The Secretary of the Company then produced certain evidence in support of the proof, including acceptances on which he maintained the debtor was liable. Eventually the claim was admitted by the Chairman to the extent of £178 14s. 2d.

A proof amounting to £18,000 of the Ticehurst and District Water and Gas Company, for whom Mr. Jarvis was appearing, was strongly objected to by Mr. Barnes. It appeared that the proof was in respect of damages for alleged fraud and misfeasance arising from the sale by the debtor to the Company of certain gas-works. In support of the proof, Mr. Jarvis said he could produce the statement of claim. The Chairman remarked that he was not going to try the action, and he should not admit the proof for anything unless there was a specified amount that had been paid by the Company. Mr. Jarvis said there was one item of £822 which had been paid by them instead of by the debtor. This had been admitted in the pleadings; and he submitted that the proof should be allowed for this amount. He had not anticipated that the claim in respect of the alleged fraud would be allowed; but he considered that when a man bought gas-works for something like £300 and sold them to a Company for £16,000 there must be a discrepancy somewhere. The Chairman said it was only the usual discrepancy in this class of case. He added that he did not see how he could dissociate different parts of the statement of claim; and, under the circumstances, he thought it his duty to admit the proof for absolutely nothing.

After the proofs were all dealt with, the Chairman said he thought

the meeting should first of all pass a resolution for a Trustee to be appointed in place of Mr. Walker, notwithstanding the fact that this gentleman had in reality tendered his resignation. A resolution for the removal of Mr. Walker was then carried *nem. dis.*, it being remarked by a creditor that he should like it to be understood that it was only a tacit resolution. Subsequently, the names of Mr. E. H. Hawkins and Mr. F. S. Salaman were submitted; and on a vote being taken, the former gentleman was appointed.

The Chairman said he did not consider it necessary to appoint another Committee of Inspection; and the meeting then closed.

Income Tax Allowance for Depreciation.

An appeal on behalf of the Montrose Gaslight Company for an allowance in respect of depreciation by way of decreased value of plant and machinery by reason of wear and tear, was recently heard before the General Commissioners at Montrose. Mr. D. Smith, who appeared on behalf of the Company, explained to the Commissioners that they had always been allowed depreciation in past years, but that in the autumn of 1909 the Inland Revenue authorities issued a circular stating that "no depreciation should be allowed." After dealing with the Acts of Parliament, Mr. Smith contended that the Company had sufficient to do in fulfilling the legislation of the Government, without submitting to regulations framed by Government officials. Several appeals heard in England, Ireland, and Scotland were quoted for the guidance of the Commissioners. After hearing arguments, the Commissioners decided that they had no option but to allow depreciation in accordance with the Customs and Inland Revenue Act, 1878, and the Finance Act, 1907; and they decided accordingly.

Dangers of Street Boxes.

In the King's Bench Division of the High Court of Justice last Thursday, before Mr. Justice Grantham and a Special Jury, Mrs. Louisa Elizabeth Elliott, wife of a music instructor in the Army, recovered damages against the Battersea Borough Council for personal injuries sustained by her. Her case was that on Oct. 29, 1909, she was standing at the corner of Latchmere Road and Battersea Park Road, and was resting her hand upon an iron box fixed in the pavement while she watched smoke issuing from the roadway. The Fire Brigade were coming along the road. Suddenly the box on which she had placed her hand was blown open, and her clothes, hands, and face were burnt. It was subsequently found that she had sustained serious internal injuries, likely to be of a permanent character. The defendants denied negligence, and said the accident was incidental to the use of electricity. It was due to a London County Council workman, who, while engaged on tramway work, injured the casing of an electric light cable and let in the damp. The Jury awarded the plaintiff £525 damages, and judgment was entered for this amount, with costs—a stay of execution being refused.

MISCELLANEOUS NEWS.

PREPAYMENT METER CHARGES IN MANCHESTER.

Gas Committee Recommend no Further Concession.

A Special Meeting of the Gas Committee of the Manchester Corporation was held last Thursday to consider a further proposal by certain members of the Council, led by Mr. Jennison, that the price of gas to prepayment consumers should be reduced. At present the Corporation supply 30 cubic feet for 1d. by automatic meter, which works out at 6d. per 1000 cubic feet more than is paid by ordinary consumers. It is argued in support of a reduction being made that it is unjust to charge so much more to users of prepayment meters, especially as they are chiefly poor people; Mr. Jennison's aim is that the price shall be the same to both classes of consumers.

A return was presented showing that, taking 44 corporations in the United Kingdom, the average quantity of gas sold for 1d. through slot-meters was 28 cubic feet, and that the average of 55 gas companies was 25 cubic feet, compared with 30 cubic feet in Manchester. It was also demonstrated that the cost of distribution, management, repairs, renewals, interest charges, &c., was 5·2d. per 1000 cubic feet in the case of ordinary consumers, and 13·2d in the case of prepayment meter consumers. Though the additional cost to the Gas Department in the case of the latter class of consumers is upwards of 7d. per 1000 cubic feet, they are only charged 6d. more than the ordinary consumers, who get their gas at 2s. 3d. per 1000 feet.

The matter was discussed at considerable length; and in the end it was decided that the Committee could not recommend the Council to make any change at present in the charge for gas to users of prepayment meters; the feeling of the Committee being that while they are expected to make so large a yearly contribution in relief of rates as they now do, they cannot possibly grant any further concessions to the gas consumers.

In the course of an interview after the meeting, Alderman Gibson, the Chairman of the Gas Committee, said there had been no complaints from the consumers, and there were numerous applications coming in for the fixing of prepayment meters. Manchester, he added, did what other towns did not. Not only did they give £50,000 a year to the rates, but supplied and fixed cooking stoves, &c., free of charge.

Some time ago, Alderman Gibson furnished Mr. Jennison with all the information available on this subject, and showed how impossible it was for the Committee to grant this gentleman's request to place slot-meter users on the same footing as ordinary consumers. By way of illustration, he pointed out that it would cost a grocer more to sell 16 separate ounces of tea than a single pound to one consumer; that the ordinary consumer burnt 40,000 cubic feet per annum against the prepayment consumer's 9000 cubic feet; that it would cost £1500 to alter

the indices of 60,000 meters; and that Mr. Jennison's proposal would mean a loss to the Gas Committee of £15,000 a year in revenue.

A notice of motion on the subject by Mr. Jennison is included in the *agenda* for the next meeting of the City Council; it not having been reached when they adjourned at the last sitting. This will be the fourth time Mr. Jennison has brought the question forward.

Some idea of the magnitude of the business done in this section of the Gas Department may be gathered from the fact that at the end of last quarter there were more than 61,000 slot meters in use within and outside the city boundaries. In round figures the year through, they yield, on an average, upwards of £1500 weekly. Besides the 48 collectors engaged day by day in the work of collection from the meters, there are 15 others known as "broken-period men," whose duty it is to visit houses where tenants are about to remove, and clear the meters of their contents.

POISONED BY COAL GAS.

A Singular Case in Lancashire.

After an inquiry extending over two-and-a-half hours, a Coroner's Jury at Leigh (Lancashire) returned a verdict of "Death from inhaling coal-gas fumes" in the case of Daniel Holt, an engineer employed at the silk mill of Messrs. S. Courtald and Sons, Leigh.

It was stated that on Saturday, Dec. 3, eight men from the Selas Gas Lighting Company commenced work at the mill for the putting down of a high-pressure gas plant (which, of course, involved a changing of the gas brackets and pendants throughout the factory); Holt being on duty on that day and the Sunday. When Holt reached home on the Sunday, he complained to his wife about having been "gassed" when passing through the shed—saying he felt dizzy and sick. He continued work on the Monday, although evidently ill; and on the Tuesday morning was taken home, dying four days later. Henry Wyatt, who occasionally took charge of the engines for Holt, said that the deceased complained to him about there being "that old smell of gas again" in the shed on the Sunday. Witness also smelt it. He heard that when the gas was turned on, the pipes were open. They called it "blowing the gas through." Dr. A. T. Ross, who had made a post-mortem examination of the body in the presence of Drs. Craven Moore, J. Jones, and Auden, said the body was well-developed and well-nourished. Rigor mortis was well-marked in the legs, arms, and jaws. The blood appeared unusually red, which was consistent with poisoning by carbonic oxide; and he was of opinion that death was due to this. The evidence was also consistent with a man dying from the result of coal-gas poisoning. In answer to a juryman, the Doctor said it was possible for two men to go where there was gas and one to escape its effects and the other to be affected. Witness's evidence was put in writing and signed by the three other medical men who took part in the post-mortem examination.

VENTILATION OF STREET-BOXES.

At the Meeting of the London County Council last Tuesday, the Highways Committee reported the receipt of a letter from the Woolwich Borough Council, asking the County Council to consider the advisability of framing regulations applying to the County of London, and enforceable by local authorities, to secure the ventilation of street boxes constructed by the Post Office, and by telephone and electric lighting bodies. The Borough Council stated that explosions had taken place owing to the escape of gas into the receptacles in question, and that in their opinion all such boxes should be ventilated, in order to prevent the possibility of explosion. The matter arose out of the application to the Borough Council by the Postmaster-General for sanction to lay an underground telegraph line in Woolwich, and the imposition by the Council of a condition of their assent that the inspection box in connection with the system should be efficiently ventilated. This condition was objected to by the Post Office authorities, and was withdrawn by the Borough Council subject to reserving their right to raise again the question of principle. The Woolwich Council stated that they had communicated with the other Metropolitan Borough Councils on the subject, and thirteen of them had made representations in support of the proposal. The Highways Committee pointed out that it was usual, in regard to works approved by the Council, to require that adequate means should be taken to prevent the accumulation of gas in boxes and conduits; but this condition did not apply to works carried out by local authorities having electric lighting undertakings, with the exception of the St. Pancras Borough Council. With regard to street boxes for telephone and telegraph wires, the Committee were advised that the Council had no general authority to frame the regulations suggested; and they recommended that it was undesirable to seek for parliamentary powers to enable such regulations to be made. This recommendation was adopted; and the Woolwich and other Borough Councils will be informed accordingly.

ELECTRICITY SUPPLY TO SMALL HOUSES.

A Proposal at Oldham.

The Electricity Committee of the Oldham Corporation recently had their attention called by the Electricity Engineer (Mr. S. W. Newington) to the scheme introduced at Eccles for supplying electricity to small houses at 6d. per week, to which reference has already been made in the "JOURNAL." He said current was supplied to a row of houses through a bulk meter, each house having half-a-dozen lights. As a matter of fact, there was nothing in the thing. He had 24 lights at his house, and his electricity bill worked out at less than 1s. per week. His neighbour had the same number of lights, and his bill was even less. It was all a question of economy in using. Electricity did not

cost more than gas in small houses if it was used carefully. The present prices at Oldham were quite as low as those quoted at Eccles. If people used electricity carefully, with metallic filament lamps, it was as cheap as any other illuminant. The people had to buy their own lamps; and the longer they had the lights on, the oftener would these require renewing. The greatest difficulty in regard to the cost was with the meters, which were on hire. His idea was to carry out the whole scheme at so much per light per annum.

METROPOLITAN WATER BOARD.

The Board as Ratepayers—Examination of River Water.

At the Meeting of the Metropolitan Water Board last Friday, the Appeal and Assessment Committee reported that, for the purposes of the current quinquennial valuation in the Metropolis, the revised rateable value of the Board's property, finally approved, amounted to £636,692. The principal valuations were: City of London, £44,518; Westminster, £59,801; Camberwell, £38,989; Wandsworth, £46,807; Kensington, £35,898; Lambeth, £32,374; Islington, £34,500; Stoke Newington, £24,140; Marylebone, £25,906; Hammersmith, £27,649; St. Pancras, £21,320; and Hackney, £22,020. The Chairman of the Committee (Mr. C. E. Musgrave), in moving the adoption of the report, said he knew of no other body in the United Kingdom which was rated so highly as the Board. Last year, cut of the gross water-rental (£2,759,000), they paid in rates and taxes £413,000, which was equivalent to 14·98 per cent. Of their gross revenue, 2d. out of every shilling which the Board took into their coffers for the supply of water was returned in the shape of rates. The report was adopted.

At the same meeting, the sixth report of the Director of Water Examination (Dr. A. C. Houston) on research work carried out by him, dealing with the comparative vitality of "uncultivated" and "cultivated" typhoid bacilli in artificially-infected samples of raw river water, with special reference to the question of storage, was presented. In the report, it was stated that the Director treated liquids containing myriads of typhoid bacilli with raw Thames river water. In two experiments the typhoid bacillus was dead within one week, and in two other experiments dead within two weeks. Although the Director was well satisfied with his negative results, he put the matter to the crucial test of drinking half-a-pint of the infected water (which contained initially over 218 million typhoid bacilli) on the 24th day from the start of the experiment without any evil effects. He pointed out that most persons would consider a "drinking experiment" as much more conclusive evidence of "safety" than any negative laboratory results.

The East Ham Town Council recently received quotations for the lighting by gas and electricity respectively of the workshops at the sewage works. The quotation of the Gaslight and Coke Company, at £14 6s., for lighting by gas was accepted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Glasgow Town Council on Thursday, Mr. D. M. Stevenson, in submitting the minutes of the Special Committee on Smoke Abatement, said he thought that everybody connected with the recent Smoke Abatement Exhibition had been satisfied with the result of the enterprise. The exhibitors were particularly pleased. The financial outcome was also very satisfactory; and he hoped they would adopt the suggestion which had been made and have another exhibition before long. In the minutes submitted by Mr. Stevenson, it was stated that the total number of visitors to the exhibition was 69,010, and that there was a net surplus of £1045. The Committee recommended that £200 be placed to each of the gas and electricity departments, on account of outlays incurred by them for work done prior to the opening and during the run of the exhibition, in adapting the buildings for the purpose of holding an exhibition, and otherwise; and that the balance be handed over to the Treasurer of the Police Department for behoof of the Sub-Committee on Air Purification, on the understanding that it be employed in furthering the objects which the Special Committee had in view in organizing the exhibition. The Committee recorded their appreciation of the services rendered by the officials of the various Corporation departments connected with the exhibition, and also of the Manager and Secretary. They were satisfied that the results had justified the carrying out of the scheme, and that it would prove to have been of great advantage to the city generally in the promotion of smoke abatement.

The following statement was published in the "Glasgow Herald" on Wednesday: "A motion to be introduced at to-morrow's meeting of the Corporation touches one aspect of municipal overlapping which is not only wasteful, but which puts ratepayers to avoidable inconvenience. There are separate staffs for the inspection of gas, electricity, and water meters; and these officials call at different times. It would be a simple matter to arrange identical periods, to which accounts apply, in the three departments, so that one visit each term, by one inspector (instead of by two or three), would be sufficient. This would effect a substantial economy, and be on the lines of municipal unification, which is essential to any real administrative reform." The motion referred to does not appear to have been made, or, if made, it would seem to have received scant courtesy.

In the Hamilton Town Council on Tuesday, the Gas Committee reported that the coal carbonized in the half year to Nov. 30 last showed a decrease of 133 tons, and that there had been an increase of 1,259,600 cubic feet in the make of gas, and a decrease of £246 in wages. The Manager—Mr. J. Ballantyne—reported that all the contracts for the new coal-handling plant had been completed, and that everything was working satisfactorily.

The Dunfermline Town Council had before them on Monday a

minute by the Gas Committee to the effect that the Convener—Mr. T. Stewart—had brought before the Committee the advisability of giving a demonstration, at or near the City Chambers, of the lighting capabilities of gas on the high-pressure system, and that the Committee had agreed to the proposal—the Lighting Committee to furnish four lamps of a sufficient candle power for the purpose, and the Gas Committee to supply the necessary compressor. The Lighting Committee's minute stated that they had agreed to fit up four lamps of 1500-candle power each, at an estimated cost of £24. Only one dissentient voice was raised to the proposal, and it was consequently adopted.

The Inverurie Town Council on Monday, on the motion of Treasurer Rae, resolved to enter into negotiations with the Gas Company regarding a transfer of the gas undertaking; and the whole Council were appointed a Committee to approach the Company on the subject.

A correspondent writing in the "Aberdeen Daily Journal" of Tuesday last, in denunciation of the proposal to obtain parliamentary powers for the sale by the corporations of electrical lamps and fittings, states that the movement is the outcome of an agitation on the part of a few municipal engineers and councillors in various parts of the country. Owing, it is said, to gas competition, the profits on electrical fittings are already cut very fine indeed, and the prospect of still further competition on the part of municipal retail trading departments, backed by the rates, is received with great apprehension.

Lecturing in the Glasgow University on the evening of Monday of this week upon "Thorium: Its History, Uses, and Radio-Activity," Mr. Frederick Soddy, M.A., F.R.S., gave an account of the properties of thorium, and of its application in incandescent gas lighting, and added interesting statistics supplied by Mr. S. B. Langlands, the Inspector of Lighting in Glasgow, with regard to the use of gas-mantles in the lighting of the streets of the city. The number of mantles used per annum in Glasgow was 200,000, giving light sufficient to illumine the road from London to Glasgow. About 9½ mantles were employed per lamp in the Glasgow streets every year; and the quantity of gas consumed per mantle averaged 1000 cubic feet. About 1 cwt. of ash was recovered each year from the mantles used in the lighting of the city streets, and was returned to the manufacturers to be utilized in the making of new mantles.

Prepayment Gas-Meters Used as Savings Banks.—Presiding at the annual meeting of the Manchester and Salford Savings Bank last Wednesday, the Bishop of Manchester (Dr. Arbuthnot Knox), referring to the action of the Committee in issuing home safes, said he had been told on good authority that the penny-in-slot gas-meters were largely used for saving money, and that when the Corporation inspectors went round to collect they had to release not only the pennies deposited for payment of gas consumed, but florins, half-crowns, shillings, and even half-sovereigns, which had been put there for safe keeping. This, added the Bishop, proved the value of home safes, of which the bank had 3659 in use.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 872.]

LIVERPOOL, *Dec.* 17.

Sulphate of Ammonia.

During the past week the market has been very quiet, with a tendency towards still lower prices. This is no doubt to be attributed to the fact of dealers having covered the bulk of their requirements for this month in good time, so as to effect shipment before the Christmas holidays. At the close, the values are £12 10s. to £12 11s. 3d. per ton f.o.b. Hull, £12 11s. 3d. to £12 12s. 6d. per ton f.o.b. Liverpool, and £12 12s. 6d. to £12 13s. 9d. per ton f.o.b. Leith. In the forward position, no new business has been recorded by manufacturers, who maintain a firm attitude; but it is reported that second-hand sellers are offering abroad at the equivalent of £12 10s. per ton f.o.b. British ports for delivery next year.

Nitrate of Soda.

There is again no change in the situation of this article, and the spot quotations continue to be given as 9s. 4½d. per cwt. for ordinary, and 9s. 7½d. for refined quality.

LONDON, *Dec.* 19.

Tar Products.

The markets for tar products have remained fairly steady throughout the past week, and the inquiry for pitch has been better; in many quarters improved prices having been paid for January-June delivery. Benzols remain in about the same position. Creosote is quiet, and new orders are difficult to negotiate. Crude carbolic makers are still firm in their ideas of price; but not many contracts are reported at the present high prices. Solvent naphtha continues quiet; and heavy naphthas are fairly firm.

The average values during the week were: Tar, 17s. to 20s. 9d. *ex* works. Pitch, London, 34s. 6d. to 35s.; east coast, 33s. to 34s.; west coast, Clyde ports, 33s. 6d. to 34s. 6d., Manchester, 32s. 6d. to 33s. 6d., Liverpool, 33s. to 34s. Benzol, 90 per cent., casks included, London, 8d. to 8½d.; North, 7¼d. to 7½d.; 50-90 per cent., casks included, London, 8d. to 8½d.; North, 7¾d. to 8d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3¾d. to 4¼d.; North, 3⅛d. to 3¼d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 11¾d. to 1s.; North, 11d. to 1s. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 1⅞d. to 2d. Heavy oils, in bulk, 2¾d. to 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d.; west coast, 1s. 1d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The inquiry for prompt delivery has been better, and prices on the whole are steady. Beckton are quoting only for spring delivery.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a stronger demand for coal, as is often seen before the holidays, and prices show some steadiness. In the steam coal trade, best Northumbrians are from 9s. 10½d to 10s. per ton for early delivery. Second-class steams are steady at from 8s. 6d. to 8s. 9d., and steam smalls are about 4s. 10d. to 6s. 3d.—steam coals being somewhat scarce for delivery before the holidays. In the gas coal trade, the heavy deliveries continue; the time of the heaviest consumption being now just at hand. Durham gas coals are quoted from 8s. 3d. to 9s. 3d. per ton f.o.b. for the usual classes; while for "Wear" specials, about 10s. 6d. is the figure. The contracts for the London supplies previously referred to are now practically settled. There are also a few smaller contracts settled at prices that are, for next year, slightly below those that now rule. At the same time, the tendency is towards the belief that there will be rather higher prices quoted now that the large contracts have been fixed, and a part of the output thus taken up. Gas coke is in better demand, at about 14s. 6d. to 14s. 9d. per ton f.o.b.

Scotch Coal Trade.

Trade has become quieter for home demands. Foreign orders for ell and splint have been more plentiful; and there have been welcome inquiries by foreign buyers for forward delivery. The prices now quoted are: Ell, 9s. to 10s. per ton f.o.b. Glasgow; splint, 9s. 9d. to 10s.; and steam, 9s. to 9s. 3d. The shipments for the week amounted to 315,553 tons—a decrease of 9287 tons upon the previous week, but an increase of 30,566 tons upon the corresponding week last year. For the year to date, the total shipments have been 15,289,738 tons—an increase upon the corresponding period of 750,371 tons.

Reduction in Price at Brighton.—The price of gas is to be reduced 1d. per 1000 cubic feet by the Brighton and Hove Gas Company as from the end of the current quarter.

Financial Position of Colwyn Bay.—The report of Mr. William Griffith, the Local Government Board Auditor, on the accounts of the Colwyn Bay Urban District Council for the year to March 31, has been submitted to the Council. It shows that there was, at the end of the twelve months, a net overdraft at the bank of £16,722, and that the overdraft on revenue account had increased from £10,044 at March 31, 1909, to £11,452. Mr. Griffith says he is glad to learn that the Council have decided to increase the general rate; and he expresses the hope that they will make further provision for the extinction of the overdraft within a reasonable period. He disallows £600 paid in interest on the money borrowed from the bank. Mr. G. Bevan, the Chairman of the Finance Committee, said that the financial position of the town was, for the time being, serious; and it would take £1366 a year for five years to wipe out the deficiency.

Electric Light Failure at Middlesbrough.

Middlesbrough was particularly unfortunate on the evening of last Saturday week, as, owing to a failure of the electric current, the tradesmen suffered considerable inconvenience. Not only was this the case, but the music lovers in the town and neighbourhood were deprived of the pleasure of hearing an organ recital at the Town Hall, in which about 1500 people were assembled, in consequence of the absence of power—presumably for working the bellows. At a quarter to nine (an hour after the recital should have commenced) it was announced that the performance would be given the next afternoon. The Electricity Engineer (Mr. H. M. Taylor) was informed of the failure about half-past seven, and at once set to work to locate and repair the fault; and by a quarter to ten the full supply of current was available. Unfortunately, those who wished to hear the organ recital were doomed to further disappointment; for, when they assembled at the Town Hall on Sunday afternoon, a notice informed them that the blowing apparatus of the organ was out of order, and could not be repaired in time.

Coggeshall New Water-Works.—The new water-works at Coggeshall, the construction of which has been in hand rather more than a year, are now nearing completion. The well which has been sunk is 59 feet deep and 7 feet in diameter. It is lined with cast-steel cylinders. The pumping-station is built of red-brick, with iron casements and tiled roof, and contains gas-producing plant which drives two 12-H.P. gas-engines, working a double set of three-throw pumps, with a lifting capacity of 8000 gallons per hour, which can be increased, if required, to 12,000 gallons. At a recent trial, the engine plant worked without a hitch. The reservoir has a capacity of 163,000 gallons. After leaving it, the water passes through a 7-inch main into Coggeshall, and thence into smaller pipes, the total length of which is nine miles.

Sowerby Bridge Gas Manager's Salary Advanced.—When a recommendation of the Gas Committee, that the salary of their Manager (Mr. A. W. Bissell) be increased by £40 per annum, came up for confirmation by the Sowerby Bridge Urban District Council, Mr. Whiteley explained that the Committee had decided on this step after fully considering the matter, and taking into account the fact that Mr. Bissell had a good chance of securing another position. They felt it would be very unwise to change their Engineer at the present time, not only because of the extensions at the gas-works, but also because Mr. Bissell, having been in the neighbourhood for such a long period, had acquired a knowledge of the works, and the district, which it would take a long time for another gas engineer to obtain. At present they supplied gas to a population of something like 30,000 people, and their gas area extended from Brearley to Starne Mill on the one hand, and from Midgley to Barkisland on the other. Though the advance proposed was no doubt a good one, he thought no one who remembered Mr. Bissell's services since he came among them would say the action of the Gas Committee was not justified. The recommendation was agreed to.

A Social Gathering at Greenwich.

An annual event which is always looked forward to with much pleasure took place at the West Greenwich Gas-Works Institute last Saturday evening, when a party of some 150 sat down to dinner, under the chairmanship of Mr. J. F. Braidwood, the Engineer of the station, and President of the Institute, which is managed by a Committee, of whom Mr. Alfred Showell is the Hon. Secretary, and Mr. H. P. Hollis Assistant Hon. Secretary. In addition to the employees at this particular works who had not to be on duty, the gathering included a number of visitors from other stations of the South Metropolitan Gas Company. Mr. W. Doig Gibb, the Chief Engineer of the Company, and Mr. F. M'Leod, the Secretary, expressed their regret at being unable to attend. Those present included Mr. J. D. C. Hunter and Mr. J. Newbold, Employee Directors, Mr. P. Richbell, Chief Cashier, Mr. H. Day, Chief of the Automatic Department, Mr. C. T. Drumgold, the Chief Storekeeper, Mr. M. E. Nicholls, the Chief Indoor Inspector, Mr. H. Austin, who has lately retired from the position of Employee Director, and some half-dozen old pensioners. After dinner, a large number of prizes were distributed to successful competitors at the summer flower show, and in connection with various games, &c.; and there was also a little appropriate speech making. These items were interspersed with music and song. The room was gaily decorated with flags; and on the walls two prominent objects caught the eye. The first was an excellent portrait in oils of the late Sir George Livesey, the cost of which was defrayed by a subscription among the men; and the other, the "Good Samaritan" St. John Ambulance trophy presented by the late Chairman some years ago for competition among the different stations of the Company, and which now for the first time is held by West Greenwich. The Chairman proposed "Prosperity and welfare in every form and shape to the South Metropolitan Gas Company," coupling with it the names of the Chairman, Directors, and two chief officers. He remarked that, but for the many kindnesses and privileges accorded to them, those serving the Company would not be in the happy position that so many of them occupied now. They owed it all really, in starting, to Sir George Livesey; and Mr. Carpenter was, he believed, following very closely in his footsteps. There was no doubt that, if each one put his shoulder to the wheel, co-partnership had come to stay. Mr. Hunter and Mr. Newbold replied. The toast of "The Chairman" was submitted by Mr. Austin, who remarked that he had heard Mr. Braidwood speak highly of those he had charge of. In reply, the Chairman said he was always pleased to help in anything going forward, and to do what he could for the men. In addition to the prizes and St. John Ambulance certificates which were awarded, several presentations took place during the evening. In acknowledgment of his services as Librarian to the Institute for the past fifteen years, Mr. Harry Colebrook was handed a silver cigarette case; while Mr. Showell, for his work as Hon. Secretary to the Sick Fund, was given a handsome case of cutlery. Last, but not least, the Chairman presented to each of the six members of the West Greenwich Gas-Works St. John Ambulance class, who had been successful in bringing the challenge trophy to this station, a photographic group of themselves surrounding the trophy. He remarked that their success was highly creditable to them, as West Greenwich was only a small station, and therefore there were not many men to choose from for the competition.

Exmouth Water-Works Extensions.—It is proposed to begin early next year the construction of the Dolton water scheme for the Exmouth District Council. The scheme includes the construction at Dolton of a pumping station, comprising air-lift plant and a tank for the reception of the water. Five miles of 12-inch and 9-inch mains will be laid from Dolton to the existing reservoir at Squabmoor; and the water will be forced to this level by three-throw ram-pumps. The motive power will be provided by gas-engines and a suction gas-plant.

Extensions at the New Mills Gas-Works.—The Clerk to the New Mills Urban District Council (Mr. J. Pollitt) has received notification from the Local Government Board that the Council's application to borrow £3400 for gas-works purposes had been sanctioned. Part of the amount is for an extension of the water-gas plant, which is urgently needed to meet the requirements of the district. Since the Council acquired the gas undertaking, the works have practically been rebuilt; and the price of gas has been reduced nearly one-half.

Royal Engineers at the Taunton Water-Works.—Through the courtesy of Alderman J. G. Vile, the Chairman of the Water Committee of the Taunton Corporation, a party of officers of the Royal Engineers, from Chatham, recently inspected the water-works, which are situated among the Blackdown Hills. Information was given to the visitors by Mr. H. T. Coles, the Manager of the works; and the party were very much interested in the undertaking. The three reservoirs—Luxhay, Leigh, and Blagdon—were quite full; the storage amounting to about 160 million gallons. The Luxhay reservoir, which was opened in 1905, has a water area of 18 acres, a depth of 57 feet, and a capacity of 120 million gallons. On the return journey, a call was made at the filter-beds.

Suicide by Gas in Birmingham.—An inquiry was held in Birmingham last Friday into the circumstances attending the death of Thomas Henry Carter (42), an art metal worker. Deceased had had family trouble and had given way to drink. The door of his house was found locked one day, and on entry being made through the window he was discovered in a moribund condition upon a bed. He was removed to the Infirmary, where he died last Tuesday. The police-constable who entered the premises said there was a faint odour of gas, and he noticed that a piece of tubing had been affixed to the gas-pipe; the other end lying on the bed. No gas was coming from the pipe, which was supplied by a slot-meter; but from the time the deceased locked himself in until an entrance was effected, 28 cubic feet of gas had escaped from the pipe, which was turned on full in the bedroom. The medical evidence was to the effect that poisoning by coal gas had probably set up inflammation of the brain, and had caused hemorrhage. The Jury found that Carter had committed suicide; but they added that there was no evidence as to the state of his mind.

Monte Video Gas and Water Supply.

According to the latest report for the year ended 1909 of the British Consul in Uruguay, the Monte Video Gas Company are steadily increasing their business, in spite of the keen competition of electric lighting. They have established themselves in a handsome new building, with ample window fronting, which affords full opportunity for an attractive display of goods. The price of gas, which in 1867 was 18c. (9d.) per cubic metre, has been gradually reduced to its present moderate cost of 8c. (4d.) for lighting and 6c. (3d.) for other purposes. This is equal to a reduction from 21s. to 9s. 6d. and 7s. respectively per 1000 cubic feet. With regard to the water supply, the Consul states that during the year covered by his report the Water Company expended £250,000 of new capital on extensions and improvements. These include a new powerful triple-expansion engine with two sets of pumps—one for forcing the water of the River Santa Lucia to the filter beds, and the other for pumping the purified water to the reservoirs, a distance of 21 miles, whence it gravitates for 15 miles to Monte Video. The capacity of the reservoirs is 13,125,000 gallons.

Exeter Corporation and the Standard Burner Bills.—At the last meeting of the Exeter City Council, Mr. Lucas, when moving the adoption of the report of the Parliamentary Committee, alluded to the share of costs the Council had been called upon to pay in connection with their opposition to one of the Gas Companies (Standard Burner) Bills. He stated that the amount would be £237.

Thefts from Prepayment Gas-Meters.—At the County of London Sessions, last Tuesday, before Mr. Loveland Loveland, K.C., Deputy-Chairman, Oscar Bartley and Rose Burrows were indicted for being concerned in stealing 5s. 11d., 10s. 4d., and 2s. from prepayment gas-meters, the property of the Gaslight and Coke Company, in premises in Cross Street, Islington. Evidence having been given by the occupant of a flat on the same floor as that on which the accused lived, the Jury found both of them guilty. Bartley was sentenced to seven months, and Burrows to three months,' imprisonment, with hard labour.

Lighting of East Stonehouse.—The Plymouth and Stonehouse Gas Company have won a notable victory in a competition for the public lighting of the part of their district of supply which is under the control of the East Stonehouse District Council. When the time came for the renewal of the contract, the Devonport Corporation Electricity Committee made an offer to the Council of a tempting character; and as the Corporation's electricity works are in the District Council's area, it found some support among those who thought that the electricity undertaking should be supported because it contributes to the rates. It was decided that a test should be carried out; and electric light standards were erected by the Corporation in several of the main streets, so that members of the Council and others interested might see the electric light in juxtaposition with the improved incandescent burners put up by the Gas Company. As the result of this competition, the Council have agreed to renew the contract with the Gas Company for a further term of seven years. The only new condition is that the Company shall maintain a gas-testing station at the East Stonehouse Town Hall.

Last week, after hearing two charges of robbing automatic gas-meters, the Willesden Magistrate said that a fortune awaited the man who invented an automatic gas-meter that could not be broken open.

It is stated in the report of the Directors of the First Garden City, Limited, for the year ended Sept. 30 last that the outlay on gas and water works, electric mains, roads, and sewers during the year was £7722.

A report of the General Purposes Committee to the Dorchester Town Council stated that they had had a consultation with Mr. Steele, representing Messrs. J. & W. Purves, of Exeter, with reference to a proposed supply of electricity for the borough. The Committee recognized the desirability of having the town lighted by electricity, and recommended that no opposition be made to the obtaining of a Provisional Order. The Council adopted this recommendation.

APPLICATIONS FOR LETTERS PATENT.

28,214.—Rowland, T., "Heating or cooling water, gas, or other fluid." Dec. 5.

28,237.—Gas Economizing and Improved Light Syndicate, Limited, and Wilkie, J., "Gas-burners." Dec. 5.

28,250.—Priestman, A., and Beddoes, H., "Controlling the flow of liquids." Dec. 5.

28,296.—Greenfield, J., and Jones, A. E., "Automatically closing gas-burner supply-pipes when the gas supply fails." Dec. 6.

28,306.—Burnett, H. R., "Fittings for the lighting of streets and other spaces." Dec. 6.

28,325.—M'Lean, D. A., "Mantles and their packing." Dec. 6.

28,388.—Duckham, A. M'D., "Vertical retorts." Dec. 6.

28,420.—Wolf, L., and Akesson-Amrein, L., "Inverted burners." Dec. 6.

28,433.—Volk, M., "Incandescent burners." Dec. 7.

28,471.—Urban, A., and Hamburger, F., "Gas-igniters." Dec. 7.

28,519.—Heane, M., "Stationary piston gas-engine." Dec. 8.

28,523.—Perry, W. F., "Lighting gas-burners from a distance." Dec. 8.

28,524.—Williams, J., "Supplying carburetted air." Dec. 8.

28,528.—Owen, R. T., "Mantles." Dec. 8.

28,542.—Mitton, T. J. L., "Self-sealing lids or joints for retort mouthpieces." Dec. 8.

28,584.—Julius Pintsch Akt.-Ges., "Lighting and extinguishing gas-lamps." Dec. 8.

28,647.—Little, N. E., "Gas-heaters." Dec. 9.

28,653.—Harris, G., "Pipe-rust interceptor." Dec. 9.

28,662.—Jones, A. O., "Quenching coke." Dec. 9.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Dec. 17. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	21/-	18/6 21/-	19/- 21/3	19/- 21/-	19/- 21/-	—
Pitch*	,,	36/-	33/6	34/-	34/6	34/- 34/6	33/-
Benzol, 90 %	per gallon	-/9	-/7½ -/8½	-/8	-/7¼ -/7½	-/8	-/8
Benzol, 50-90%	,,	-/10	-/8¼ -/8¾	-/9	-/8 -/8¼	-/8¼ -/8½	—
Toluol, 90%	,,	-/10	-/9 -/9¼	-/10	-/10	-/9¾	-/10
Crude naphtha, 30%	,,	—	-/3¼ -/3½	-/3½	-/3¼ -/3½	-/3⅜	—
Light oil, 50%	,,	—	-/3¼	-/3½ -/3¾	-/3 -/3¼	-/3 -/3¼	—
Solvent naphtha, 90-160	,,	—	-/10½ -/11	-/10	-/10	-/11½ 1/-	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11	-/11½	-/11½	-/11
Creosote in bulk	,,	-/2½ -/2¾	-/2 -/2¼	-/2	-/2 -/2⅛	-/2$\frac{1}{16}$	-/2
Heavy oils	,,	-/3¼	-/2½ -/3	-/2¼	-/2¾	-/2⅞	-/2⅞
Carbolic Acid, 60's	,,	1/1	1/- 1/1	1/1	1/- 1/1	1/0½ 1/1	1/1
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	47/6	47/6 50/-	—
,, pressed	,,	—	60/-	63/-	60/-	60/- 72/6	—
,, whizzed	,,	—	—	—	70/- 72/6	60/- 75/-	65/-
Anthracene	per unit	-/2	-/1⅜	-/1½	-/1¼	-/1¼	—

* Advancing.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 835.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord.	79—82	−4	6 1 11
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	95—98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd.	6⅝—6⅞	..	5 1 10
40,000	5	,,	7	Do. New, £4 paid	5—5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c.	28½—29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c.	16¼—16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	248—251	..	4 19 7
330,000	,,	,,	9½	Do. New	189—191	+3	4 19 6
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb.	97—99*	..	4 0 10
220,000	Stk	Aug. 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	158—161	..	4 19 5
460,000	20	Sept. 29	10⅝	British	44—45	..	4 12 4
109,000	Stk.	Aug 12	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	107—109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	90—92	..	4 17 10
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5$\frac{2}{10}$	Commercial 4 p.c. Stk.	106—109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do.	101—103	..	4 17 1
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77—79*	−½	3 15 11
800,000	Stk.	,,	4	Continental Union, Ltd.	86—91*	..	4 7 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	134—136*	+½	5 2 11
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord.	103—105	..	4 15 3
486,090	10	July 14	12	European, Ltd.	23¼—24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾—18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord.	105¾—106¾	..	4 7 5
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87—89	..	3 18 8
4,062,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	,,	Dec. 15	3	Do. 3 p.c. Con. Deb.	78—80*	..	3 15 0
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17—17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅜	Ilford A and C	145—148	..	4 19 8
65,780	,,	,,	5⅞	Do. B	114—116	..	5 1 3
65,500	,,	June 29	4	Do. 4 p.c. Deb.	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	185—187	..	4 16 3
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	120—122	..	4 18 4
561,000	Stk.	,,	10	Liverpool United A.	220—222	..	4 10 1
718,100	,,	,,	7	Do. B	164—165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	Dec. 15	6	Malta & Mediterranean.	4⅝—4⅞*	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb.	99—101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99—101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12¼—12¾	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	137—139	+1	5 15 1
60,000	5	Sept. 15	8	Ottoman, Ltd.	6¼—6¾	..	5 18 6
31,800	53	Aug. 31	13	Portsea Island A.	131—133	..	5 3 0
60,000	50	,,	13	Do. B.	124—126	..	5 3 2
100,000	50	,,	12	Do. C.	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	102—104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord.	7¼—7¾	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref.	5¼—5½	+⅛	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd.	15¼—15¾	..	5 14 3
115,000	10	,,	6	Do. 6 p.c. Pref.	11¼—11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾—11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 12	5⅝	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	109—111	..	4 10 1
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c.	141—143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c.	112—114	..	4 16 6
149,470	,,	Dec. 15	4	Do. 4 p.c. Deb.	95—97*	..	4 2 6
182,350	10	June 10	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	113—115	..	4 6 11
255,636	Stk.	Aug. 31	6¼	Wandsworth B 3½ p.c.	140—142	..	4 15 1
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	74—76	..	3 18 11

Prices marked * are "Ex div."

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

CHRISTMAS HOLIDAY.

In consequence of the CHRISTMAS HOLIDAYS, it will be a convenience if Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS are received at the Office by 10 o'clock ON FRIDAY MORNING at latest.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, College Hill, Cannon Street, London, E.C.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

PATENTS AND TRADE MARKS PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SUCCESS by Saltation for most is im-probable; the law of averages indicates system, backed by expert advice, as giving the surest results. Discard spasmodic, amateur efforts, and write now Herbert Greatorex, Application Specialist, Beechwood, Matlock.

JOHN RILEY & SONS, Chemical Manu-facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

GAS OILS.

MEADE-KING, ROBINSON, & CO. Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, Exchange Street, Manchester, and Tower Building, 22, Water Street, Liverpool.

WANTED—Tar and Ammoniacal Liquor. Any Quantity.
Grindley and Company, Limited, Rawcliffe, near Goole, Yorkshire.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
Brotherton and Co., Ltd., Chemical Manufacturers, Works: Birmingham, Leeds, Sunderland, and Wakefield.

CALCIDUM, a Limpid, Colourless, Neutral Liquid; does not affect Metals, freezes only at -67° F., and, therefore, when mixed with Water in Gas Meters, Engines, Generators, &c., prevents these Freezing in the most severe weather. It is also the best means of thawing everywhere, for Extinguishing Fires, and for working Mortar and Cement in Winter. Used regularly for Eight Years by one English Gas Company.
Richard Simon and Sons, Limited, Nottingham.

AMMONIA. Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Dorio," Newcastle-on-Tyne. National Telephone No. 2497.

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ROYAL SCHOOL OF MINES, and
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THE Second Part of a Special Course of ADVANCED LECTURES, as follows, will begin during January next:—
Subject:
"GASEOUS FUEL AND COMBUSTION."
Conducted by
Professor W. A. BONE, D.Sc., Ph.D., F.R.S.
Particulars of this, and other Courses to Follow, Free on Application to the Secretary.

THE UNIVERSITY OF LEEDS.
(Department of Fuel and Gas Engineering.

SPECIAL LECTURE COURSES OPEN TO THE PUBLIC.

(*A.*) The Distribution and Uses of Coal Gas.—

A COURSE of 22 Lectures on Wednes-days at Six p.m. and Thursdays at Nine a.m., during Eleven consecutive weeks, as under:—
1911.
Jan. 11 to Feb. 2.—Eight Lectures on "Distribution of Coal Gas," by Mr. Walter Hole, of Leeds.
Feb. 8 to 16.—Four Lectures on "Gaseous Combustion and Structure of Flames," by Professors Bone and Smithells.
Feb. 22 to March 9.—Six Lectures on "The Uses of Coal Gas for Heating Purposes," by Mr. John Bond, of Southport.
March 16 to 24.—Four Lectures on "Gas Lighting and Photometry," by Mr. Jacques Abady, of London.
Fee for the whole Course £1 1s., or 10s. 6d. for a Single Section thereof.

(*B.*) Bye-Product Coking Processes.—
A Course of Eight Lectures on Saturdays at 3.30 p.m. Commencing Jan. 21, 1911, by Mr. Ernest Bury, M.Sc., of the Skinningrove Iron Company, Limited.
Fee for the Course, 10s. 6d.
For further Particulars Apply to the Registrar.

MANAGER FOR TOWN IN MIDLOTHIAN.

THIS Situation is now Filled. Testi-monials will be returned on Request.
Wishart and Sanderson, 23, Rutland Street, Edinburgh.

CLERK (Age 20), with Three-and-a-half Years' Experience in Gas Office, desires CHANGE. Business College Education, Shorthand, Typewriting, and Book-Keeping, &c. Excellent Reference.
Address No. 5331, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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FOREMAN, with many years' experi-ence in this Line, and well acquainted with all the necessary Work except "Knitting," wishes to Change his present Situation in order to go to England or other Countries Abroad.
Please Apply sub O.U. 8571, to Rudolf Mosse, Frankfurterstrasse, 31, Berlin.

WORKS Chemist wanted for Works in Yorkshire, Age 22 to 30, of Sound Training, with Works Experience and some Engineering Knowledge. Gas-Works Practice desirable, but not essential.
Apply, by letter, stating Full Particulars, and Salary required, to No. 5332, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

A GAS Engineer of an Enterprising Gas Undertaking in the Midlands, making between 300 and 400 Million Cubic Feet per Annum, has a Vacancy for a Well Educated Youth as PUPIL.
Address No. 5334, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GRIDS for Purifiers, about 3000 Square Feet ORDINARY and 1500 Cubic Feet HURDLE GRIDS, at 20s. per 100 Feet Respectively. Sold in Smaller Lots.
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Address No. 5333, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

THE Tonbridge Water-Works Company, Limited, have for Disposal a Horizontal Duplex Compound PUMPING ENGINE, in excellent order, capable of delivering 25,000 Gallons per Hour. Can be seen at work; Also a similar One capable of delivering 6000 Gallons per hour, to be removed to make room for larger Plant; Also Two CENTRIFUGAL PUMPS and One Worthington Boiler-Feed PUMP.
All Particulars can be obtained from Jas. Lees, Engineer and Manager, 4, The Terrace, Tonbridge.
November, 1910.

FOR SALE—Complete Gas-Making PLANT, including New Gasholder and Steel Tank, 10,000 Cubic Feet capacity, ready for delivery, with Condensers, Scrubber, Purifiers, &c. Erected complete in England for £1200. Detailed Plan and Specification submitted.
TWO PURIFIERS, 12 ft. by 8 ft. by 5 ft. deep. Three Purifiers 5 ft. 6 in. square, complete with Four-Way Valves and Connections. Re-Erected cheap for immediate Sale.
GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

SPENT OXIDE.

THE Kings Lynn Gas Company invite TENDERS for about 150 Tons SPENT OXIDE. Particulars and Samples of the undersigned,
Edmund G. Smithard,
Engineer.

LEEK URBAN DISTRICT COUNCIL.

COAL WAGGONS.

THE Lighting Committee of the above Council invite TENDERS for the Supply of Eight new 12-TON COAL WAGGONS for the Gas Department.
Specification and Form of Tender can be obtained from the undersigned.
Sealed Tenders, addressed to the Chairman of the Lighting Committee, to be delivered at the Town Hall, Leek, not later than the 30th of December, 1910.
The lowest or any Tender will not necessarily be accepted.
S. Trow Smith,
Engineer and Manager.
Gas-Works, Leek,
Dec. 10, 1910.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS from Ironfounders, Gun-Barrel Manufacturers, Timber Merchants, Druggists, Rope Makers, &c., for GOODS to be delivered on the Company's Works, Great Brunswick Street, in such quantities as may be required from time to time up to Dec. 31, 1911.
Samples of Goods required are open to inspection on the Works, Great Brunswick Street; and printed list of the articles required can be had on Application to the Company's Offices, D'Olier Street.
Tenders, endorsed "Tenders for Stores," to be lodged in my office on or before the 27th inst.
Francis T. Cotton,
Secretary and Manager.
Head Office: D'Olier Street,
Dublin, Dec. 14, 1910.

CAPITAL AND RESIDENCE OF BUDAPEST.

NOTICE.—Based upon his resolution No. 106,956 of December 1, 1910, the Magistrat of the Capital and Residence of Budapest brings herewith to the knowledge of all those whom it may interest that the TERM for submitting TENDERS for the Supply of TWO GASOMETERS and a COAL AND COKE-TRANSMISSION for the Central Gas-Works of the Capital and Residence of Budapest, has been *ADJOURNED* from the 28th of January, 1911, to the 16th day of March, 1911.
In consequence, Tenders for the Supply of the Two Gasometers and the Coal and Coke-Transmission for the Central Gas-Works of the Capital and Residence of Budapest are to be handed in on the 16th day of March, 1911, 12h merid., to Mr. Dr. János Buzáth, Chief of Section (Budapest IV. Városház-utcza 16. II.), but *NOT* to the Councillor Mr. Bátor Piperkovits.
The other Dispositions of Conditions, Specifications, &c., remain unaltered.

CORPORATION OF LEICESTER.
(Gas Department.)

RETORTS AND FIRE-BRICKS.

THE Gas Committee of the above Cor-poration are prepared to receive TENDERS for the Supply and Delivery of RETORTS and FIRE-BRICKS required for the Year 1911.
Specification, Quantities, and Form of Tender can be obtained upon Application to the Engineer.
Tenders, addressed to Mr. Alderman T. Smith, J.P., Chairman, and endorsed "Tender for Retorts, &c.," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, Dec. 31, 1910.
The Committee do not bind themselves to accept the lowest or any Tender.
Hubert Pooley, Assoc.M.Inst.C.E.,
Engineer and Manager.
Gas Offices: Millstone Lane,
Leicester, Dec. 12, 1910.

CORPORATION OF LEICESTER.
(Gas Department.)

CAST-IRON PIPES.

THE Gas Committee of the above Cor-poration are prepared to receive TENDERS for the Supply and Delivery of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 to 36 inches in diameter, required during the Twelve Months ending the 31st of December, 1911.
Specification and Form of Tender can be obtained upon Application to the Engineer.
Tenders, addressed to Mr. Alderman T. Smith, J.P., Chairman, and endorsed "Tender for Pipes, &c.," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, Dec. 31, 1910.
The Committee do not bind themselves to accept the lowest or any Tender.
Hubert Pooley, Assoc.M.Inst.C.E.,
Engineer and Manager.
Gas Offices: Millstone Lane,
Leicester, Dec. 12, 1910.

MANCHESTER CORPORATION GAS-WORKS.

THE Gas Committee invite Tenders for the Supply and Delivery of the FIRE-CLAY GOODS required during next season at their several Gas-Works.
Full Particulars and Forms of Tender may be obtained from Mr. Fredk. A. Price, Superintendent, at the Gas Offices, Town Hall, Manchester, on payment of a deposit of Two Guineas, which will be returned on receipt of a *bona-fide* Tender.
Sealed Tenders, endorsed "Tender for Fire-Clay Goods," addressed to the Chairman of the Gas Committee, must be delivered at the Gas Offices, Town Hall, Manchester, on or before Thursday, the 12th of January, 1911.
The Gas Committee do not bind themselves to accept any Tender, and reserve the right to divide any Offer as they may deem advisable.
By order,
Thos. Hudson,
Town Clerk.
Town Hall, Manchester,
Dec. 16, 1910.

WANTED, Tender for 1800 Yards of 6-inch, 500 Yards of 10-inch, and 300 Yards of 3-inch CAST-IRON PIPES; also SPECIALS.
For Particulars, Apply to GEO. E. Woodford, RUABON.

GAS TAR AND AMMONIACAL LIQUOR.

THE Harrogate Gas Company invite OFFERS for their Surplus TAR and AMMONIACAL LIQUOR for the Year 1911.
For Particulars, Apply to H. WILKINSON, Secretary and General Manager, Gas Offices, James Street, HARROGATE.

HARWICH GAS AND COKE COMPANY.

TENDERS are invited for the Surplus TAR produced at this Company's Works for the Year ending Dec. 31, 1911.
The Tar will be delivered free into Railway Tank Waggons or Tank Barges at this Works.
Probable quantity, 120 Tons.
The Directors do not bind themselves to accept the highest or any Tender.
Sealed Tenders to be delivered addressed to me, not later than the 6th day of January, 1911.

GEO. BAINES,
Secretary.

COUNTY BOROUGH OF ROTHERHAM.

THE Gas-Works Committee of the Rotherham Corporation are prepared to receive TENDERS for the Supply of RETORTS and FIRE-CLAY GOODS.
Specifications, Quantities, and Forms of Tender may be obtained on Application to the undersigned.
The person whose Tender is accepted will be required to enter into a Contract which will contain the usual Fair-Wages Clause.
Tenders, endorsed "Retorts and Fire-Clay Goods," must be sent to the Town Clerk, Town Hall, Rotherham, not later than Thursday, the 29th inst.

By order,
J. S. NAYLOR,
Engineer and General Manager.

THE Directors of the Sheppy Gas Company invite TENDERS for the Purchase of the Surplus TAR produced at their Works from the 1st of January to the 31st of December, 1911.
Approximate Quantity, 40,000 to 50,000 Gallons.
May be removed by Water or Rail. If the latter, the Contractor must provide his own Casks and accept Delivery at Sheerness Dockyard Station.
Tenders to be sent to the undersigned not later than the 2nd of January, 1911.
The Directors do not bind themselves to accept the highest or any Tender.

By order,
H. BARBER,
Secretary and General Manager.
Gas Offices, Sheerness,
Dec. 15, 1910.

NEWTOWNARDS (CO. DOWN) URBAN DISTRICT COUNCIL.

GAS-WORKS EXTENSION.

THE above Council hereby invite TENDERS for the Supply and Erection of One Set of Three PURIFIERS, each 20 ft. by 20 ft. by 5 ft., with 12-inch Connections, &c., in accordance with Plans and Specification prepared by Mr. W. H. Roberts, the Council's Engineer.
Copy of Plans and Specification will be supplied by me to intending Contractors on payment of One Guinea, returnable on receipt of *boná-fide* Tender.
Tenders, endorsed "Tender for Purifiers," will be received by me up to noon on Thursday, the 29th inst.
The Council do not bind themselves to accept the lowest or any Tender.

H. McCARTNEY,
Clerk to the Council.
Town Hall, Newtownards,
Dec. 14, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

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Descriptive Catalogue on Application.

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Makers of Cast-Iron PIPES and CONNECTIONS for Gas, Water, Steam, Electrical, Sanitary, and other purposes; also TANKS, COLUMNS of every description, Hydraulic, Gas, and Colliery PLANT, &c.
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UNEQUALLED.
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MIRFIELD COLLIERY COMPANY,
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.

HEATHCOTE GAS COAL
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GRASSMOOR COLLIERIES,
CHESTERFIELD.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
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3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

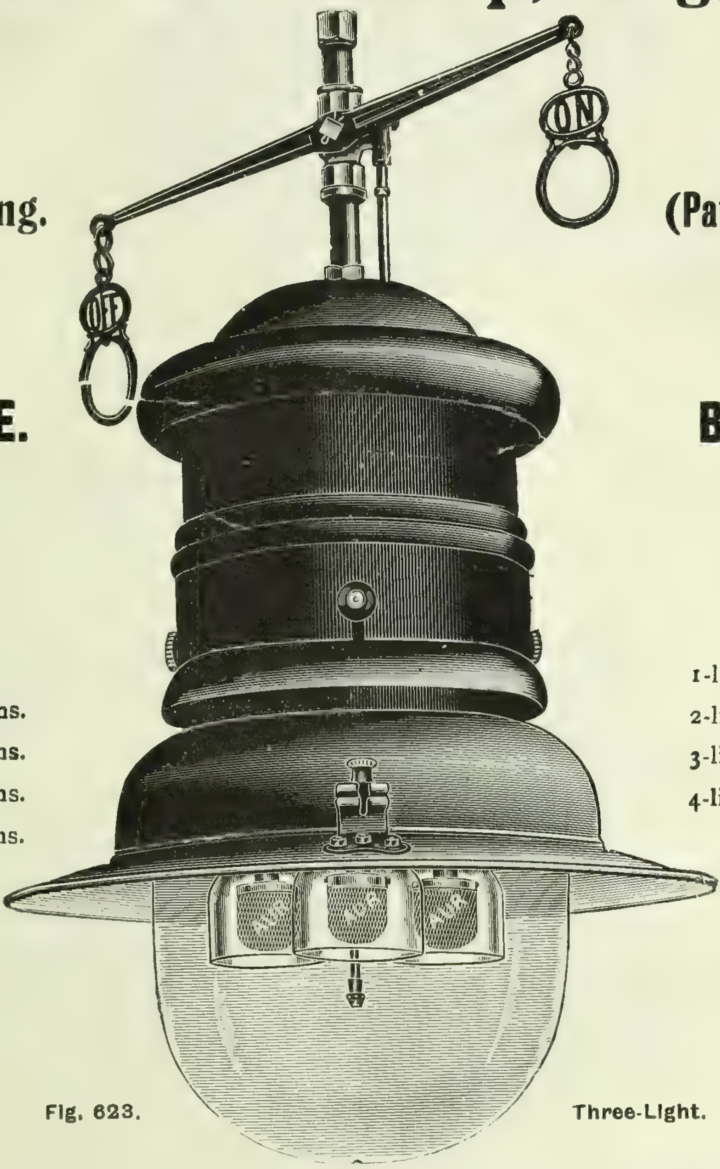

Fig. 623. Three-Light.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

Width over all.

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4-light . . .	1 ft. 8 ins.

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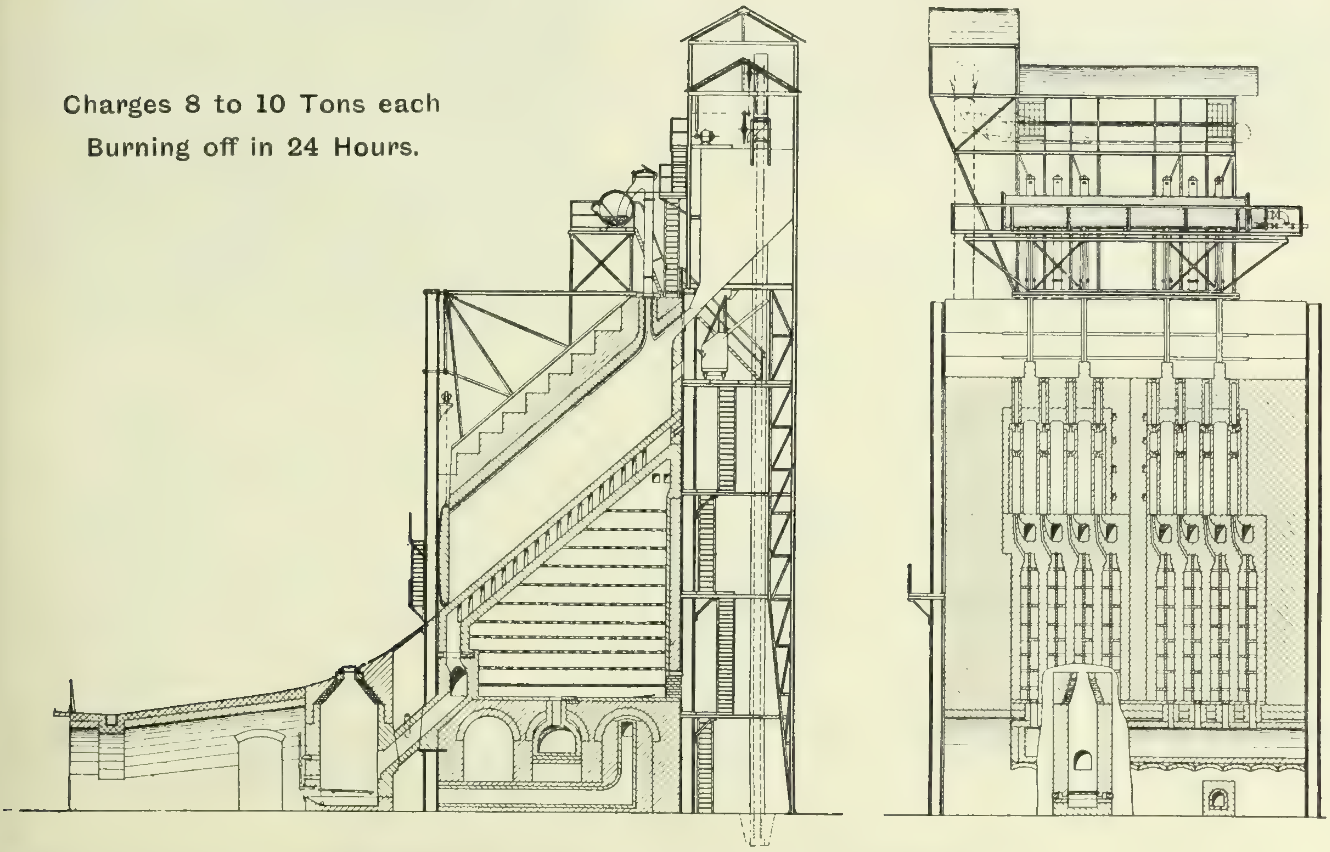

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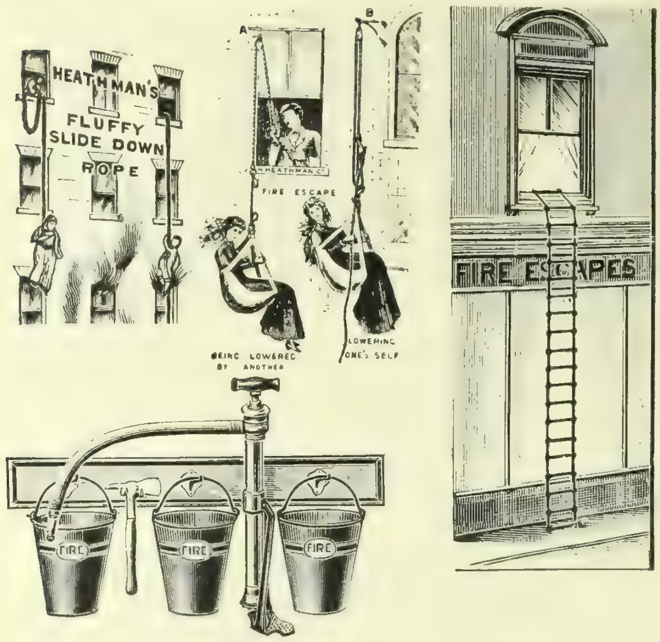

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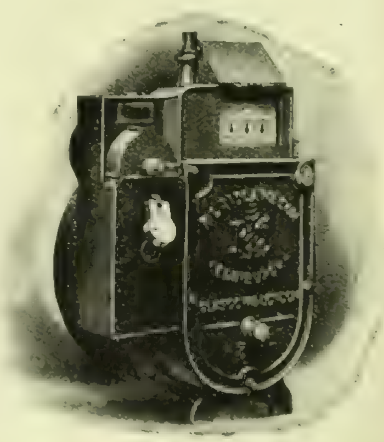

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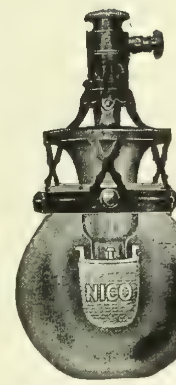

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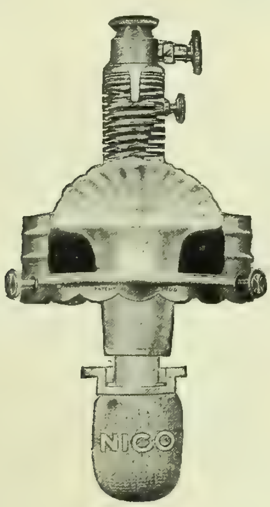

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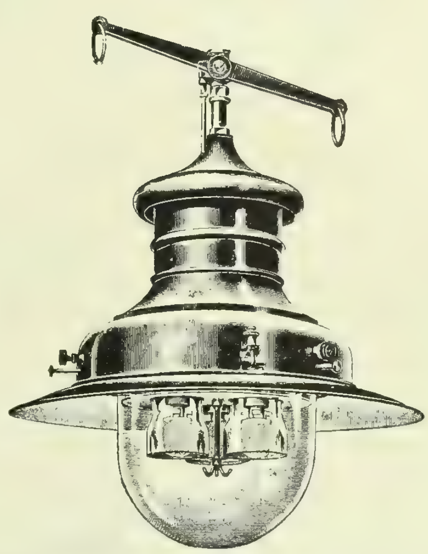

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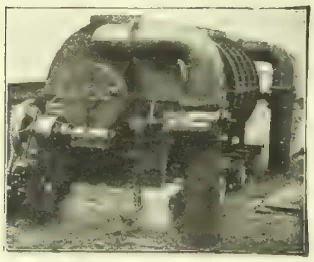

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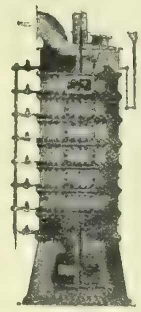

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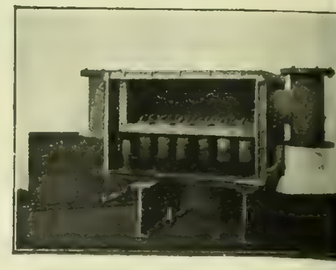

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CONTENTS.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXII., No. 2485.——TUESDAY, DECEMBER 27, 1910.

1910.

A Retrospect.

A FEW days hence and another year will have completed its contribution to the vast accumulated history of the world and of human affairs. Casting the mind over the past twelve-months, we cannot say, now that entry will soon be made upon the New Year, that it is with any feelings of regret that we are leaving behind the old one. Not that 1910 has been altogether a bad year. It must have its due. Trade has not been, as things go, at all bad. Several of the years of the decade of which this is the last one have been much worse. The Board of Trade returns, indeed, show for the year a considerable improvement in trade. Employment, too, is on a better scale. The hideous processions of unemployed and unemployable have not this winter season projected their disgrace on the streets of London; and, save in those districts where labour has been at war, without good reason, with the conditions of its employment, there have been no general complaints from any part of the country as to any abnormal state in regard to work. The country has been at peace, and has continued in amity, with all the nations of the earth. No great catastrophes involving much sacrifice of life have come to veil the country in gloom. For these mercies, there is true thankfulness. [Just after these words were written intelligence of the dreadful pit disaster in Lancashire came to hand.] But it has been a year of almost continuous disquietude and obscurities—chiefly at home. The country in May was plunged into the deepest sorrow and mourning through the death of well-beloved King Edward VII.; but, on all hands, there was gratitude that succession to the Throne was provided for in one who had shown those personal traits that had endeared the royal father to the nation as a wise ruler, and as one who had done more than any other to smooth down the animosities of nations and to promote a universal peace.

But through the greater part of the year—excepting a period succeeding the death of King Edward and the accession to the Throne of King George, during which period conference (which ended abortively) proceeded between the leaders of the two predominant parties in our governmental system—the country has been in constant political turmoil, and at no time has the immediate future been anything but nebulous in the extreme. Uncertainty has been the rule. The year opened with a General Election; and the year closed with one. The first General Election resulted in sending the Radical Government back to power, dependent on the Labour and Irish Parties for a safe tenure of office. A million-and-a-half to two millions of money have just been spent over a second election, with absolutely the same result. The old quarrel of the Radical, Labour-Socialist, and Irish Parties with the House of Lords has been revived; and the Government are desirous of curtailing the powers of the Upper House. On the other hand, members of the Upper House are willing to submit to reform, but not to being rendered absolutely and abjectly impotent. The Labour members and the Irish Party have shown by their election speeches that the Government will only be able to command their allegiance by complying with their several requests. That is the—plainly and briefly stated—present situation without a note of political prejudice. Many other matters are involved; but it is not our business to enter into them here. Other domestic anxiety and difficulty has been the labour unrest in different parts of the country—the coal miners' troubles and local strikes in Durham and Northumberland early in the year, difficulties with northern railway men, a fresh rupture in the shipbuilding trade, and, above all, there were the strikes in the Welsh coal-field, which were accompanied by much rioting, destruction of property, human suffering, and dislocation of trade. But the outlook in the district is not now so serious; and we arrive at Christmas with a condition of peace in all other directions in regard to labour, and in friendly relationship with all nations, but with big clouds in the political sky obviously near breaking-point. The railway strike in France and the revolution in Portugal were events that temporarily and partially diverted attention from troubles at home.

With so much domestic disturbance, it is not surprising that in the stock and share markets, in the ordinary lines of investment and speculation, there was during the year almost incessant oscillation; and the condition of things naturally had its effect on even such a sedate class of investment as gas stocks and shares, though the movements up and down of the latter were, generally speaking, modest and in accord with the characteristic of stability. Among the events of the year was the low point to which Consols fell. They dropped at one time down to $78\frac{13}{16}$—a point to which we believe they have not declined for fifty years or more. At the time of writing, the market value is still below 80. The depreciation of the market value of the "choicest" of gilt-edged securities has naturally been accompanied by a recession in the values of others; and throughout the commercial world, where reserve and other funds, are invested in such "securities," there has had to be a considerable writing-off on account of depreciation. The Bank-rate has also fluctuated frequently during the year—there has been nothing settled at all about, and consequently no reliance could be placed upon, the conditions. A still further feature of the year has been the speculation in the shares of rubber and oil companies—mostly new promotions. Fortunes have been made; much money has been lost.

As remarked, gas stocks and shares have been slightly affected by the general tendencies. Taking our share list as it appeared a fortnight since, and comparing it with one at the beginning of the year, and noting the steadiness and the upward tendency of dividends in recent years, we are inclined to the opinion that the public have not yet grasped fully the circumstances of the gas industry as they exist to-day—particularly in respect of its added stability through the constant growth of its day load along lines that are subject to as little competition as any commodity can well be. Take the Brentford, Liverpool, Newcastle, Portsea Island, and Sheffield Companies, dividends (excepting in the case of Newcastle, in which the dividend receded 2s. 6d. per cent.) have remained steadfast, but market values declined through some mysterious cause. Within the last few days, however, there have been some respectable markings-up. Generally in other directions in home stocks and shares, prices at the end of the year are much the same as at the beginning. Brighton and Hove "A," East Hull, Gaslight and Coke, Ilford, and Tottenham and Edmonton have made noteworthy advances. Alliance and Dublin continue weak. The last parliamentary bargain made by the Company does not appear to be generally approved of; but, at the most, if disadvantage it be, it can only be said to be temporary. Imperial Continental ordinary stock has made the largest number of points of any stock in our list; being only matched by the ten points that the Cape Town $4\frac{1}{2}$ per cent. debenture stock has recovered. The market values of other shares of this last-named Company remain in the same emaciated condition in which they began the year. The shares of the South African Gas Company have likewise dropped somewhat. Outside the Stock Exchange, the popularity of gas stocks and shares as an investment has continued. In no quarter perhaps is the finger kept more constantly on the pulse of affairs in this regard than in that of the firm of Messrs. A. & W. Richards, through their agency in placing new issues and disposing of privately-owned stocks and shares that it is desired to realize. The information obtained from them is that throughout the year their auctions have been well attended; and there has been excellent competition not only for the many new issues of capital which they have made for London, Suburban, and Provincial Gas and Water Companies, but also for the numerous parcels of such securities realized for executors and other private owners. Looking back over the twelve months, the firm cannot say that there has been any appreciable variation in prices, as compared with those prevailing

last year; but buyers have evinced a decided preference towards ordinary stocks, and have been less ready to absorb debenture capital bearing a fixed and low rate of interest. With the exception of small portions of two issues of the latter stock which were not absorbed, they have sold every lot brought to the hammer—a fact which it is felt speaks for itself as to the great favour with which investors regard the stocks and shares of successful gas and water companies.

The Commercial Affairs of the Gas Industry.

While the technical work of the gas industry must, and does, receive unremitting attention, bearing as the results do so considerably on commercial success, by the force of the circumstances into which its affairs have drifted in the natural order of events relating to general progress and development, the commercial part of the work of the industry absorbs a large share of the time, the thought, and the activities of its executive officers. The position is one which has to be accepted, and be dealt with, the same as all other change; and what is there that is mundane that is not mutable? The increased responsibility that has devolved, by mere force of changing circumstances, upon the officers of the industry, year by year results in a devolution of the detailed work from the supreme executive head—results in a departmentalizing as it were; and it is really the only way in which, save in the smaller undertakings, the manifold work of the gas industry can now be dealt with. The pressure of the times upon the responsible officers is great. It is found in the technical side of the work, from which claim is made for more and more economy. The requirement of cheapness in production compatible with serviceable product is insatiable. The pressure is found in the uncertainties of the markets for raw materials and secondary products; and in the pressure of competition both in the lighting, cooking, heating, and power fields, and in the ever-expanding output of those commodities which are of the industry's secondary, but valuable, products. The pressure, too, is found in the inflexible fiscal demands—both imperial and local, and in the change that has come over the composition and policy of our municipal bodies. These are all conversions from old conditions that, we say, have to be accepted and faced. There is nothing about them that is merely abstract; they are all concrete conditions that have been gradually—almost imperceptibly—introduced by the advances of science, advances of men and thought, and development along well-defined tracks. Perhaps there is an exception in the development of local municipal policy, and in the extension of municipal activities into trading. Now too late, it is seen that these developments have been brought about largely by communal indolence, and by, as Mr. Balfour Browne, K.C, recently remarked, intelligence sitting at ease in an arm-chair. But in all these directions, the pressure of the times on the executive heads of the industry is seen. On the other hand, there are the compensations; and all honour to those who have laboured during the period of transition, and continue to do so with zeal. It is necessary.

The pressure of responsibility embraces the diversity of business in which the gas industry engages; but this business diversity is of the very backbone of the industry. Surveying the elevated position at which the industry has arrived to-day, it is said with the utmost confidence that it was never in stronger case, never were its opportunities greater, never was it better equipped for meeting competition. This is not the feeling engendered by any passing enthusiasm; but it is a view derived from serious consideration. The capital engaged in the industry has never been at a lower point than it is to-day per unit of business done; manufacture has never been at a higher point of economy and efficiency; the price of gas, taking the industry through, has never been lower; the business is to-day built up of several constituents; the demand for gas has never before been spread in present magnitude over so many hours of the day; never before has the difference between the summer and winter demand been so narrow; and the efficiency of the means of gas utilization has never been greater than to-day. There is an unceasing general progress; and, while progress increases the weight of responsibility, and attracts greater competition, there is the satisfaction of a present strength that has nothing at all comparable with it throughout the industry's past.

All this is well reflected by the gas undertakings returns issued towards the close of the year. Economies we showed in the "Journal" were illustrated by the lower capital involved per million cubic feet of gas sold, by the reduction in the consumption of coal, by a make of gas per ton of coal transcending anything that previous returns had presented; and business strength was accentuated by the big expansion of the consumption of gas, the enlargement of the number of consumeis and of public lamps, and the extension of canalization. The figures were mainly for 1909, with three months taken out of 1910 for local authorities gas undertakings. Glancing over the current year, we shall look for the returns that are issued twelve months hence telling us a similar tale. The addition to the history of gas undertakings that has been made in our columns by the year's work shows the world-over an improved financial condition; and to a large extent this is due to the greater makes of gas per ton of coal carbonized, to the effect this has upon the costs of coal and labour, and to the consequent improved relation of capital charges to make, all of which have contributed to the reducing of the price of gas to consumers. Reductions of price have been proceeding throughout the country, both by company and local authority concerns. We will not catalogue the numerous satisfactory records of concessions. But if we take the capital alone (representative only of the trend of events elsewhere), it may be said that the total gas consumed in London and its environs has never before been sold at such a low price as at the present time. This is accounted for by the fact that, in the 100 square miles or so of the district of supply of the Gaslight and Coke Company, the price of gas has at no previous time been at the rate at which it is sold to-day. The South Metropolitan Company sold gas at 2s. per 1000 years gone by; but it was generally agreed that the price was before its appropriate time. The Company are now selling at 2s. 2d. —1d. less than the figure to which the price had to ascend at the time of the last great rise in the cost of coal. The Gaslight price will at the end of this year be down to 2s. 7d. —a figure that has only been reached by a deliberate onslaught on the conservative, stunted policy of the old oligarchy that, fortunately for London and the proprietors of the Company, has been superseded by rational direction. In the Commercial Gas Company's area, too, the price of gas is down to 2s. 4d. So that in the Metropolitan area prices do not present that wide divergence that at one time existed. But speaking of the Metropolis, the palm for lowness of price in the neighbourhood must be given to the Wandsworth and Putney Company, whose charges supply striking evidence of the effect of a low capital upon the price at which gas can be sold.

The Gaslight and Coke Company have claimed considerable attention during the year—this being the first in which the West Ham Company's area and business were brought into the reckoning; and this year, too, sees the primary step in the efforts of the Company to annex still more open area, with the view of making greater use of their opportunities for economy, and to enable that economy, through expansion of business, to bear upon the whole of their operations. Annexation of territory in this way is going on on a smaller scale in other parts of the country, to the benefit of the annexed areas. The Metropolitan Gas Companies' accounts, as did those from other parts of the country that were issued in the spring of the year, generally exhibited a good increased consumption for the second half of 1909. But, on the other hand, the residuals markets had not been at their best, combined with which, of course, was a somewhat reduced production of secondary products, owing to the larger makes of gas per ton of coal, and the consequent reduction of the consumption of the latter. To set against this was the lessened expenditure on coal and carbonizing wages, and the increased revenue from gas per ton of coal. The rate of increase in consumption in the first half of the year was not quite up to the mark of the preceding six months; but residuals were showing a hardening tendency. In the second half of the year, most undertakings from which information has been received report that consumption will show increases, which the character of the weather of late has had some hand in improving. Secondary products, however, will, taken in the whole, show financial improvement; the demand (more especially for coke) and prices having been particularly gratifying. Reverting to the Gaslight and Coke Company, it must not be overlooked—forming as it does a point marking an important change in the industry—that this was the first year of their working under a penal test for calorific power in conjunction with the supply of gas of a standard illuminating power of 14 candles.

The year's financial outcome of the working of home gas

undertakings generally—company and local authority—has, as previously remarked, been excellent. The same applies to those undertakings directed from this country on the Continent, in India, and South America; and undertakings carried on and administered in our Colonies have shown the (almost) universality of the gratifying tale. There is regret at the necessity for inserting here a qualifying word. But where there has been exception from the very common experience, it has been due entirely to local or special circumstances. There was the Continental Union Gas Company, with the Union des Gaz. Strikes, floods, and earthquake formed a concatenation of untoward events that brought heavy financial strain upon the concerns; but the position has been met in a wise, statesmanlike manner that will wipe out the effects in the quickest possible way. The conditions in South Africa, too, had a repressive influence upon the gas undertakings working there; but at the meetings of the Companies there was report of signs of an improved outlook. The beginning of the year witnessed the completion of the amalgamation of the Buenos Ayres Gas Companies—the Buenos Ayres (New), Primitiva, and River Plate—and already the results are showing that, in the interests of the city and of the Companies themselves, the fusion of the concerns was the proper course.

Among miscellaneous matters connected with gas companies that have occupied attention during the year has been that of the allowance of depreciation in assessing for income-tax. The Gas Companies' Protection Association (who did excellent work during the year in connection with the Standard Burner Bills, and in several other ways) elicited from the Inland Revenue authorities that it was not their intention, by the circular they issued (which gave rise to so much concern and opposition) to their surveyors, to remove the question from the jurisdiction of the District Commissioners. The object of the circular (which literally was so plain) becomes more inexplicable than ever on this explanation, and by what has transpired during the year. Several companies—English, Scotch, and Irish—have on appeal to the District Commissioners proved their title to an allowance, and have obtained it. Income-tax in another form cropped up at the meetings of both the British Gaslight Company and the Imperial Continental Gas Association, through the resolutions of the Boards to in future pay the shareholders their dividends with income-tax deducted—thus bringing them into line with other companies. Referring to the Gas Companies' Protection Association, there was some discussion at the annual meeting which resulted in the suggestion as to whether the scope of the activities of the organization could not be usefully extended. Touching the Metropolitan and Suburban Gas Companies who use the Thames for their incoming and outgoing materials, there was considerable discussion over the provisional schedule of rates and dues put forward by the new Port of London Authority; and the gas companies affected were among those who objected to the maximum rates proposed for coal. An inquiry was held by Lord St. Aldwyn, who thought the proposal of the Authority too high; and he laid it down as a rational principle that the margin between the maximum and the actual rate on such a necessity as coal should not be wide, so as to remove uncertainty. The upshot of the inquiry is that the maximum for coastwise and oversea coal will be 2d. per ton.

The Wreckage of Company Promotion.

The year holds a sorry tale and an accumulation of wreckage from the promotions of gas companies by unscrupulous and callous company mongers. Year after year we criticized prospectuses and issued warning against these men and their schemes. They were not deterred, nor did they seek to justify or defend themselves against accusations and imputations freely levelled against themselves and their oblique doings. The expected has now happened. There was bound to be a collapse; and it has come this year with brutal force and comprehensiveness. The Law Courts have been busy with the affairs of these ill-fated concerns. Receivers and managers have been appointed; and all possible is now being done to save for those who were tempted by plausible prospectus, and by the good name of the gas industry for sound investment, some little part from the concerns that are but the mere shadows of what they were represented to be. Company promoters have, of course, a right to a fair profit; but between real value and the price sought to be obtained from the public, there has been, in the transactions before us, no trace of conscientious dealing. Some insight was obtained into this in the case of the Kent County Gas Company in connection with a point raised in the Courts as to undisclosed profits in the prospectus. The promoters of this concern are at present in retirement in one of the country's penal establishments. These men purchased the Goudhurst works for £2350; and in a few months sold them to the public for £21,800! There is the case of the Amman Valley works, too. Mr. Charles Carpenter was appointed by the Board of Trade as arbitrator in the matter of the price to be paid by the Ammanford Gas Company for the works. His award amounted to £4195. Eaton and his confederates raised from the public nearly £14,000! Another prominent promoter—Preston—has just been in the Bankruptcy Court; and some of his concerns have dropped into the hands of receivers, or have otherwise broken to pieces. The day of reckoning has come for certain of these men. Fortunately, there has not been much in the way of promotion this year. A brazen-faced attempt was made to revive the Natural Gas Company of Heathfield fame; the celebrated Solidified Tar Company could have done with, and we believe tried to get, more money. There was a fresh breaking-out in the promoting line by the floating of the East Hants Gas Company, which we firmly believe to be considerably over-capitalized, and with which are associated features upon which we made comment at the time of the issue of the prospectus. The page soiled with the record of sordidity may be turned for the consideration of other matters.

Municipal Delinquency.

Bearing upon the work of private enterprise in gas supply, it was Mr. Corbet Woodall, the Governor of the Gaslight and Coke Company, who, in one of his addresses to the proprietors during the year, called attention to the little encouragement that is received by gas companies from municipal authorities to serve the public well. They fail to realize that their attitude should be co-operative and not obstructive. It is a pity, from the public point of view, that this should be so. The attitude is the growth from a number of conditions brought into existence in latter years, and traceable to the altered composition of the governing bodies, and to a permeation of their affairs by fresh policy, in which there is a strong socialistic tendency. Municipal trading has largely shattered the sense of justice and equity in local government. It is, said Mr. Balfour Browne, K.C., in a lecture before the British Constitution Association early in the year, "insidiously winding its way into our social system, and threatening to sap individual vitality to the degeneration of personal effort, responsibility, and character, and to the hurt of the country generally." The gas industry feels this keenly through the large domination of the electricity supply industry by local authorities. Every possible way is now sought, in the mistaken notion that primary consideration must be given to the electricity undertaking, to squeeze and obstruct the local gas concern, directed by private enterprise, although one of (sometimes) the most important contributors to the local exchequer. Local rates do not decrease; and local authorities want their full pound of flesh in the nature of assessment connected with the gas undertakings. Obstruction found its example in the opposition to the Standard Burner Bills this year; unjust treatment, in the matter of favouring local electricity undertakings by transferring to them street lighting and the lighting of public establishments, without any consideration being paid to the question of either economy or efficiency. But more on this point presently.

Inequality of treatment also exists in cases where both gas and electricity undertakings are under municipal control; favour generally inclining to the younger child. More freedom is given to the electricity concern; and, in numerous instances, the administration is allowed to proceed year after year on lines that result in deficits and calls upon the rates, to which the gas undertaking has to largely contribute. Differences between the Manchester Gas and Electricity Departments have by no means been kept within the walls of the City Hall. The Gas Department has over many years chafed under the demands for profits in aid of the rates equal to £1000 a week; while the electricity undertaking has been allowed to conduct its affairs so as, in the past, not to be in a position to contribute anything towards the rates, and now only a comparatively small sum. Alderman Gibson, the Chairman of the Gas Committee, and Mr. J. G. Newbigging, the Chief Engineer, have protested against the inequality—the protest having at its base a desire to give smoke-ridden and begrimed Manchester a supply of gas at fuel and still

more popular prices. The chief officials of the two departments met in conference during the year so as to see whether they could not arrive at a better understanding between themselves; and at the conference, they agreed that a proper basis of rate contribution would be 1 per cent. on the outstanding loan debts of the undertakings, following the decision given in the Salford case by Parliament, when the Corporation were last at Westminster with a Bill, and beat a hasty and undignified retreat with it when they heard of the restriction that it was proposed to impose. Birmingham is another bad case of gas profit-taking; their accounts published during the year showing that, in aid of the improvement rate, public and court lighting, and other things, no less than £92,024 had been taken from the gas profits. In the last two sessions, starting with Salford and Oldham, and continuing with Glasgow and Kirkcaldy, Parliament has shown that it is dissatisfied with the general municipal abuse of privileges. We say "general," because in the Scotch cases named there has not been abuse, and Parliament declines to allow the opportunity for any backsliding.

Municipal authorities throughout the country have been discussing the rights and wrongs of this (they do not so term it) pilfering of the gas consumers, and producing in this way inequality by relieving, through them, the responsibility of all ratepayers to equal contribution, on a common basis, to the local expenditure. The law, the year again shows, sadly needs amendment, so as to limit the amount of profit that may be taken (if any) from municipal trading undertakings; and likewise the period ought to be limited within which undertakings—electricity concerns, for example—can be so administered that they produce loss. At present there is an indefiniteness in both respects. The licence of municipal trading has much to answer for. It oversteps the bounds of legal propriety. Leicester found this out when the Law Courts decided this year that statutory authority to trade in electricity did not confer power (without there was express sanction) to supply wiring and fittings. In this they have transgressed. Hence the movement this year to obtain the coherent support of municipal electricity traders to the promotion of a measure to invest with authority to trade in this direction, at present barred by the want of statutory power. The point has been raised again, in the course of the year, as to the right of a large ratepaying industry such as that of gas supply having a voice in the direction of local affairs. Gas companies, like other joint-stock enterprises, are voteless; but nothing can prevent directors and officers becoming members of local bodies. There are isolated examples of gas officials being members of local Councils; and with their varied business experience and training, who better? Only the other week, too, Mr. Fred J. West, at the meeting of the Society of British Gas Industries, was urging the members of that organization to take part in the administrative work of their own localities, on the grounds of suitability through qualification, of the necessity that exists for obstructing the progress of the extremists, and, generally, of aiding in the defence of community and industry.

Coal, Oil, and Secondary Products.

There are three sides to the industry's commercial activities that have to be included in a year's historical review. There are the markets for the raw materials, the markets for the secondary products, and the situation in the matters of business and competition in connection with the industry's staple product. The two former sides engage attention first. The most disturbing factor in the coal market continued to be the Coal Mines (Eight Hours) Act. Coming into force in Durham and Northumberland at the beginning of the year, it at once produced disorder; and several pits were closed down. Fortunately, however, after the country had been thrown into uncertainty as to what was going to happen, and after considerable damage to the business of several collieries had been caused, and the affected districts gravely disordered, the "referendum" was brought into action, and the question of a strike was voted upon by the men. The majority was against; and the malcontents were therefore compelled to return to work, and accept the agreements entered into by their leaders (against which and whom they had revolted), as nothing was to be gained by holding out with disunited ranks. This meant peace in the whole of the coal-fields from which the gas industry draws supplies. In South Wales, however, strikes, disorder, and lawlessness have been rampant, and things are not yet properly composed. What this mistaken piece of legislation which was carried through in arbitrary fashion over all competent opinion, has cost the country, or will cost it, is incalculable. As to coal prices there have been no violent fluctuations during the year. The market quotations at the beginning of January for Durham coals were 9s. 6d. to 11s. 3d. for the ordinary classes f.o.b., and 11s. 9d. for specials; but at no time during the year have the quotations—and that during the time when labour trouble caused uneasiness—been above 10s. 9d. to 11s. 9d. for the usual descriptions, and 12s. for specials f.o.b. Though this is a busy season for gas coal, last week's report quoted 8s. 3d. to 9s. 3d. for ordinary classes, and 10s. 6d. for specials f.o.b., so that prices are appreciably easier than at the beginning of the year. The history of market prices in connection with Yorkshire and other varieties of gas coal for the year is much the same as that for the Durham varieties. The coal strike in Australia caused trouble and increased expense to the gas companies there. Experiments are being, or have recently been, made with German coal, by the Gaslight and Coke Company, for the purpose of getting experience with it, and having, as it were, another string to their bow. It is just as well to know the full extent of one's resources when one of the sources of supply is so largely controlled by an unruly labour element.

Two or three points appertaining to the year, in reference to the conveyance of coal and other material, are noteworthy. The Royal Commission on Canals and Waterways reported in favour of the formation of a Central Waterway Board for Great Britain, and submitted a scheme. But in the state of political affairs for how long the matter is likely to be pigeon-holed is a question upon which it would be unprofitable to trouble one's head. Mr. Balfour Browne, K.C., called attention to a decision in the Court of Appeal that is serious for the owners of private railway waggons. He pointed out that 15 millions sterling have been expended on these waggons; but the Court has held that railway companies have the option of receiving private waggons—that is to say, they can only be expected to receive them for transit when they do not themselves provide sufficient trucks for the purpose of carrying the materials or goods. Inquiry into the provisional schedule of maximum rates on goods sent through the Port of London resulted in the maximum rate for coal being reduced to 2d. per ton.

Oil prices have been particularly favourable to gas suppliers. New companies, competition, and the Standard Oil Company's methods of strangling competitors have all something to do with the easier prices at which contracts have been entered into.

Gas undertakings will have, taking them on the whole, no reason to quarrel with the prices realized for secondary products during the year. The demand for coke has been a heavy one, and reports from many quarters tell of stocks being cleared out, and a difficulty in some cases of keeping pace with the orders. The market prices opened well in January; in April and May still higher figures were being quoted; in July in the North the highest figure of the year was being secured; and though there was a falling away of the quotation during the autumn, November and December have realized excellent figures. For coke, the year has indeed been a particularly good one. The prices of tar have kept fairly steady throughout. It will have been noticed that just lately a table has been published in the "Journal" giving representative manufacturers' prices for tar products, in addition to the market quotations. The course of sulphate prices during the year has also been satisfactory. The level at which prices in the sulphate market opened in January represented about the lowest point of the year. There was a gradual ascent to April, with subsequently an easing off, while in the summer months the prices that were being realized at the opening in January were again touched. But the autumn witnessed an upward tendency again; and November saw some of the best prices of the year being booked in the North. Prices were subsequently a little easier. Considering the increased production of the secondary products of gas-works by competing sources (in 1909 no less than an additional 24,000 tons of sulphate was noted from other sources, mainly from coke-oven recovery plants), the course of the markets this year is anything but discouraging, though a stronger tendency in tar would be welcomed. On all hands, tar is being increasingly used for road-surfacing purposes; and interest in the many advantages of this application appears to be well sustained by papers before various organizations the members of which are concerned in the maintenance of roads. In connection with the manufacture of sulphate of ammonia,

several papers were read on plant and method; and further consideration was given to the question of the direct system of manufacture. Small works have now the opportunity of adopting suitable plants, as seen by the paper read by Mr. P. G. Moon at the Southern Association meeting recently. The Sulphate of Ammonia Committee are extending their propaganda work; but financially in their work they are not being supported with the same liberality as in the case of the sulphate of ammonia propagandists in other countries. Some interest was aroused during the year by the fresh efforts that are being made to encourage the cultivation of beet in this country. Nitrate of soda during the year has been in good demand, but the supply is plentiful, and complaint is made of lowness of price. Quotations have fluctuated a little during the year—9s. 3d. to 9s. 6d. per cwt., and 9s. 9d. to 9s. 10½d. are among the quotations observed in the spring. There was a little retiring from these figures in the autumn; but there has been a tendency to a modest toning-up again in more recent times.

The Deplorable Tale of Coalite.

Touching the secondary products of the gas industry, that (on paper) remarkable process, which was to have reached the meridian of economy and valuable product from the carbonization of coal at low temperatures, is, as Professor Vivian B. Lewes recently expressed it, under a cloud; and though in his view it offers the "ideal fuel" for general use—an opinion that was contested a fortnight since in these columns—the process by which it was to be made has, up to the present, proved both a technical and commercial failure, and consequently a financial one too. The relationship that may exist between myth and company promotion has once more been demonstrated. No stone has been left unturned to sustain the hopes of the shareholders and the market value of the Coalite shares, without effect in either case. Failure refuses to be hidden behind bald words and broken promises. An attempt was made by the Company during the year to get gas undertakings to allow the erection of 50-ton carbonizing plants on their works on certain terms. The offer was a specious one; but gas companies did not jump at it. They have plenty to do without being worried with any such philanthropic endeavour as that of improving the position of the fortunes of a concern whose process is not an economical one from the point of view of those whose business it is to supply cheap gas of reasonable thermal value. The plant erected at the Hythe Gas-Works has come to the ignominious end of being transferred to a dealer in old iron, or as much of it as is of any value to the dealer. It was a nuisance to Hythe, instead of a blessing. The reports from the Plymouth Gas-Works (as a letter in our "Correspondence" columns for Dec. 13 showed) have not contributed to confidence; nor have those from Barking and Wednesfield. At one time during the year, the question of the disposal of the gas was put forward as the obstacle to progress; and a way out of this difficulty was most airily suggested in the establishment of electricity generation at Barking, and inviting indulgent manufacturers to spend their capital erecting factories adjoining the plant and so absorb the electricity for power. But so far this appears to be merely an addition to the many castles in the air that have been constructed about this process. The real difficulties seem to be inherent to the plant itself; and during part of the year that at Barking has been idle, and no special efforts, so far as we have been able to trace, have been made in developing the business in coalite for the present fuel-consuming season. A series of articles in the "Daily Chronicle" showed the parlous condition of the Company. The opposition to the granting of a patent to a Glasgow Syndicate for the production of smokeless fuel was unsuccessful; and we have not heard of success attending a proposed issue of £300,000 of 5 per cent. mortgage convertible debentures. How far off is the end of this at one time pictured El-dorado? There are rumours of a reconstruction scheme; and reconstruction schemes are suspicious things.

Commercial Activity and Publicity.

It has been shown that the gas industry never stood commercially in a sounder position than to-day; and in entering upon this branch of our review, witness must be borne to the useful work that has been done by the Commercial Sections of the District Gas Associations. The report presented at the conference held during Institution week in London showed the range of activities, and the sharp eye that is being kept upon movements that in any way affect, or threaten, the prosperity of the gas industry. Reductions in the price of gas, and the provision of gas of a quality suitable to the improved appliances that are available, are directions in which the industry have been moving in meeting the competition of the times. The maintenance of gas-burners and gas-fires has become part and parcel of the work of every gas undertaking that is progressively administered; and the degree to which this should be carried has been discussed during the year. Apart from local displays, there have been prominent exhibitions of the latest improvements at Shepherd's Bush and Glasgow; and the British gas industry had also representation at the Brussels Exhibition. Gas undertakings, too, have been adding to their staffs active officials to deal with gas sales. Local advertising has likewise been extended; and individual undertakings have taken part in advertising in papers having general circulation. All these things must be maintained; but that does not suffice. There is a call to the gas industry to combine for the common protection of its interests. The electricity industry has its Electricity Publicity Committee, who are liberally financed by electricity undertakings to carry on a campaign directed solely against the gas industry. The propaganda system of this Committee is an extensive one. Advertisements and advertisement articles in newspapers circulating throughout the country—newspapers read by hundreds of thousands who never trouble to open a local newspaper—paragraphs and letters to newspapers, leaflets and circulars of various descriptions, all emanate from the Committee. Misrepresentation and calumny have part in the campaign. It has to be met. The Council of the Institution of Gas Engineers have formed themselves into a Publicity Committee, with power to add to their number gentlemen of special qualification to help them, to deal with the situation created by the electricity supply industry. This movement has been long in shaping itself; and definite information is awaited with the view of assisting in furthering a cause that needs urgent prosecution. The main thing will be the financing, and that will not be a serious question if the gas industry makes up its mind to co-operation on the lines that have been suggested—viz., a small contribution per million cubic feet of gas sold. It will be no use entering upon this work unless it is well and vigorously done; and when commenced, sustained with thoroughness.

High-Pressure Gas for Lighting and Industry.

As we have said earlier in this review, the industry was never better equipped for business than it is to-day. A feature of the year has been the development of high-pressure supply. The current uses of gas have demanded higher and more constant district pressures than were the vogue up to quite recent years, and gas of more constant composition. This is being freely recognized and acted on; and there has been a considerable amount of discussion—notably at the last meeting of the Southern District Association—as to what this is leading to. It is considered that the trend of practice is to higher district pressures still, and the application of service governors to reduce pressure to the requirements of each premises. A good service governor—cheap and reliable—is wanted. Mr. Charles Carpenter, at the meeting referred to, spoke of one that he is using. Meanwhile (apart from high-pressure gas-mains for feeding special areas), high-pressure systems for business purposes are springing into being here and there. Their development has been striking during the year; and there are cases of initial pressures running up to 80 inches. These high pressures, with the inverted lamp, are the gas industry's answer to the electric flame arc lamp. Whether or not the propriety of high-power sources of light is admitted, the competition of the flame arc has to be met. High-pressure supply and the inverted gas-lamp have captured important lighting in London, and have effected a change in some of our choice West-end thoroughfares from flame arc lighting. In Manchester, Birmingham, and other large cities, installations have appeared. These will most assuredly grow. In the same way a big business is to be done in what is termed "parade" lighting—that is to say, the lighting of ranges of shop fronts, some examples of which are to be seen in London, Tottenham, and Ilford. The paper by Mr. A. E. Broadberry, read at the November meeting of the Southern Association, is highly encouraging to the making of effort in this branch of business. In the lighting of factories and other large buildings and railway stations—one of the latest examples being Brighton, with electric distance lighters—the high-pressure lamp is taking an important part. But

lighting is not the only business to be done from a high-pressure system. The industrial use of gas at high pressures is a business well worth developing. The Gaslight and Coke Company find it so in the printing region round about Fleet Street. The Birmingham Corporation have put down an extensive distribution plant partly for the supply of high-pressure gas to the industries of the city—a descriptive article upon which we have recently published. There is such confidence in this branch of the business that it is to be dealt with as a special sub-department, with Mr. E. W. Smith (formerly of the Leeds University, and the Research Chemist to the Gas Heating Research Committee of the Institution of Gas Engineers) as the technical supervisor. In this connection, it will be remembered that Mr. A. W. Onslow read a paper, in the fore part of the year, before the Society of Chemical Industry on the use of high-pressure gas in industrial operations, in which he demonstrated that, by the employment of high pressures, constancy of temperature in furnaces is assured, and regulation can be effected with certainty to any degree desired. Our columns in the course of the year have shown that in all countries high-pressure distribution is wending its way; and everything points to big developments in the future.

Street Lighting—Discomfiture of Unbelievers.

The progress that has been made in gas lighting does not appear to have been fully realized, until this year, by our electrical contemporaries. Gas has reached a status among the lighting agents (as set forth by Mr. F. W. Goodenough in his paper before the Illuminating Engineering Society) from which there will be difficulty in dislodging it. It has, in fact, been a year of surprises for our electrical rivals. They were the "Thomases" to whom only actual demonstration would carry conviction. They did not believe this or that claim of the gas industry as to the high efficiencies obtained by inverted gas lighting—high and low pressure—until demonstration came; and since there has been deadly silence, excepting with the view of trying to traduce the accomplishments in matters of detail. They did not believe that any single high-pressure lamp could give from 3000 to 4000 candle power; Aldwych silenced them. They did not believe that high-pressure gas-lamps could be centrally suspended, and the lamps be propelled to one side of the street, and there be raised and lowered. Cannon Street silenced them on that score. It came as a bolt from the blue when the Gaslight and Coke Company secured a large contract in the City of Westminster for the supply of illumination by means of high and low pressure lamps of varying powers, with severe penalties attaching for deficiency; and thereby turning out flame arcs from some of the choicest streets in the nocturnally busy parts of the West-end. Supplementing this, news came of boroughs one after the other who had let contracts for inverted gas lighting north and south of the Thames for a number of years, some with electric lighting in competition—Hackney, Bethnal Green, Finsbury, Stoke Newington, Lambeth, Southwark, Chelsea, and maybe others. In various places, too, throughout the Provinces inverted burners are still further winding their way in favour among lighting authorities. It has been a terrific blow, a severe eye-opener, for the competitors, this advance of high-pressure inverteds to the tune of 60 candles per cubic foot of gas consumed, and low-pressure inverteds to that of 25 to 30 candles. As soon as ever the truth dawned upon their dazed understandings, there was a casting about for excuses. Arithmetical exercises on false foundations were made to show that the Gas Companies had miscalculated the economies of the inverted gas-burner, and were undertaking the lighting on an uncommercial basis. All sorts of things were suspected. The gas consumption must be greater than was represented, mantle maintenance greater than the Companies themselves were aware of. In short, those who had entered into these contracts did not so well know what they were about as their electrical critics.

Some interesting figures were published of a test of the Aldwych lamps by Mr. John F. Simmance, which showed them well up to the illuminating power, measured at the Westminster contract angles of 20° and 50°, which angles the electricians assert are wrong. But Mr. J. W. Bradley, the City Engineer of Westminster, defends them when he publicly announces his responsibility for a specification which he finds to be "a most convenient and workable one." On this question of public lighting contracts on an illumination basis, Mr. Jacques Abady read, before the Institution of Gas Engineers, a paper—a veritable *magnum opus*—that will, we opine, have a big future effect in relation to this question. The main parts of the Westminster and Calcutta specifications were included in the paper. Now there is a movement for the preparation of a model street-lighting specification for the guidance of street-lighting authorities—the lead having emanated from electricians; and it is to be taken up by the Illuminating Engineering Society. This must be carefully watched by the gas industry. The Calcutta public lighting contract was secured by the Oriental Gas Company for a long term of years. There is a fight going forward for the Holborn contract; and a trial of the competing lights is being made in Gower Street. Berlin is often quoted in our columns as a city in which inverted gas lighting has largely established itself in favour; and information was published in our columns that no less than 313 miles of the streets in that progressive city are lighted by high and low pressure incandescent lamps, while only 19 miles are illuminated by electric lamps. As fast as possible, the upright gas-burners are being converted to the inverted form. For street lighting, papers and discussions showed that uncollodionized mantles are now in great favour among gas-lighting experts; and some very interesting information reached us from the Chief Inspector of the Brentford Gas Company (Mr. E. R. H. Wingfield), which showed that the consumption of mantles in the high-pressure lamps in the grounds of the Japan-British Exhibition, during six months' run, averaged less than two per lamp.

The success on merit in street lighting is one side of the picture. Mr. Corbet Woodall presented another, at a meeting of the Gaslight and Coke Company, when he complained that certain Borough Councils were, against the interests of the ratepayers, evicting gas from the streets as an illuminant—not on the score of economy and efficiency (which should be the final arbiters), but purely on the ground of the fact that they were the owners of electricity supply undertakings. In Marylebone, Hampstead, and elsewhere thousands of pounds have been expended, upon conversion, to say nothing of the annual expenditure for a lower lighting efficiency in excess of the contract prices at which lighting can be done by inverted gas-lamps. Very reluctantly, the Finance Committee of the London County Council gave their consent to a loan for the conversion in the case of Marylebone, not being at all satisfied as to the wisdom of the proposal in the interests of the ratepayers. But what are the electricians doing? They are spreading broadcast the annual costs of present electric metallic filaments in the street lamps, with electricity supplied at extraordinarily low rates, in comparison with the costs for systems of gas lighting that have to-day been superseded by the more economical and efficient inverted lamp. They find it to their interest to do this; and it is the business of the gas industry to expose such fraudulent representations. From all over the country comes information of greatly increased costs in street lighting where gas has been supplanted by electricity. Among other subjects associated with street lighting that have received prominence in our columns during the year has been that of automatic street lighting; and huge developments in this direction are taking place. We ought not to omit to note the improvements that have been made in street lanterns specially suitable for the inverted gas-burners, and of the ingenious combination sets for the conversion of suitable existing lanterns.

Indoor Lighting—Fixed or Adjustable Regulation.

The improvement that has been effected in inverted gas-burners for street, shop, and factory lighting has also been evidenced in the further refinements and increased efficiency realized in burners specially for domestic lighting, from the large to the popular medium and bijou sizes. Towards the end of the year—this has application to street as well as to indoor burners—we had Mr. Charles Carpenter and Mr. Alfred Mansfield coming out as advocates of fixed adjustment for all kinds of inverted burners for both gas and air supply (instead of the provision in the burner itself of means for regulation at any time)—that is to say "fixed" according to the pressure and composition of the local gas supply. Many gas experts see the difficulties of varying pressures, composition, and specific gravities of gas to which the inverted burner is more sensitive than the vertical one; but Mr. Carpenter claims that his burner allows of a range between a maximum and a minimum variation in these respects. The economy and cleanliness of small lighting units in domestic service are being increasingly recognized. An upright burner was brought before us in the early part

of the year that is made in various sizes consuming from a little above ½ cubic foot an hour upwards. As we have already said, the question of the maintenance of consumers' incandescent burners has been a subject of much discussion. In connection with the work of gas undertakings, there is a growing feeling that the gas-fitter requires better technical qualification. Several gas companies have individually taken up this matter; and the Manchester Institution have inaugurated a movement with the double object of getting technical night schools to take up this educational work, and of securing the countenance of master men in connection with it. But the latest report is that the unresponsiveness of the fitter is not very encouraging. Taxation of lighting accessories is a retrogressive act for which Germany may take credit. The first year's result was that the taxing of mantles to the number of 61,380,188 yielded £74,850. It is to be hoped that the Chancellor of the Exchequer at home will not alight on this means of increasing his revenue. The accessories of incandescent lighting, in the way of fittings, glassware, and automatic lighters, continue to show excellence in new design, workmanship, and utility, though, of course, there is much cheap and nasty stuff on the market, as there always will be while the demand exists. Associated with internal lighting, the electrical competitors of gas continued to make, as a feature of their compaign, the usual malicious slanders concerning noxious fumes from the use of gas; and the installation in their principal rooms, by the Society of Medical Officers of Health, of inverted incandescent gas-lights, and a hot-water and air-heating system, in which the heat is derived from gas-fed boilers, together with a gas-fire in the meeting room, caused some stir—not to say concern—among those who saw in it a heavy discounting of their baseless insinuations.

Heating by Gas.

The winter months of 1909-10 saw a big boom in gas-fires; and this is being repeated in the present heating season. Manufacturers have been extremely busy. The persistence of the smoke abolitionists has helped in this matter; and their work deserves encouragement. There is a strong, and very proper, feeling among them that municipal authorities ought not to be permitted to take surplus gas profits in aid of rates, but that the money should be devoted to the reduction of the price of gas, in order to make it more and more attractive as a fuel. These views were laid before the President of the Local Government Board; and the Right Hon. Mr. John Burns was very sympathetic. He brought out the notable fact that the Gaslight and Coke Company and the South Metropolitan Gas Company between them had (to say nothing of privately acquired appliances) placed no less than 1,300,000 gas-fires, gas-cookers, ring-burners, and hot-water heaters—all representing a lessening of the smoke evil. In Glasgow some excellent work is being done in a special and persistent crusade against the smoke nuisance; and from the Corporation Gas Chemist (Mr. F. W. Harris), the Sanitary Inspector (Mr. Peter Fyfe), and the Chief Engineer of the Gas Department (Mr. Alexander Wilson, the President of the Institution of Gas Engineers), came, at the beginning of the year, a valuable report on the heating efficiency of gas-fires in comparison with coal-fires, with the results of an investigation into the question of air contamination. The tests were conducted under ordinary conditions; and the report upon them has a large commercial and educative usefulness. This was followed in the autumn by an exhibition in Glasgow that was a big attraction not only to the citizens, but to others—drawing as it did many visitors from distant places. While on the smoke question, it may be mentioned that the London County Council were unsuccessful in obtaining the elimination of the qualifying word "black" from the Act applying to the Metropolis under which factory owners and others (save householders) are proceeded against for nuisance in respect of smoke.

Manufacturers of gas-fires, cookers, and other heating appliances are individually exerting themselves in the matter of bringing their work of improvement under greater scientific supervision; and the advantage of this is being witnessed in their productions, which, in point of economy, efficiency, and suitability, are far different from what they were once upon a time. Structurally, consideration of the question of the ease of maintenance, and economy in this work, has resulted in much ingenious device. The same applies to appliances for industrial use. Novel proposals in the way of gas-fires (lately described in our columns) have emanated jointly from Professor W. A. Bone, Mr. J. W. Wilson, and Mr. C. D. M'Court. The Gas Heating Research Committee of the Institution of Gas Engineers, in conjunction with the Leeds University, continued to do useful work in connection with gas-fires; and the disinterested reports made by the Research Chemist (Mr. E. W. Smith) have afforded much that is of valuable use in guiding to perfection. Unfortunately, there is a pause in the work; and the Gas-Heating Research Committee has been disbanded. Mr. Smith, as previously mentioned, has gone to Birmingham as technical supervisor in the industrial high-pressure supply work of the Corporation Gas Department. It is now left for the Livesey Memorial Advisory Committee to look into the question of future gas-heating investigation—a hint to this effect falling from Professor Arthur Smithells at a conference held but a few weeks since at the Leeds University. Meanwhile, it is hoped that Professor Smithells will be able to undertake, single-handed (in accordance with the suggestion he made at the meeting of the Institution in June), an investigation into the hygienic aspects of gas heating. The question of allowing discounts for gas used for heating has been discussed during the year; and in our columns Mr. R. W. Edwards and Mr. H. J. Woodfine have brought to the notice of readers some highly successful experiences. Seeing the importance of a growing proportion of the total gas output being consumed during the hours of daylight, there is the strongest possible reason for not allowing omission in the matter of encouragement to stop the very natural trend in the development of the industry. In these columns were produced figures from the First Garden City—the gas business of which has been reared on modern lines by Mr. Charles Hunt (as Consulting Engineer) and Mr. A. W. E. Bullmore (as Resident Engineer)—which showed that 60 per cent. of the gas output passes through consumers' meters during the hours of daylight. The use of gas for the heating of water in connection with the ordinary hot-water circulating systems of houses is a branch of business to which several gas undertakings have been paying very special attention.

Gas Power—Need of Low Gas Prices.

Nothing very important has transpired during the year in connection with gas-engines. The British Association Committee on "Gaseous Explosions" have continued their excellent informative work; and, in their last report, they dealt with the important factor of heat-flow radiation in connection with internal combustion engines. But though this work is proceeding, Mr. Dugald Clerk does not think that the improvements that can be effected in gas-engines to produce a higher efficiency can be made at a cost that will be economical in relation to the gain, and therefore much more can be done in the matter of economy by the cheapening of town gas than by making the engines more costly to build. In connection with the gas-turbine, one authority tells us that the progress so far effected has not been by any means illusory.

Measurement and Prepayment Price Questions.

Bearing upon the sale of gas, the subject of its measurement has been fairly well brought to the front in presidential addresses and papers during the year. The claim that the time has long since arrived when the Sales of Gas Act, 1859, should be revised, has been revived; and the powers that be cannot continue much longer to neglect the inharmonious conditions that at present exist. The standard conditions with which meters have to comply in their official testing, are not by any means on good terms with the conditions under which the meters have to be used in these times of higher gas pressures. Attention was called, in a very clever address by Mr. Franklin Thorp to the Manchester Junior Institution, to certain of the factors in meter error. The discount meter is receiving larger and larger appreciation in assisting in the application of differential prices in connection with gas heating, and in serving to boost-up this section of the business where it has been lagging behind. In the spring, an electric gas-meter was described in our columns; this being an American invention about which nothing has since been heard in this country. The means of measurement on works have received an addition by the adaptation of the Venturi principle to the registration of gas. For this purpose, it was first brought into use by Mr. W. Woodward, at Bromley, and was described in connection with an account of his extensions in these pages, and further explanation was supplied in a paper by Mr. J. L. Hodgson.

In the council chambers of many cities and towns in the country, the question of the excess charge above the ordinary to prepayment meter consumers has been raised—the gas-works being municipal possessions. Parliament has long since decided what are fair excess charges—10d. with fittings, 1s. with fittings and cooker, and 10 per cent. on the cost of meter without fittings—and we do not see, where the ordinary price is a reasonable one, why this matter should be approached in any philanthropic spirit, and not regarded entirely from an equitable business point of view. Mr. W. R. Herring discussed the point exhaustively in a report he made to the Edinburgh and Leith Gas Commissioners, and he declared that 1s. 2d. was fully justified (whether advisable is another matter) in view of the greater expenses incurred in connection with the prepayment consumer, as compared with small consumers on the ordinary system, who, he showed, consumed, on an average, nearly double the quantity of gas taken by the prepayment meter consumers.

Higher Makes—Illuminating and Calorific Power.

We have dealt in this review somewhat extensively (and yet the surface only has been skimmed) with certain of the commercial aspects of the gas business, because they have assumed a significance and a magnitude that cannot now be said to hold a position of second importance to works' operations. Works plant and processes require large technical ability; and from their very nature they appear more imposing than aught else. But examine the position with care from the point of view of relative responsibility. The responsibility in the works and the acumen required are great. Look outside the works at the area, the number of consumers, the commercial competition, the advances in the means of utilization; and the expanse demanding active and unremitting oversight and energy must be admitted to be equally great. The responsibility is, and the acumen required is also, of the first order. Statistical proof is required by some. Here we have it. Take the last half-yearly accounts of the Gaslight and Coke Company as the largest of examples, all others following in something like proportionate relation. The expenditure on manufacture was £962,110; the receipts from gas were £1,623,644. In this last figure we recognize a larger responsibility than in the former.

But we have now to turn to the works and the primary product. The character of the primary product and the method of production have due relationship. Whatever form of retort is used, the value of the heavier or full charge has become practically universally recognized, to the financial advantage of all concerned, and to the secondary—some may say equally important—end that a gas more suitable for use in admixture with air is produced. Parliament last session continued to grant a standard of 14-candle power tested by the No. 2 "Metropolitan" argand burner (the Bury and Middlesbrough Corporations are not tied to anything now in excess of a standard of 12 candles). The more lenient conditions favour higher makes; but with full, or approximately full, charges, the experience throughout the country is that, while makes are higher, the illuminating power is not materially degraded, nor is there any parallel lowering of the calorific power. It is generally accepted now that, in ordinary working, the ratio of depreciation of quality is that 2 per cent. reduction in illuminating power represents only 1 per cent. reduction in the calorific power. But study the figures for vertical working; and it cannot be said that the rule has any common application.

However, higher makes have come to stay; their material benefits, pointed to and emphasized many times during the year, will not allow them to depart. When the last-issued Board of Trade returns show a reduction of 168,987 tons in the quantity of coal carbonized in a year in statutorily controlled gas-works, and an increase in the make of coal gas (not including water gas) of no less than 1,632,331,000 cubic feet, the point needs no laboring. We do not hear much about the higher makes from Scotland; but, though change is slow, they are not so strongly wedded there now to high illuminating power as formerly. This is seen in the application to Parliament for lower standards, and by the discussion that took place this year at the informal meeting of Scottish Gas Managers. Apart from heavier charges, gas managers continue to be attracted by the advantages of accessories in maintaining uniform conditions of working. Meunier's patent arrangement for maintaining and controlling the level of liquid in hydraulic mains was introduced during the year, and was publicly well spoken of by, among others, Mr. H. Kendrick and Mr. S. R. Ogden. The subject of gas enrichment has been almost completely set on one side. Enrichment is something that had existence in the past, and only survives in a few places outside Scotland to-day. During the year, a report on benzol enrichment was received from the American Gas Institute, in which this form of enhancing illuminating power was credited with being the most economical, if only handled in the proper way.

There cannot be the slightest doubt that the day when the illuminating power standard will be superseded by the calorific power one has been brought appreciably nearer by the fight over the joint promotion for the "Metropolitan" No. 2 burner during the past session. The Chairman of the Commons Committee (Sir Henry Kimber) who considered this matter had this feeling after he had heard the whole of the evidence; and Parliament has not yet entertained any suggestion of a dual standard. The agreed calorific standard of the Gaslight and Coke Company, working in conjunction with the illuminating power one, is confessed to be somewhat irksome, and limits freedom. The Company have done well in complying with obligations during the year; but it will not be good policy in the interests of the public to keep them under the yoke of a double standard, and so impose restraint upon their movements in the service of the consumers. The question of calorific power being the sole working quality has been, and is being, considered in all countries. It has been very extensively discussed by our friends in the United States; and a paper from Mr. J. B. Klumpp, narrating what had been done there, was presented at our Institution meeting in June. But at the meetings of the American Gas Institute, the German Association, and the French Society the subject was a more prominent one than at our own Institution meeting. The point was made at the German Association meeting that not only is the calorific power the right working quality in view of current conditions, but that its adoption gives a wider choice of raw material from which to select than when sperm value has to be reckoned with. In the State of Wisconsin, calorific power has been adopted as the standard, to the exclusion of illuminating power. The Canadian Association also considered the subject, and brought out the interesting facts from collected statistics that of the total gas output no less than 57 per cent. is used for fuel, 32 per cent. for incandescent lighting, and only 11 per cent. for flat-flame burners. A studious contribution to our columns was by Mr. Thomas Holgate, on an examination into the causes and ranges of variation in calorimetric tests. Several papers were read (but chiefly before the Junior Associations) on the general subject of calorimetry; and in certain instances criticisms were made about some of the details of well-known types of calorimeters.

Carbonization.

In treating of illuminating power and of financial matters, the value of the new systems and methods of carbonization have been incidentally referred to. Round about the subject, there has been prolific discussion in the course of the year, from all aspects. For example, Dr. Colman showed us in a lecture at the Manchester University that the theories of carbonization are having very complete confirmation in current practices. Then Mr. Ferguson Bell, among others, has added to the experiences of heavier coal charge; and Mr. A. F. Harris, of Market Harborough, raised practically all carbonization points from Dan to Beersheba in a paper read before the Midland Association, and brought upon himself the advocates of various systems in fairly strong force. There has been quite a host of contributors to the subject at the technical meetings in this country, in Germany, and to a less extent in France. But with it all gas engineers are asking for some systematic investigation, so as to give them better means of judging of the values of the relative claims of the different systems. The Institution Carbonization Committee have not been in a position to furnish much assistance to this end up to the present. Professor H. E. Armstrong came out strongly at the British Association meeting as a defender of low temperature carbonization. His advocacy was estimated at its proper worth by all practical carbonizers; and his style was described as rather a personal than a professional characteristic. Professor Lewes also lectured at the London Institution on smoke abatement, and gave low-temperature carbonization the credit for producing the "ideal" smokeless fuel. His view has been combated. The heavier charge has raised several questions of much interest. One is as to whether the wear and tear upon horizontal

retorts is greater than before. The answer is that the inequalities of temperature in the retorts cannot be so great with the heavier and longer duration charge as with the lighter charge which necessitates more frequent charging and discharging. Bearing upon this, pusher machines are now invariably chosen when new plant is being selected for a retort-house. Projector charging machinery continues in great favour; but the machines for carrying in coals have now been adapted to deal with heavier charges, and they, too, find considerable favour. Interesting developments to be described and illustrated have been the combined De Brouwer charger and discharger, and the Paris discharger with two rams, so that their alternate use will enable one to cool while the other is in action.

The Vertical Systems.

Carbonization with horizontals on the new methods, with the excellent accompanying benefits, has monopolized a considerable amount of attention during the year; but there is not the novelty attaching to their use that there is to vertical retorts—intermittent and continuous—or chamber settings with large bulk charges. Therefore, it is not surprising that much interest is evinced in the advances and the working of these systems; and that gas engineers are anxious to have the latest authentic accounts of their adoption and operation. In installations, the Dessau retort had a big lead upon the Continent; but this year we have seen one or other of the continuous systems forging ahead, and securing substantial contracts. The Dessau system is now planting itself beyond the borders of the Continent and this country to more distant parts—such as North and South America, while Melbourne is its latest capture. On the Woodall-Duckham system, in addition to the former well-known installations in this country, the working has just been started, or is about to start, of the settings at Lausanne, Luton, and in the United States. The Glover-West system, in addition to St. Helens, has a large installation running at Manchester; and Mr. Newbigging reports it is doing well. Contracts have also been booked for Bradford, Rochdale, Helensburgh, and Lurgan; and Japan, Australia, and the United States will have installations respectively at Tokio, Sydney, and Fitchburg. The year has witnessed a remarkable growth in favour of vertical retorts. But this is merely the incipient stage; and there is confidence in seeing notable developments. We cannot in this review enumerate the claims for the systems. They have been stated over and over again. But as a development introduced to notice this year, may be mentioned the modification in the design of the Dessau system, which has enabled eighteen retorts to be included in a single setting; and this has enhanced the duty per setting (not per retort), and constitutes an economical advance. In this and the other systems, labour costs are running out at very low figures. It has been shown that the vertical retort system is economically applicable to quite small works—at Dronfield, for instance, one bed of 4-metre retorts on the Dessau system has lately been adopted. At Edinburgh, experimental work is proceeding on a system of vertical retorts, devised by Mr. W. R. Herring, which can be operated either continuously or intermittently; while at Glasgow, Mr. Alexander Wilson has running a bench which he calls the continuous-intermittent system, in which a definite part of the charge is taken out at fixed periods, and the space thus provided in the retort is filled by a fresh charge at the top of the retort. It is, in short, a partial discharge and charge system. There will be interest in closely watching these two fresh developments. The chamber settings for heavy charges of coal for gas-making purposes are forging ahead on the Continent; and in our pages there have been described installations of both the Koppers and Munich systems, by which many millions of cubic feet of gas are made daily. A polemical subject on the Continent is still the relative advantage of water-gas production in vertical retorts, or the separate production of blue water-gas and its addition to the ordinary coal-gas supply.

British Retorts and Other Refractory Material.

The year has witnessed big strides in re-establishing confidence in British-made retorts and other fire-clay goods, through the work of the Refractory Materials Committee, acting in conjunction with the Retort and Fire-Brick Section of the Society of British Gas Industries. Testimony in our columns varied considerably as to working experiences, and the information published in the report of the Refractory Materials Committee in June last showed that there was not a small number of gas engineers who were of opinion that the quality of British retorts and other fire-clay materials gave room for some improvement. The report also furnished useful information as to average maximum and minimum working temperatures for different parts of retort-settings and water-gas plants; and the information is of a character that the makers, it was stated, have been wanting for years past. The first-fruits of co-operation between the makers and the Refractory Materials Committee took the form of a specification for retort manufacture and testing. This was published last week, and comment made upon it. In this matter, production will now be compatible with use; and in future there should be no room or excuse for the charge of retrograde movement in the matter of quality, or rather of quality not keeping pace with requirement. Several articles and papers on the general subject appeared in our pages in the course of the year.

Other Works' Plant.

When we consider the commercial conditions of the gas industry to-day in relation to the works and plant of a gas undertaking up to the point of the consumers' meters, one cannot help being impressed by the fact that the commercial changes have brought to the gas industry more economical conditions of working, through both the larger output of the works' plant and the more regular use to which the distribution plant is put. Where the make of gas has increased by 1000 to 2000 cubic feet per ton of coal, and where the proportion of the output during the hours of daylight has reached figures in the vicinity of 40 to 50 per cent. of the total, such conditions must have had an important bearing on capital, labour, and establishment charges to the point of the meter. What has been done during the year has left its impression in this direction. New works and extensions, too, are now carried out at lower capital cost than formerly, though where mechanical operation is largely adopted, capital and maintenance expenditure is supplemented, with a set-off in working economy. Many extensions of gas-works and the results of much of the work of different inventors have been described and illustrated during the year—work both at home and abroad. The Zurich, the Strasburg, and the Hoboken (Antwerp) Gas-Works supplied articles of more than ordinary interest. The Continent, as a matter of fact, has of late had the largest examples of new gas-works construction to present to professional students. The large expenditures, and the ready way that capital is subscribed for gas-supply purposes, go to show how thorough is the general belief in the future of the gas industry. The information came to hand as to the Paris Gas Company having determined on an expenditure of no less than £7,200,000 on new works and extensions at the existing stations, in addition to an outlay of about £1,880,000 that had been made, as a matter of urgency, during the two years prior to the announcement. In connection with works at home, the battle of the sites at Belfast aroused a great deal of interest; and it has been settled by the new Gas Engineer to the Corporation (Mr. J. D. Smith) having propounded a scheme for the reconstruction of the present Ormeau Park works, which he estimates will carry the department on for the next sixteen years.

Excepting retort-settings, if there is one part of the plant of gas-works that has received more attention than another during the year it is the gasholder. The disaster, with such terrible effects, to the Hamburg overground vaulted gasholder (towards the end of 1909) seems to have been the starting-point of revived interest. In our pages this type of holder was subjected to criticism by Mr. F. S. Cripps; but it was learned that the holder is to be reconstructed on the same lines, but with a high factor of safety. A good deal of consideration was afterwards bestowed on the precautionary measures to be adopted in the construction of tanks and holders—contributions coming from Germany and America. A series of articles of considerable value must be mentioned. They were by Mr. Cripps on gasholder cups. Many gasholder cups blow and cause waste every time they uncup; and Mr. Cripps discussed the reason and the remedy. It is not, he submits, too much to say that gasholder cups are little understood; but his thesis on the subject will have induced a better acquaintance with the necessities of this important and most critical part in a holder structure. Mr. Norton H. Humphrys also gave some sound practical advice on the maintenance of holders. What Mr. Cripps described in our pages as the most interesting and novel contribution to gasholder tanks that has appeared for a long time, was

M. Edouard Bonnet's presentment of a new form of steel holder tank with bulging sides. The largest work in hand at the present time in gasholder building is that which Mr. J. G. Newbigging is carrying out at Manchester. The holder will have a capacity of nearly 10½ million cubic feet; and it will rank third largest in the world. The constructional details of the work received description and illustration during the year, mainly from the pen of Mr. Frank H. Robinson, who was formerly one of Mr. Newbigging's assistants, but has now obtained the appointment of Engineer and Manager of the Knutsford Gas and Water Works. It was twenty-three years since Mr. William Gadd patented the spiral-guided gasholder; and the world over there are now standing, and accident has yet to be recorded, examples large and small of the correctness of the theories and principles embodied in his clever design. We have described the latest structures on this system at Oldham and Tunbridge Wells; and others have been in course of erection in different parts of the country during the year. British gasholder builders, like British makers of other forms of gas plant, have secured a big proportion of work that has been up for contract outside this country. Among "foreign" gasholders booked for production at home, there is the 5 million cubic feet one for the Toronto Gas Company, which will be the largest existing in Canada.

Purification processes have again claimed fresh consideration—among the principal new plans being the Burkheiser, which seems more applicable to coke-oven plants than to ordinary gas-works operations. Introduced to notice, was Herr Feld's system for obtaining and utilizing sulphur from sulphuretted hydrogen and sulphur dioxide. The number of purifier-box accidents that have taken place brought Dr. Lessing into our columns with the suggestion that a more or less inert gas might be employed with advantage in place of air for testing new gas plant; and this was followed by Mr. W. J. A. Butterfield pointing to the extensive use to which flue gases were put for the displacement of air, prior to the admission of coal gas, from practically the whole of the new plant and distributing system of the Vienna Municipal Gas-Works in 1899. The daily increasing requirements in gas manufacture demanding the corresponding use of efficient instruments for analysis and testing, Mr. C. W. Somerville, in a special article in our columns, brought to notice a new process he has devised for the rapid estimation of sulphur and sulphuretted hydrogen.

Water-gas manufacture did not receive much attention during the year as a subject for consideration either in the form of contributed articles or before technical societies. The President of the Dutch Society (Mr. J. van Rossum du Chattel), in his address, discussed the question of the relative cost of the carburation of blue water gas and the direct production of carburetted water gas; and this led to some correspondence in our columns.

Gas Distribution.

In gas distribution, the subject of high pressures has again had considerable attention directed to it; and news came from all countries of their employment as an economic factor in gas-works operations. In the United States, it is reported, there are now in use 1500 miles of high-pressure mains. General distribution pressures on a higher level than formerly, and high-pressure supply for lighting and industrial purposes, are referred to in an earlier part of the review in treating of the character of the business with which gas undertakings have now to deal. An interesting discussion took place in our columns during the year on the flow of gas through pipes; this being started by an article written by Mr. D. Chandler, of the South Metropolitan Gas Company.

Technical Organizations—The Insufficiency of the Institution as a Central Body.

The technical organizations of the industry had a very busy year, and the harvest has been of excellent quality. Foremost, of course, stands the meeting of the Institution of Gas Engineers, outside which meeting, except through the work of the Gas Heating and the Refractory Materials Committees, not much additional tangible usefulness has to be recorded to the credit of the central body. But the meeting itself contained a great deal of interest; and it is to be hoped that what transpired on this occasion will eventuate in a reconstruction or an expansion of the membership and work of the Institution, so as to give it greater power and scope for usefulness as the representative body of the whole industry. That was the cardinal subject and feature before the meeting in June; and it was raised in the inspiring and thoughtful address of the President (Mr. James W. Helps). The industry, largely in its technical aspects, entirely in its commercial aspects, has changed completely; but the Institution still runs on its old lines. Organically and functionally, the Institution requires reformation; and that was the base upon which Mr. Helps's address was founded. Is anything being done in the matter? It has to be admitted that we cannot say. But are the thoughts, the aspirations, the very necessity that exists, to be left as dead, and as of no consequence, with the dying away of the last note of the President's voice as he delivered the address? The inaction, or, if there is action, the secrecy, in regard to the matter, is incomprehensible. We will not refer to the papers read, or the reports presented, at the meeting. Some of them are alluded to in dealing with the subjects elsewhere in this review. As a matter of fact, the contribution of technical and commercial papers from the Institution, and the District and Junior Associations, with those of the German, French, American, Victorian, and other Societies, grows so that, to merely mention the whole of the subjects, would be to republish large portions of our quarterly indices. But in connection with the financing of the work of the Institution, we are sorry to see that the Special Purposes Fund is being whittled down by the lessened annual contributions; and the constant begging that has to go on in the wealthy gas industry for contribution to the Benevolent Fund of the Institution is painful in the extreme. The District and Junior Associations made rich contribution to the technical literature of the year. At the meetings of the German and French Associations, carbonization, purification, illumination, calorific power, constructional, and commercial topics engaged attention. The visits of members of the German Association to this country in the autumn (postponed to then from earlier in the year, on account of the death of King Edward) was an event which their British colleagues will store in memory with the happiest of recollections. They were the guests of the gas industry through the Institution; and special hosts were the Gaslight, South Metropolitan, and Croydon Gas Companies, and the Edinburgh and Glasgow Corporations. Works were thrown open to, and hospitality showered upon, the visitors in a manner that convinced them that they were honoured guests, and this cemented friendship in the strongest possible manner. The French Society visited Brussels at the time of their annual meeting, and were entertained in right royal fashion by their Belgian colleagues. The Society of British Gas Industries, under the presidency of Mr. Balfour Browne, K.C., had a successful year; and Mr. Fred. J. West, the successor to Mr. Charles Clare in the Chairmanship of the Council, showed that valuable as had been the work of the Society in the past, its usefulness had still greater opportunity open to it. The Illuminating Engineering Society, too, indicated by its work that it occupies a place that has been inadequately filled in the past, although the Society has yet to convince us that the independent, impartial illuminating engineer is not a *rara avis*, despite the interesting work done by the young organization itself. The British Association meeting furnished our columns with a mass of matter which exhibited the high-class character of the work in connection with internal combustion engines that is being carried out, under the auspices of this heterogeneous scientific body, by the savants. A big and valuable compilation on gaseous combustion, leading up to his own work on the acceleration of combustion by surface contact, was presented at the annual meeting by Professor William A. Bone, who occupies the Livesey Chair in the Gas Engineering and Fuel Department at the Leeds University. The many technical organizations in which the gas industry is concerned have again proved the importance, value, and indispensability of conference in these progressive times.

The Imperative Educational Work.

The gas industry progresses and prospers abundantly, and with its advance has come an increased recognition of the need for the best possible trained intellects—trained technically, commercially, practically, and with the qualifications attributed to a man of affairs—for official service in it, offering as it does such large opportunities in the matters of the progress and the protection of technical economy and efficiency, and open as it is to the attack of competitors on all sides. Seniors and juniors are animated by the need. Quietly endeavour to project ourselves into the future, and

the argument supporting the contention becomes intensified. The Leeds University has been chosen by the gas industry—through the endowment, in memory of its foremost worker, Sir George Livesey, of the Chair of Gas Engineering and Fuel—as its chief centre of educational and research work. The arrangements made for the foundation and endowment of the professorship were completed during the year. The department at the University has revised its course of study for gas engineering students, and has extended the scope of its present and prospective lecture courses. It is hoped that full advantage will be taken of the provision. Through the instrumentality of the Manchester Junior Institution of Gas Engineers and the Manchester Institution, combined with the good offices of Professor Harold B. Dixon, the Manchester University has also inaugurated a series of lectures of a high order for those who still deem themselves learners in the art and science of gas manufacture and utilization. In this, there is no rivalry with the Leeds University. The Welsh Institution has been putting forth efforts, too, in making provision in its area for technical instruction for those of their juniors who are engaged day by day in the practical work of the industry. And so by these efforts from base to peak, knowledge spreads and ascends in the gas industry, and must of necessity continue to do so. It is convenient here to mention the establishment by the North British Association of a "Memorial Lectureship" to commemorate the work of the late Mr. William Young, who contributed so much to the store of chemical and physical knowledge of carbonization.

Examinations.

The examinations in connection with gas engineering and gas supply continue to encourage students; and the numbers who now present themselves for the honour of gaining the certificates of the City and Guilds of London Institute bear a marked and significant advance upon those of a time ago. It is our desire to incite and encourage interest in these examinations year by year; but one of the means hitherto available for doing this has been withdrawn by the authorities of the City and Guilds of London Institute, in refusing the pass lists, and forcing upon us the necessity of taking the circuitous course for obtaining the lists of canvassing the Secretaries of the different centres. This exposes to error in securing a complete list; but we hope the privilege of a direct communication of the names of successful candidates has only been temporarily withheld. The usual series of special articles, giving questions and answers in the Gas Supply examination, appeared in our columns; and we hope their instructive value was duly appreciated. A difficulty in connection with the examinations was referred to by Mr. James W. Helps, at the recent meeting of the Society of British Gas Industries. It is that the man who is practically trained in a gas-works is in no better case in the result than the successful student who is merely book or class educated. He also mentioned that the Council of the Institution, who are now the advisory body in connection with the gas examinations, are looking into the question of a revision of the form of the questions, presumably in order to give the practically trained man his due.

The Session's Legislation.

The parliamentary session of 1910 will stand prominent for the gas industry, not from any large amount of legislation affecting its interests, but on account of the decisive fight that was waged over the "Metropolitan" No. 2 burner, through the Bills jointly promoted under the ægis of the Gas Companies' Protection Association. Had it not been for these Bills, excepting for the few novel clauses that appeared in Acts (and which gave promise of a little more leniency to the gas industry in the matter of the revision of those parts of archaic enactment which are repugnant to the circumstances of the times), the session for the industry would have been somewhat humdrum in character. All the events associated with the Burner Bills from promotion to Royal Assent—the virulent and persistent opposition, the victorious emerging from every conflict by the promoters—are all so fresh in the memory of every reader that we may well leave the story with congratulation to the industry on the ignominous defeat suffered, at each stage, by the would-be obstructionists to—many of whom are materially interested as competitors in the obstruction of—the industry's progress. Their repulse, and the scattering of the old stock and vapid arguments that have been brought off the shelf year after year for some time past, have settled the matter for all time; and we cannot imagine that any parliamentary adviser of a local authority will now have the audacity and want of conscience to advise that any good case can be put forward against the burner that has been irrevocably adopted as the standard by Parliament during (may it not be said now?) the remaining years that the illuminating standard may still exist. It is a pleasure to think that we have had part in the fight for the industry's liberty. On very good authority we have it that, in the camp of the opponents, the articles that were published in our columns on "The Case for the Standard Burner" had effect in considerably weakening the confidence of the opponents, and that had it not been for the influence and stimulation of Liverpool, with its special case, there would have been difficulty in keeping the opposition coherent as long as was the case. Bills of costs coming upon defeat time after time have enabled many of the local authorities to properly size-up their attitude in the matter. But the main point is that the conclusiveness of the issue places the industry in a stronger position than ever. There was some talk of an attempt, if the measures could not be destroyed, to get a calorific clause inserted in them. But Parliament has been firm against all suggestions as to dual penalty tests and dual standards for a single commodity; and so all claim to calorific power was abandoned. A calorific power standard will only come in substitution for the illuminating power one, and not as a supplement.

The Brighton Gas Company's Bill was interesting. The Corporation tried to get some form of regulation inserted in regard to the use of carburetted water gas. On a Speaker's order, Dr. Haldane was called, and showed conclusively that the transformation of the conditions of gas utilization since the Departmental Committee reported on the matter had wholly undermined the necessity for regulation that he saw years ago. The Brighton Company obtained the right to create a redemption fund, by half-yearly appropriations of £1800 to extinguish £57,000 which at present represents abandoned works. Further instances of stand-by clauses being allowed were placed on record; and in the next session additional undertakings are asking for the protection. In an editorial article in our issue for Oct. 25, some novel forms of clause, relating to the building-up of a reserve fund, providing for depreciation, and concerning differential prices, were brought before our readers. The new policy of Parliament to tether municipalities in the matter of the sums taken from gas profits—in consequence of the wholesale abuse of the privilege that has been proceeding—was continued. Glasgow and Kirkcaldy, quite innocent of transgression in this matter in the past, had their purity compulsorily perpetuated by Parliament disallowing all claim to profit appropriation for purposes other than those directly affecting the interests of gas undertaking and consumers. The notices that have been given for next session show that Salford will be back again to ascertain whether better luck will attend them in regard to the disposal of the profits of the gas undertaking than was the case a couple of sessions ago, when upon Parliament providing for a limitation, they fled in utter dismay, leaving derelict the measure that they had been promoting. An interesting geographical extension, following up the annexation of the West Ham Company's district, is proposed to be made by the Gaslight and Coke Company, by taking over the areas of the Barking and the Chigwell, Loughton, and Woodford Companies.

In the Courts.

Almost without exception, the cases in the Law Courts in which gas undertakings have been involved during the year have been destitute of any particular principle, and there has been nothing that will hereafter be called to mind as a *cause célèbre*. It is particularly noticeable how comparatively free, considering its magnitude, the gas industry is from litigation affecting the operations within its manufacturing stations, which speaks well for the care exercised in management. The bulk of the cases that came before the Courts this year had reference to occurrences in connection with the distribution system, and business and events associated with it. This is not surprising in view of the great extension of the work of the distribution department; and having regard to this, there must be commensurate extension of care, in order to protect both undertakings and their patrons. Numerous were the cases before the Police Courts (this is starting at the lower end of the scale in importance from the legal point of view) affecting money stolen from the boxes of prepayment meters; and we can well understand the cry of a London magistrate the

other day for some genius who would invent a meter and money-box that would defy the attacks of depredators. The magistrate, of course, does not know what has been done in this matter; nor would he, if he did know, understand the reasons why there has not been a larger adoption of the strong money-box. There was the usual crop of cases of stealing gas. And instances come along showing the necessity of taking every precaution for protecting gas consumers against bogus inspectors and itinerant salesmen. Bogus collectors and bogus representatives of gas undertakings for the sale of fittings and mantles have been seen in the Courts during the year; and they have received the proper reward for their misdemeanours. Four or five cases of embezzlement of the moneys of gas undertakings by members of the staffs have claimed notice; and here again there has been due punishment. As usual, too, there were claims in connection with explosions, with varied issue, which we cannot now stay to re-chronicle. As has been seen in an early part of this review, a very considerable amount of the time of the Courts has been absorbed over the wrecks of the rotten Companies that have emanated from the gangs of City promoters which have been infesting the gas industry for some years. The list is a long one in which receivers and managers have been appointed. The honour of the promoters to whom reference is directed has never been a conspicuous feature. The Official Liquidator of the Kent County Gaslight Company preferred a claim in the bankruptcy of the man Darby for a sum of £14,000 odd (being the balance of a larger sum of undisclosed profits made by him as a promoter of the Company named); and the claim succeeded. A firm of solicitors had to proceed against the well-known Eaton for their costs in connection with the promotion of the Amman Valley Gas Bill. They won their case. Whether there has yet been a settlement has not transpired. E. O. Preston has had prominence in the Bankruptcy Courts; and a firm of contractors had to seek the aid of the Courts to obtain payment for a purifier and fittings. Whether there has been actual payment, there is no knowledge. Various companies, apart from those floated by these men, have come to the winding-up stage—among them representatives of the companies that sprung up two to four years ago for exploiting petrol air-gas. There was a little crop of workmen's compensation cases; but each one having different features, and features that may not arise for years again, and perhaps never, it would be unprofitable to occupy space here to specify them all. There was not, in fact, one that can be singled out as presenting features that are likely to have any frequency in the operations of gas-works.

There was only one instance where any disagreement arose between a Local Authority and a Gas Company, and that was in the case of Liverpool; the point being as to whether a certain public lighting agreement between the parties covered the lamps in unadopted passages. The Company made a substantial claim in connection with these lamps; but afterwards in a general settlement of differences embracing this and other matters, further proceedings were rendered unnecessary (see *ante*, p. 627). Perhaps the case of the year having most general interest was one in which the Worthing Gas Company were concerned. A declaration from the Courts was sought that the Company were bound to invest, and to keep invested, all sums appropriated for the renewal fund until wanted for the specific statutory purpose. It was the opinion of the Court that it was incumbent upon the Company to make a statutory investment of the fund, and not merely to allow it to remain unrepresented by some indefinite part of the general assets of the Company. Open trenches in public roads afford a fairly fruitful source of litigation—many people thinking they are entitled to compensation if, by their own heedlessness, they suffer injury in connection with them. But not in one of the cases reported in our columns this year was there any success. The Court recognize that they are bound to consider whether reasonable care has been taken by the parties responsible for the opening of the trench, and also not to overlook the proneness to a want of sufficient care on the part of wayfarers when they see the normal conditions of the road have been disturbed.

The Redhill Gas Company were fined for opening, without giving notice, a road which is not repairable by the public; but it was considered by the Bench to be a proper case to carry forward to the Higher Court. The Sunbury Gas Company were fined for (so it was alleged, and believed by the Bench) not keeping their testing-place in sufficiently good order. The Hamilton (N.Z.) Gas Company, before the Judicial Committee of the Privy Council, succeeded in their appeal against a decision of the Supreme Court, in favour of the Corporation, that their works should be valued on the structural value. The Judicial Committee decided that the commercial value should be taken. Mr. W. Ewing was unsuccessful in his action against the Greenock Corporation for payment for work which he contended did not come within the scope of his duties as Gas Manager. The Corporation of Leicester were set right in the matter of their mistaken notion as to powers of electricity supply permitting them to extend their trading operations into electric wiring and fittings. The West Ham Corporation had their knowledge expanded by the Courts as to the illegality of overdrafts and borrowings without sanction. The use of tar on roadways has opened up a fresh line of litigation. The circumstances of the case in which the Kent County Council were ordered to pay damages for the loss of a cow will be fresh in memory; and so will be the one in which the Pembroke (Dublin) Council had to compensate a lady cyclist to the extent of £250 for injuries sustained in riding over a road newly surfaced with water-gas tar, which had not been sanded over. The jury found that the road was dangerous. A trade libel case between Mr. B. Cars and the Bland Light Syndicate ended in a verdict against the latter.

The arbitration awards in the case of the Lisburn and Prestatyn gas-works purchases were issued during the year. The amount arrived at in the former case was £33,000; and in the latter, £14,170.

Labour.

Peace has continued to pervade the whole of the labour of the gas industry; the industry being more injured in these days by external labour disaffection than by internal. As a matter of fact, we cannot trace more than half-a-dozen instances—these having reference to municipal concerns, though there may be companies of which we have no knowledge—in which during the year there was any request for even an alteration of pay and hours of labour. The gas worker (as was shown by a Board of Trade return issued during the year) is well paid, in comparison with labour in other industries, and his conditions are good; betterment having advanced with rapid stride in late years. The application for higher pay had varied result—generally it was found that there was no good ground for the application; but in the case of Leeds small advances were granted to different classes of the men. Co-partnership is making splendid progress. A table published in our issue for Jan. 11 gave the position up to that time. There were then 18,000 gas workers under the system; and the total sum divided among them, from the varied dates of adoption, was £593,717. The later additions to the roll, and not included in the table, are Cambridge, Dartford, Enfield, Ilford, Wandsworth, and Weston-super-Mare. From all quarters come good reports as to the working; and this must give gratification to the co-partners of the pioneer South Metropolitan Company, who this year celebrate the "majority" of the system in connection with their own Company. Co-partnership was a great inspiration; and it was a great work that its founder did. It brings employers and employed into closer sympathy. Employers, through the work and the opportunities that co-partnership brings in its train, obtain a more intimate knowledge of their men and their affairs. "Even with the meanest," wrote Charles Kingsley, "we cannot gain a glimpse into their inward trials and struggles without an increase of sympathy and affection." The employees on their part learn more, through the system, as to the numerous influences, good and bad, with which the employer has to deal in producing a successful issue. The statue of the founder of the system in the gas industry, which the South Metropolitan co-partners subscribed to for erection at the Old Kent Road works, was on view at the Royal Academy this year.

We look at the conditions in the gas industry, and then at those over its borders, but which have more or less influence on its fortunes. There we find the trade unions have largely placed themselves under bondage to the Socialistic factions, which are bent on disturbing more and more the conditions between capital and labour, and to make war between class and class. Even the rank and file of the unions are now rebelling against their own rules and their own leaders—against law and order in their own organizations. This was seen in the Durham and Northumberland coal-fields at the beginning of the year, and subsequently in other directions—agreements entered into by the elected leaders

of the men being freely repudiated. Owing to this, and to the serious issues of the Osborne judgment, the Labour Congress assembled at Sheffield under an acknowledged cloud, and with failure written all over the procedure of the labour extremists. The Osborne judgment—pronouncing the illegality of a compulsory levy on trade unionists for the payment of representatives in Parliament, and so committing the individual to a policy of which he may not sympathize—was a great blow for the Socialists. The only lawful escape was by voluntary contribution on the part of the members of the unions; and the members showed which way their inclinations ran by (by a great majority) declining to voluntarily contribute. There was a deadlock. State payment of members of Parliament will not satisfy these men. They clearly want to bind the Government to "re-establish" a "right"—that is to say, compulsory contribution by members of the unions—which has never had any legal existence. That is the present position; and there is going to be hard fighting and hard talking over it by Socialistic representatives in Parliament. Labour exchanges were brought into operation early in the year, and their establishment has been spreading. It is claimed that they are doing an excellent work; but the degree of excellence varies with locality. They are of little, if any, use as agencies for the great labour-employing gas industry.

Official Transferences.

Official movements in the gas industry were many; and we cannot re-chronicle all here. A few of the more notable changes, however, may be mentioned. Mr. W. R. Herring resigned his post at Edinburgh (where he leaves behind him a monument to his engineering skill), to devote himself to consulting work; but the Edinburgh and Leith Gas Commissioners retain his services as Supervising Engineer. Mr. A. Masterton succeeds Mr. Herring as Engineer-in-Charge. Mr. R. S. Hilton was appointed to the office of Secretary and Manager of the Birmingham Gas Department, in succession to the late Mr. G. Hampton Barber. Mr. Hubert Pooley gained the Leicester appointment; and Mr. J. D. Smith won Belfast. Mr. James Paterson has gone from Redhill to assist his father at Cheltenham. Mr. E. P. Stevenson took over the engineership of the Milan Gas-Works of the Union des Gaz. Mr Canning Williams was appointed Treasurer and Collector of the Edinburgh and Leith Gas Commissioners, in succession to Mr. J. S. Gibb, who retired with to his credit many years of honourable work in that office. Mr. W. M. Valon was appointed to succeed Mr. Pooley at Stafford. Mr. John Phillips, who is still Secretary of the Bristol Gas Company, has received the reward of election to a seat at the Board. These are but a few of the many changes that have been made; but, without distinction, to those mentioned and those unmentioned, our heartiest congratulations are offered on their appointments, and the most cordial wishes for success in them. Two retirements have been alluded to in the foregoing. There were others. Among them Mr. P. H. Garnett, the Secretary of the Liverpool Gas Company, and his colleague the Treasurer—Colonel J. F. Robinson—gave up office. Mr. H. King-Hillier retired from the Engineership of the Shanghai Gas Company; and Mr. H. Smith from that of the Bingley District Council Gas Department. Mr. R. Forbes Carpenter, who unfortunately has not been enjoying the best of health, resigned the Chief Inspectorship under the Alkali Works Regulation Act, in which position he had endeared himself to the gas profession. He is succeeded by Mr. W. S. Curphey, who has to his record a large experience in the work. That veteran gas administrator—Mr. R. Hesketh Jones—relinquished the Chairmanship of the Oriental Gas Company.

From the Scenes of their Labour.

One by one the old friends pass away, and new ones take their places. Whatever their stations in the gas industry, those who have left our ranks during the year are missed by their colleagues, and the memories of them are treasured. Prominent in the long list stand the names of Mr. George C. Trewby, Mr. Alfred Colson, Mr. James Stelfox, Mr. Robert Sharpe, and Mr. Alexander Bell. Only a few out of many. It has been a year in which quite a number of veterans identified with the industry have passed from among us. Long years of service to gas engineering and management stand to the credit of Mr. J. Birch Paddon, Mr. Robert Shadbolt, Mr. James Manwell, Mr. Thomas Whimster, and Mr. John Smith. Among secretaries of gas undertakings, a great number of years of service was registered by Mr. C. Crowther Smith and Mr. Benjamin Haynes. Among gas chemists, the name of Mr. C. H. Greville Williams is revered. In the section of the industry devoted to plant manufacture and construction, the names of Mr. John Romans, Mr. John Spencer, and Mr. Thomas Vale have stood from the deep past. From among gas-works administrators the names of such esteemed and wise workers as Sir Frederick Thorpe Mappin and Mr. Frederick Tendron have been erased; but numbers of years will pass before they are forgotten. The year has closed the record of many an honoured career.

Accidents and Otherwise.

Considering the magnitude of the gas industry, the accidents—fatal and destructive of property—in gas-works at home are few. There have been quite a small number—perhaps half-a-dozen all told—of fatal accidents to workmen; and as to the mishaps to works, it is hardly worth while specially mentioning them. Accidents in connection with purifier-boxes happened at Coatbridge and Stalybridge. At Saltley (Birmingham) a tar tank was fired owing to the disobedience of a workman in using a fire bucket. To look further afield, the Hamburg gasholder disaster (which occurred in December, 1909) was a subject of much interest early in the year. The floods at Paris and the neighbourhood, which interrupted the gas and electric supply in parts, and caused much inconvenience in carrying on the operations in low-lying works, were serious matters that claimed the interest of gas men near and far. Parts of Zurich also experienced the inconvenience of an interruption of the gas supply through floods. At the Lausanne Gas-Works, owing to the breaking of an electric lamp, a serious explosion occurred, in which six men were more or less seriously injured. In the course of the year, an official account was issued of the calamitous accident in August, 1909, at the Geneva Gas-Works.

Accidents, though often deplorable, carry their lessons, and teach us what to avoid. Outside gas-works, there was a case of a death at Belfast, owing to suffocation by gas, escape of which was occasioned by an electric wire crossing a gas-pipe in a house, and causing fusion. A correspondent, in a letter published in our columns, called attention to trouble that arose through an electric meter being fixed close to a gas meter, with a metal coal vase forming a connecting link between the two, and allowing current to pass to the gas-meter. There was a death at Belfast through a gas-fire being fixed (not by the Gas Department) without a flue; and an extraordinary case of suffocation elsewhere was due to the flame of a boiling-ring on top of a gas-fire being extinguished through a kettle boiling over, while the occupants of the room were asleep. A case was also recorded of a coke-fed fire near a meter in a cellar causing an escape of gas and a slight explosion. At Manchester a bridge over the River Medlock was damaged by a gas explosion in February. Half-a-dozen fatalities were recorded by explosions; and eight explosions were reported upon in which little damage arose. A number of these were due to that time-honoured piece of foolishness of searching for escapes of gas with a light, and to the neglect of defective fittings. Largely to the same cause, may be attributed the eight fatal cases of suffocation, and two non-fatal ones, of which we had intelligence. No less than twenty cases of suicide by gas came to our notice in the course of the year. Acetylene gas was responsible for two or three cases of death during the twelvemonth.

In Conclusion.

We have completed our task of reviewing in mere outline the affairs of the year and of current interest relating to the prosperous gas industry. It has been a year of progress, despite the existence of certain conditions that were the reverse of favourable. There is nothing immediately near or on the horizon worse than the circumstances of which we have had experience in the year just closed that threatens to mar effort or stay progress. The industry is on the right high road. But it is a high road along which progress can only be effected by sheer hard work. As we close, each in our respective spheres, the work of the year we are about to leave, and as entry is made upon the New Year, may it be with the full resolve that nothing shall be wanting on our parts individually to discharge, to the best of our abilities, the duties that devolve upon us, to the furtherance of the interests of our several undertakings and of those of the

industry generally, to which industry it is a pleasure and an honour to belong. In the spirit that dictates these words, we wish all our readers and all associated with the industry, whatever may be their place and influence,

HEALTH, HAPPINESS, AND SUCCESS DURING THE COMING YEAR.

Sulphur in Coal Gas.

We publish to-day the full text of a report by Professor P. Phillips Bedson, M.A., D.Sc., with reference to experiments undertaken by him, on behalf of the Newcastle-upon-Tyne and Gateshead Gas Company, for the purpose of demonstrating whether or not the air in consumers' premises is rendered injurious to the occupants, during the burning of coal gas, by the presence of sulphur compounds in the gas. The details of the investigation are set forth at considerable length; and these will no doubt prove of value to those who may at any time contemplate the carrying out of tests on somewhat similar lines. It is, however, to the results of the tests that we would here specially direct the attention of those who are anxious to see that gas has fair play, and that it is freed as completely as possible from the prejudices against it which, even in these days, are far too frequently met with. Reference is made to the earlier researches of Mr. Otto Hehner and Dr. Rideal, which, it is pointed out, amply support the conclusion of Professor Bedson that the air of living-rooms, under ordinary, reasonable conditions of everyday life, is not so polluted by the sulphur acids produced by the burning of coal gas as to be injurious to the inhabitants. In fact, it will be seen from the report that the experiments demonstrated that the sulphur remaining in the air form but a small proportion of that given to the air by the gas burnt. This, as is stated, is the more remarkable considering the conditions under which the experiments in the several series of tests were performed. The tests were, indeed, made under conditions exceptionally severe from the point of view of contamination of the air by the sulphur acids discharged into it by the combustion of coal gas; and yet, as is pointed out in the report, the results give evidence that these acids are removed as quickly as produced. Some figures of tests of outside air taken in Manchester (many carried out in foggy weather) are quoted in illustration of the fact that the proportion of sulphur in the air of a town may represent a condition of affairs which it would be very difficult to attain by burning gas in an ordinary living-room. One set of Professor Bedson's tests, it will be noted, was made with practically unpurified coke-oven gas. Taking the whole of the experiments, using gas which contained from 14 to 47 grains of sulphur per 100 cubic feet, the average amount of sulphur found in the air of the rooms (under the very stringent conditions of the tests) was only 2·64 per cent. of that discharged into the air by the gas burnt. "The experiments," finally remarks the investigator, "show how small a proportion of the sulphur of coal gas becomes an aerial impurity, and consequently how insignificant is the question of whether oxide of iron or lime be adopted as a means of purifying the gas."

At the Japan-British Exhibition.

There is at once pleasure and disappointment over the report and statement of accounts received from Mr. F. W. Goodenough, the Hon. Secretary and Treasurer of the Joint Committee (of which Mr. D. Milne Watson is Chairman) who took upon themselves the responsibility of the Gas Companies' Joint Exhibit at the Japan-British Exhibition last summer. The pleasure arises from the success that the display made in attracting attention; the disappointment, from the comparatively small number of companies among whom was distributed the expenditure involved. It is mentioned that there were were no less than 4583 callers at the stand who gave their names and addresses, in order that they might be furnished by their local gas undertakings, or by the makers of goods on view, with further particulars respecting fittings or apparatus in which they became interested; and that number is but a modicum of those who came upon (in the course of their perambulation of the exhibition) and inspected the striking advertisement of some of the latest methods of utilizing gas. But one result of these booked inquiries was that 388 gas undertakings received communications from the representative of the Joint Committee; and this 388 (to say nothing of the indirect advantage to every gas undertaking in the country) stands in peculiar contrast with the 47 companies who subscribed, variously in large or small amount, to the cost of running the exhibition throughout six months. The 47 subscribing gas companies represent only 9·4 per cent. of the statutory companies in the country, and less than 6 per cent. of the total of the statutory undertakings, including local authorities. This was a very poor response to the appeals made for contribution; and, though the results of the display were good, the Committee felt acutely the limitations to effective work through further funds not being available.

A Chance Next Year.

But there will be a chance next year for the gas companies throughout the country to do something better—something on a larger, or more imposing and effective, scale—if they will only co-operate on proper lines. The Committee, it will be seen from the report on p. 939, suggest a display. There are two special reasons why next year there should be one in London, and one worthy of the industry. It is Coronation year; and there is to be a Coronation Exhibition. London will be the centre of attraction to people in all parts of the country; and the Coronation Exhibition is certain to be one of the popular places of resort for visitors. Another reason why a good display should be made is that the electrical industry (which is reported to be giving strong support to the project) is holding a large exhibition at Olympia. The Committee, in making the suggestion for a gas display at the Coronation Exhibition, trust that they may rely upon more general financial support; and, under the special circumstances of the year, it is hoped that it will be accorded with no niggardly hand. More will be heard about the matter in the New Year. Experience is a fine educator; and, reading the report now before us, there is a striking point about it that bears upon the organization plans. It is that position is of greater importance in a display of this kind than size. The position secured for the display this year has proved better than the one in the Machinery Hall at the Franco-British Exhibition, for capturing the public in their exploration of the big show. This is an experience worth following up, by an attempt to get a position nearer still to the Wood Lane entrance, in order to draw notice from the great incoming and outgoing tides of visitors. The space hereabouts, close to the principal entrance and leading to the Court of Honour, is the most frequented of any of the indoor parts of the whole exhibition.

What Was the Cause?

It would be interesting to know what caused the big fire at Maidstone last Saturday week, when a life was lost, and three shops belonging to Messrs. Denniss, Paine, and Co. were destroyed, occasioning about £50,000 damage. "It was in the Christmas toy room, at the rear of the drapery establishment, that the outbreak occurred; and though it is generally attributed to the fusion of an electric wire, the real cause is unknown." So writes the representative of the "South Eastern Gazette." In another account, Mr. Paine is reported to have said that "electric wires were suspended from the ceiling in 'Fairyland,' on which were ten glow lamps." Mr. Cruttenden, another partner, asserts that, after "Fairyland" was completed, he came to "the conclusion that the glow lamps were placed in perfectly safe positions. The electricians visited the shop twice a day to see that everything was right." The electricians were evidently anxious; and electricity is manifestly suspect. Unfortunately, an errand boy lost his life in the fire; and an inquest has been held. The evidence pointed unmistakably to the general opinion that the electric lighting arrangements were at the bottom of the disaster. Nearly the whole of the evidence centred on this; and the appearance of Mr. Hoadley, the Corporation Electrical Engineer, as a witness, accentuates the direction in which belief rests as to origin. But all that could be definitely said was that the place where the fire originated was lighted entirely by electricity. There was a blue flash on one side of "Fairyland;" and the view of the assistants present was that "something had gone wrong with the electric lighting." The installation of the additional lamps for the Christmas display was made by the Corporation Electricity Department; and it was repeated in evidence that an electrician had called twice a day to make inspection. Public confidence in electric lighting is evidently not growing. But it is only fair to say that the Coroner was not sufficiently satisfied as to the cause of the fire to express any decisive opinion.

A Better Outlook in South Wales.

News arrived at the end of last week that there was every likelihood of the early return to work of the large number of miners at the Powell-Duffryn Company's collieries in the Aberdare Valley. This welcome intelligence is the outcome of a resolution passed some days previously, at an adjourned conference of miners' delegates representing the South Wales Federation lodges throughout the coalfield. While, however, deciding by a large majority that the Aberdare strikers should return to work, the conference also resolved that the fight with the Cambrian Combine should continue; and it was determined to appeal to the Miners' Federation of Great Britain to assist in carrying on this particular struggle. Most of the time that has since elapsed has been occupied with communications passed between the men's spokesman and the representative of the Powell-Duffryn Company. Apparently, the former was desirous of obtaining guarantees before the men resumed work; while the management felt themselves not to be in a position to discuss grievances or to give further guarantees while the pits remained idle. The upshot of the delay thus experienced, was a conference last Thursday between representatives of the strikers and the Miners' Executive Council. The strikers reported that, in consequence of failure to secure an understanding with the Colliery Manager that none of the workmen were to be victimized, they did not resume work in accordance with the terms of the resolution passed at the previous conference. The Council expressed the opinion that any attempt at victimization would be a distinct violation of the decisions of the Conciliation Board, and undertook, after the men had resumed work, to resist any attempt that might be made to victimize any workmen. Upon receipt of this assurance, the deputation consented to recommend the men to return to work at once; and local opinion inclined to the view that this advice would be accepted by an overwhelming majority. So far as the Rhondda trouble is concerned, the latest development is a refusal by the owners to discuss terms of settlement until the workmen's representatives come to them with plenary powers to settle. Mr. Askwith and Mr. Mitchell, of the Board of Trade, thereupon proceeded to Tonypandy (of ill-repute) to urge that the miners' delegates should be given such powers, so that another conference with the owners might take place. The firm position which the colliery proprietors are maintaining should stand them in good stead in times to come; and we sincerely hope it will.

The Accounts of Borough Councils.

Opportunity is taken to reproduce, in another portion of to-day's issue, some figures from Part V. of the Annual Local Taxation Returns—the particular volume of a heavy series of Blue-Books which refers to the accounts of Councils of Boroughs other than Metropolitan Boroughs. The statistics, which occupy practically 250 foolscap pages of tabular matter, deal with the financial transactions of the 327 boroughs (exclusive of the Metropolis) during the twelve months ended March 31, 1908; and therefore the position of affairs revealed by them is that which existed some time ago, and not necessarily that which is to be found to-day. For instance, at the date mentioned the total amount of outstanding loans was about £246,600,000; and no doubt this has since been substantially increased, judging from the fact that twelve months earlier the sum was £244,000,000, and three years before that only £217,700,000. The money, of course, has been borrowed for a large number of purposes—some of the undertakings concerned being of a "reproductive" character. The following are a few of the directions on which much money has been spent, with the outstanding loans under each head: Tramways and light railways, £21,828,117; water-works, £60,673,440; gas supply, £19,297,126; electricity supply (including indistinguishable items for public electric lighting), £20,709,006; roads and streets, £27,656,764; sewerage and sewage disposal, £20,336,499; and public lighting (other than indistinguishable items for public electric lighting), £93,008. With the solitary exception of gas, these are all increases over the previous year; while education (£18,983,726) is another item which also continues to grow. Taking the figures with regard to gas and electric lighting, it is found that, while the outstanding loans on gas-works show a decrease of some £200,000 as compared with the preceding year, those for electricity supply undertakings exhibit an increase of some £300,000. For several years gas loans have shown a falling off to about the same extent. The increase under the item of electricity supply for 1906-7 and 1907-8 is very much smaller than it was in the two years before that, when, on each occasion, there was an addition to the outstanding loans of considerably over £1,000,000. It appears that the total rateable value of the boroughs in the period now dealt with was £74,409,884.

Rate Relief and Deficiencies.

A section of the Blue-Book which naturally appeals to the student of municipal finance is that which contains tables showing respectively the "Sums transferred from other accounts of the councils to meet deficiencies in revenue," and the "Surplus revenue transferred to other accounts of the councils in relief of rates." Taking the four instances of what are usually regarded as "reproductive" undertakings whose accounts are separately dealt with in the Blue-Book—namely, tramways and light railways, and gas, water, and electricity supply—it is shown that for the year 1907-8 there was a total sum transferred in relief of rates of £1,051,994—about £20,000 less than for the preceding twelve months; while the extent of the deficiencies in revenue which were made good out of the rates was £372,076, or an increase of over £50,000. With regard to the falling off of profits, one may hope that this is the result of concessions made to the consumers or users of the different undertakings. The growth in the amount of deficiencies to be made good is, however, a matter which rate-payers will probably be inclined to regard with less equanimity As is invariably the case, gas-works are on the present occasion responsible for by far the largest profit (£480,634), and also the smallest loss. As to water-works, the total losses, as usual, reach a considerably higher figure than the aggregate profits; deficiencies made good of £248,990 having to be set against transfers to the rates of £116,139. From the businesses carried on by the different borough councils as purveyors of electricity, some rate-payers benefited to the extent of £121,776, which was the amount handed over in relief of the rates; while others had to provide a sum of £44,973 to make good deficiencies in revenue.

OBITUARY.

It is announced that Herr Ludwig Tittel, the Manager of the Schwedt-on-the-Oder Municipal Gas-Works, died on the 29th ult.

The last number of the "American Gaslight Journal" to hand contains an announcement of the death on the 4th inst., as the result of an attack of pneumonia, of Mr. Frederick Lines Bradley, Divisional Engineer of the Consolidated Gas Company of New York, and a brother of Mr. W. H. Bradley, the Company's Chief Engineer. Deceased was in his 61st year.

Mr. Hugh Ballingall, an ex-Provost of Dundee, died on Monday, the 12th inst., at the age of 70. On the same day, Mr. George Stevenson, an ex-Bailie of Dundee, died at the age of 76. Both had been Conveners of the Gas Committee of the Town Council. Mr. Ballingall was in office at the time the gas-works were reconstructed; and it is said to be largely owing to the "herculean efforts" of the deceased gentleman and a few councillors that the Gas Department is at present in its satisfactory position.

Refractory Materials and Their Testing.—Our report of the discussion that took place after the reading of Dr. Lessing's paper, on refractory materials (see *ante*, p. 841), is unavoidably held over until next week.

Tests of London Water.—The annual report of the Local Government Board, which was issued last week, contains the usual particulars relating to the water supply of London. With regard to the testing of its quality, it is shown that during the year 1909 no fewer than 13,888 samples of water were examined in the Board's laboratories, mostly by bacteriological methods. The results are briefly summarized in the appendix to the report, which also gives a *résumé* of the report of Dr. A. C. Houston to the Board, on his experiments to determine the effect of storage on the life of cholera germs artificially introduced into samples of various kinds of water. In the Board's report for 1908 similar information was supplied as to the effect of storage on typhoid germs. The result is said to form another link in the chain of evidence which Dr. Houston has sought to establish—viz., that by adequately storing the raw impure river waters, which constitute the chief sources of London's water supply, antecedent to their filtration, the safety of the Metropolis as regards water-borne epidemic disease (apart altogether from the possibility of accidental infection of the works, or subsequently in the pipes) is almost, if not quite, assured.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 952.)

The week before Christmas is usually rather a dull one on the Stock Exchange. But this year the period exhibited a remarkable contrast to the general rule. Cheerfulness at the present and hopefulness for the immediate future in the New Year imparted a very favourable tendency in several important lines, with resulting advances in quotation. There was a nice demand for securities of the best quality; and Home Government issues were well supported. Railways moved quite in sympathy; and, undamped by the dismal weather, they were at times bright and buoyant. The sensitive American Market effected a recovery, though the pendulum afterwards swung the other way. The Foreign Market was calm and peaceful. Tea drew strongly at first—the novel line apparently having attractions; but some closing-down before the holidays made it weaker. In the Money Market, there was a nice demand, and lenders were able to obtain better rates; but discount terms began to give way. In the Gas Market, the chief feature was an almost general advance in quotations made on Monday in the Suburban and Provincial group, and supplemented by others later on. This recognition of value might well have been made some time ago. Apart from these, there was little movement, except that Gaslight and Coke ordinary had a slight set-back. But the recorded transactions showed slight falling off. In the secured issues of the same Company, the maximum was done at 87 and $87\frac{3}{4}$, and the preference at 104 and $104\frac{1}{8}$. South Metropolitan was quiet and unchanged; the few dealings marked being within the limits of $121\frac{1}{2}$ and $122\frac{1}{4}$. No business was marked in Commercials. Among the Suburbans and Provincials, Alliance and Dublin rose 1, Brentford old 2, ditto new $3\frac{1}{2}$ (with transactions at $193\frac{1}{2}$ and 194), Hastings $3\frac{1}{2}$ per cent. 1, Ilford "A" and "C" 1, ditto "B" 1, Lea Bridge 1, Portsea Island (all issues) 1 each, Southampton 1, Tottenham "B" 1, Wandsworth and Putney "B" 2. British was done at $44\frac{1}{2}$ and $44\frac{3}{4}$. In the Continental companies, Imperial realized $185\frac{1}{4}$ to $186\frac{1}{2}$—being practically unchanged from the previous week. Union preference was done at $134\frac{1}{4}$. Among the undertakings of the remoter world, Primitiva changed hands at $7\frac{5}{16}$ and $7\frac{3}{8}$, and ditto preference at $5\frac{3}{8}$ to $5\frac{15}{32}$.

ELECTRICITY SUPPLY MEMORANDA.

Fun from Failure—Primary Importance of Continuity to the Motor Load—In Open Competition—The Need of Advertising and Dishonesty—Municipal Objection to Control—"Incidental" to Electricity Supply.

We learn from an electrical contemporary that "it is now well recognized that continuity of supply is a *sine quâ non* in any electricity undertaking that aspires to commercial success." The phrasing of this philosophical statement suggests that electrical people have only just lately become aware of the fact that continuity is a desirable—and not only so, but, in the public interest, it is an imperative—condition for any system supplying light and power. But if we understand our friends correctly, continuity of electricity supply was not always deemed by them to be an essential factor to success; on the contrary, failure at one time was thought to be a rather popular form of surprise recreation. We read that "at one time, when private lighting was the only load, the position was very different; in those days, a rush for candles in the middle of dinner provided more amusement than vexation." In other words, the deprivation of the householder and the shopkeeper of his means of lighting was at one time only a matter of small account in the eyes of the suppliers of electricity. The innocent merriment, too, that was caused by host and hostess and their guests having to leave the dinner upon the provision of which the hostess had expended infinite care, and scurry through the streets to obtain a supply of candles, was something for which electricity could frankly take credit. "In those days," it is said, this amusement was caused; and therefore it may be supposed that private electricity users have been so surfeited with this form of amusement, that it is so no longer. But believe us, our friends of the electrical contemporary referred to must have had a shallow and narrow experience of private users of electricity. We have never found any electricity using people, right away from the advent of electricity supply, who were tickled into a state of merriment by a collapse in the middle or any other part of dinner, or during evening shopping hours. We have recollections of more than one social evening spoilt by the ficklest of all illuminants. Did the guests jump for joy on any one occasion? Did host and hostess look their genial part, with faces radiant with smiles, and evince any amusement at the contretemps. Not a bit of it. What did happen? But perhaps we had better draw a veil over the events. Suffice it that those evenings were certainly not the most pleasant within our experience; and in the failures, there was full justification for the words and acts on those occasions.

It seems that what our contemporary has in mind that has altered the position in the case of a collapse from one that is comparatively immaterial to one that is material, is that the power load has grown. "Such a load," we read, "carries much responsibility with it." Does not the lighting load? We always regarded public safety as carrying an immense responsibility, and public safety leans heavily on the continuity after dusk of the lighting of streets, places of entertainment, railway stations, shops, and so forth. But it is the power load that is evidently of supreme importance nowadays. In connection with it, "interruption in the supply may mean serious financial loss to those dependent upon it. In industrial works, every hour of the working day is worth a great deal to the management; and if the supply of electrical energy fails from any cause, there is expenditure without any equivalent income." Not a word there about the suffering householder and tradesman. They are evidently of but secondary importance; and their compensation comes from the amusement supposed to be caused by the failure. If we take the country through, failure of electricity is not an infrequent occurrence. We shall have a little list of failures to incorporate in our review of the year next week, as was the case twelve months ago, and before. A fortnight since (p. 768) comment was made in these columns upon a bad failure at Glasgow; and last week in a news paragraph a collapse of the supply was recorded at Middlesbrough. We can picture the placid, mild, good-tempered men of Glasgow and Middlesbrough smiling over these occurrences, and patting the Electrical Engineers in the most jovial fashion on their backs for the amusement afforded them and their families. The time is remembered when one of the technical papers of the industry was lecturing the electrical engineers on the subject of these breakdowns; but, as we were saying recently, in the best of regulated systems—in the systems that are protected to a degree suggested by the highest ability—failures occur, though continuity of supply is a *sine quâ non* to commercial success. We learn that in the areas where the failures have occurred, brisk business is done re-establishing gas-fittings, either to supersede electricity, or to act as a stand-by to it. It's an ill-wind, &c.

Paddington has not a Borough Council burdened with an electricity supply undertaking; therefore the Council are free to choose the illuminant they think the better of two for street lighting. The Metropolitan Electric Supply Company are the suppliers of electricity in the borough; and they have no ratepayers whom they can compel to shore them up, and it is their business to work at a profit. The Borough Council are considering the question of a new public lighting contract; and the Finance Committee and the General Purposes Committee a short time ago reported in favour of the renewal of a contract for the lighting with the Gaslight and Coke Company, under improved conditions, and on easy terms to the Council. But the Metropolitan Electricity Supply Company had certain friends at court; and the recommendation was referred back to the Committees, with instructions to obtain tenders from the Electricity Company. The requirements gave the Company the option to quote for the whole of the lighting, or only a part of it. They elected to quote for part. A report published elsewhere gives a critical examination of the financial aspects by the Borough Surveyor. The Finance and General Purposes Committees have done what the Council instructed them to do; and on the most careful consideration of the competing tenders, they can only return to the Council with the same recommendation as before, that the Gas Company's tender be accepted. The Committees are wise. In the electrical prints we have often been told that the public lighting is a load worth having by an electricity undertaking, and that there is proof that borough councils owning electricity supply undertakings carry out electric lighting on a commercial basis. But they do not explain why electricity supply companies are unable to do the same as electricity-ridden borough councils. The fact is, electrical papers all, there is more in the administration of electricity undertakings by local authorities than all your wit has enabled you to fathom.

While the gas industry is leisurely proceeding with its arrangements for a general publicity campaign, the electricity industry is hammering away with all its might and main at the doors of the public through page advertisements in the daily papers of various description. Page advertisements have been published during the past week in the "Financial News;" and in them the public are informed that there is not a private dwelling, a place of business, or a public establishment of any kind, in which the electric lamp will not afford the light *par excellence*. But it seems to require a big expenditure, a lot of advertising space, great and venomous verbosity, and much reiteration of a few badly soiled (by frequent usage) quotations from two or three reports that are nothing more than expressions of opinion, to aid the attempt to carry conviction to the public mind. Combined with which dishonesty has to be brought into play. If all that is said were true, the public would not be long in realizing it, and the breaking up of the lighting business of the gas industry would be the work of a very brief time. But the big expenditure of money and energy on the part of the electricity industry (which, however, must not be left without its answer) tells its tale of immense difficulty. It tells of the merits of electric lighting not being accepted by the public at the valuation electricians choose to put upon them; and of the public being in a position from experience to discount the demerits that business rivals chose for their own ends to attach to gas. In these "Financial News" advertisement articles, there is presented what purports to be a history of the advances of gas and electric lighting. The "conquest" comes with the advent of the metallic filament and tantalum lamps. But the author of the articles, through some extraordinary oversight, has forgotten to mention the advance made to inverted gas lighting. This is a pity, as the public are getting, as proved by the immense business that is being done in inverted gas-lamps, a good notion of their

virtues in the matter of economy and efficiency; and they have before them striking demonstrations of their value.

The great safety of electric lighting is made much of; the public remember the Clapham, Accrington, and other fires, and the appalling loss of life. A senseless reference is made to the oft-discussed report of the Chief Inspector of Factories for 1909, upon which we have passed our comments on previous occasions; and there is reliance too—for lack of something better—upon the "mare's nest" that the "Lancet" discovered once upon a time in connection with the supposed heavy leakage of gas in London, and upon which we challenged that paper without procuring any answer (it was a case of discretion being the better part of valour). If what it said was true, perpetual headaches, and rolling about the streets of every individual in London through dizziness, should be experiences of the times. We would suggest to our electrical rivals that they should rely upon something better than the crude conditions of factories which do not represent the realities of the general use of gas of to-day, and something better than an extravagant utterance of the "Lancet," which that paper has not had the courage to since defend, though challenged. We should like to know from the Electricity Publicity Committee whether they are prepared to prove that the conditions attributed to factories exist in rooms where gas is employed under ordinary circumstances, and whether they are prepared to furnish the proof as to the correctness of the statement quoted from the "Lancet." Their reply would be interesting and valuable; their silence will receive very proper interpretation. It would, to say the least, be more honest to secure something more definite and better attested. But this seems to be a difficulty under which the electrical industry labours. One of the worst features is that the Directors of the London Electric Supply Companies are subsidizing the dissemination of this dishonesty.

A quarrel is now pending between the London County Council and the Islington and Marylebone Borough Councils regarding the provision of testing-places. The matter has an interest for gas people, in view of the fact that every statutory gas supply in the country has incorporated with it testing-places, where prescribed tests are applied to ascertain compliance (penalties following for non-compliance) with standards as to illuminating power, purity, and (in the district) pressure. In London, the County Council have control of 22 testing-stations for keeping the Gas Companies up to their legal obligations in respect of supply. The trouble in connection with the testing of electrical energy in London shows how circumstances alter municipal opinion. The Borough Councils who were not owners of electricity undertakings were the first to suggest that bridle and bit should be put on to the Electricity Companies supplying in their areas; and in every case the notices served on the Companies to provide testing-places have been complied with. Naturally the Companies argued "if our supply of electrical energy is to be thus governed, then surely similar protection should be given to the consumers in the areas of the fourteen supplying Borough Councils." The only authority who could, with any effectiveness, move in the matter were the County Council; they having the power to require the electricity purveying Borough Councils to provide testing-places. There does not, however, seem to be any express penal provision for enforcing the requirement. The result is only three Borough Councils—Poplar, Stoke Newington, and Woolwich—have complied with the requirement. It can hardly be that there are no means of enforcing a power conferred by Parliament. Among those the County Council notified regarding the provision of testing-stations are the Islington and Marylebone Councils. This was in 1907; and the latter have been fencing with the matter ever since. The patience of the County Council is exhausted; and so they propose taking proceedings to settle the dispute once and for all. Several of the Borough Councils want—of course, they do—to come under section 41 (sub-section 3) of the schedule to the Electric Lighting (Clauses) Act, 1899, which directs that "where the local authority are themselves the undertakers, a court of summary jurisdiction may, upon the application of any ten consumers, direct the undertakers, at their own cost, to establish at such places, within a reasonable distance from a distributing-main, and keep in proper condition, such reasonable number of testing-stations as the Court may think proper and sufficient." Quite in accordance with the general policy of local authorities to impose as much control upon others as they can, and to resent control being placed on themselves, is this preference of the Metropolitan Borough Councils for the circuitous route to the ordering of these testing-stations to the shorter and more direct one provided by their own Provisional Orders.

There are many forms of "accident incidental to electricity." There are failures, fires, shocks, electrocutions, and so on. One form of accident "incidental to electricity" was before the Courts a week or so ago. Mrs. Louisa Elizabeth Elliott was one day innocently engaged in the Battersea Park Road watching smoke issuing from the roadway. Smoke coming from the roadway is not a common occurrence; and so Mrs. Elliott was interested. While her mind was riveted on the phenomenon, she rested her hand on an iron box fixed in the pavement. She was unfortunate in the choice of position, and of the box upon which she placed her hand. The box blew open, flames burst forth, and the clothes, face, and hands of Mrs. Elliott were burnt. Subsequently, it was found that she had sustained severe internal injuries. Damages were sought against the Battersea Borough Council, who denied there was any negligence on their part—contending that the "accident was incidental to electricity." We are sorry to hear it. It was suggested that a London County Council workman while engaged on some work connected with the tramways had injured the casing of an electric lighting cable, and let in damp. There is something very human in the dislike of electric lighting cables to damp. The emollient prescribed by a Special Jury for the effects of this "accident incidental to electricity" was £525.

PHYSICAL SOCIETY'S EXHIBITION.

In accordance with the intimation given in the "Journal" last Tuesday, the sixth annual exhibition of the Physical Society of London was held at the Imperial College of Science and Technology, South Kensington, on that day. There was a very interesting display of scientific instruments; but only a few of them were of special application in the gas industry.

At the stand of Messrs. Townson and Mercer were seen the gas analysis apparatus designed by Mr. C. Winthrope Somerville, Mr. C. J. Dickenson Gair, and Mr. P. Hulme Hornby. Mr. Somerville's apparatus is for testing gas for sulphur compounds and sulphuretted hydrogen; and it has been designed to replace the inefficient method in which a solution of a lead salt is coloured by sulphuretted hydrogen and matched to a standard tint. In the new process, an intense blue coloration of a solution is instantly discharged by a known volume of the gas containing the impurity being bubbled through it, and the solution becoming colourless. In the case of sulphur compounds, a test in which the whole of the sulphur is recorded occupies from three to six minutes, and gives, it is claimed, results of equal accuracy to that of a Gas Referees' test. In the case of sulphuretted hydrogen, the tests occupy from five seconds to two minutes, according to the quantity of the impurity present; and the results are given in terms of sulphuretted hydrogen, instead of sulphur as in the old process. Merits of Mr. Somerville's method of testing are that it can be carried out by the most inexperienced workman, and that it is very inexpensive; while the portability of the apparatus is an important feature.* Mr. Dickenson Gair's apparatus has been designed for the complete technical analysis of coal gas, water gas, &c. The inventor claims that not only is it perfectly accurate in such simple estimations as CO_2 or O, but it may be equally well applied to elaborate analyses. In shape, it is somewhat similar to the Orsat-Muencke apparatus; but the method of using it is entirely different—being the same as that adopted by Hempel. The apparatus is portable, rapid in estimation, and so easy of manipulation that a workman can learn to use it in a very short time. Mr. Hornby's apparatus has been designed for the complete analysis of gas; and the chief advantages claimed for it are ease and simplicity of manipulation (a complete analysis being possible without any disconnection of the parts), greater accuracy and simplicity in reading the burette, and compactness and convenience for transport.

Photometry was a prominent feature of the stand of Messrs. Everett, Edgcumbe, and Co., Limited. The bench equipment on view comprised, besides various adjuncts, the latest form of Trotter-Conroy photometer head, which is fitted with the Trotter coloured-light filter arrangement, whereby, it is claimed, the measurement of the candle power of lamps differing greatly in colour is rendered perfectly simple. The Trotter portable photometer, which is now to be occasionally seen in use in certain West-End thoroughfares, though retaining the main outlines of the instrument previously exhibited, embodies a number of improvements, among which may be mentioned the substitution of a single lamp for the two lamps formerly employed, whereby the simplicity of manipulation is very much increased. The portable direct-reading lamp photometer shown is the embodiment of a new principle, whereby the whole available space is utilized to much greater advantage than has hitherto been possible. The instrument has a very extended range. The makers state that lamps of from 5 to 100 candle power can be measured in the photometer itself; and it can be used for testing arc lamps and incandescent gas-mantles which cannot be placed within it. Lights of any colour can be compared. The firm also showed a pocket "luxometer" capable of being used for illumination and for candle-power measurements with either daylight or artificial light. This little instrument, which is based on the Trotter principle, measures 7 in. by $3\frac{1}{2}$ in. by 2 in., weighs less than 1 lb., and has a range of from 0 to 4 foot-candles.

At the stand of Messrs. R. & J. Beck was to be seen the new instrument designed for the measurement of surface brightness which Messrs. Dow and Mackinney a short time ago brought before the Optical Society, and which was described and illustrated in the "Journal" for the 18th of October (p. 199). It will probably be remembered that it is a small box-shaped instrument which will measure the brightness of any object from the hundredth of a candle-foot up to 100 candle-feet power. In use, it is pointed at the object to be measured, which is seen in the centre of an illuminated screen. This screen can be varied in brilliancy by means of sector diaphragms governing the amount of light from an electric lamp within the instrument. When the brilliancy of the screen has been adjusted so that it is the same

* Mr. Somerville's apparatus was described and illustrated in the "Journal" for the 4th of October last (p. 28).

as the object that is being observed, the foot-candle power is read off on engraved scales.

Among the interesting exhibits of the Cambridge Scientific Instrument Company, Limited, was a "bi-meter CO_2 recorder" working on very simple and practical principles. The advantages claimed for it are that it contains no absorbent liquids (the absorbent material used being only dry lime), while the flow of gas through it is in a steady and continuous stream, so that no valves are necessary. The essential part of the recorder consists simply of two ordinary gas-meters. The flue gases under test are continuously drawn first through one of these meters, then through an absorption chamber in which the gases are freed from carbon dioxide, and, lastly, through the second of the two meters. The meters operate a recording pen through a differential gear arrangement, and cause it to rise at a speed dependent on the proportion of carbon dioxide absorbed. The maximum heights to which the pen rises are a direct indication of the percentage of carbon dioxide removed. The standard chart records from 0 to 25 per cent. of carbon dioxide, and covers a period of 24 hours. It is stated that the instrument may be adjusted to make as many as 25 analyses per hour.

A few other exhibits of interest to "JOURNAL" readers may be now briefly noticed. The Foster Instrument Company showed a fixed-focus radiation pyrometer which gives direct temperature readings without focussing or other manipulation; Messrs. A. Gallenkamp and Co., Limited, had on their stand a Mahler-Kroeker bomb calorimeter, for technical and scientific research; Messrs. Adam Hilger, Limited, had on view a Féry spectrograph, designed by Professor Féry with a view to the simplification of the spectrograph as used for industrial investigations, and also a small direct-vision spectroscope; and Messrs. Evershed and Vignoles, Limited, showed the Digby and Gibbs "Dionic" water-tester—a novel apparatus designed for detecting, by means of conductivity, the presence of extraneous matter dissolved in water and other liquids.

In connection with the exhibition, lectures were given afternoon and evening by Professor Fleming, F.R.S.; and short cinematograph demonstrations by Mr. R. W. Paul, of moving diagrams of lines of force by Professor Silvanus Thompson, F.R.S., and of sound-wave forms by Professor R. W. Wood.

MUNICIPAL INCOME AND EXPENDITURE.

Statistics from the Annual Local Taxation Returns.

SEVERAL Blue-Books have lately appeared—somewhat earlier on this occasion than is usually the case—which furnish particulars with regard to local taxation. The statistics, of course, are compiled annually; and the latest issued returns for the boroughs and urban districts deal with the twelve months ended March 31, 1908—a date which, in view of the time that has since elapsed, it is necessary to bear in mind when considering the figures. The first book demanding attention is Part V. of the Local Taxation Returns, dealing with the accounts of the Councils of Boroughs other than Metropolitan Boroughs for the year named.

The number of boroughs in existence at the end of the year 1907-8, excluding the City of London and the Metropolitan Boroughs constituted under the provisions of the Local Government Act of 1899, was 327, including one new borough (Nuneaton), which was constituted during the year. Of these, 73 (Smethwick was constituted a county borough on April 1, 1907) were county boroughs. The receipts (including transfers from one account to another), other than from loans, which are shown in the abstract of the accounts of borough councils for the year 1907-8, not being the exchequer contribution accounts of county boroughs, nor the accounts relating to tramway, light railway, or water, gas, or electricity supply undertakings, amounted in the aggregate to £33,605,225. Of this sum, £19,129,952 was from rates; £27,770, the grant under the Agricultural Rates Act, 1896; £1,051,994, sums transferred in relief of rates from accounts relating to tramways and light railways and water, gas, and electricity undertakings; and £5,694,195, on account of education. The expenditure (exclusive of that defrayed out of loans, and of exchequer contribution accounts and accounts relating to tramway, light railway, water, gas, or electricity undertakings), including money passing from one account to another of the same corporation, amounted to £33,329,861, including £10,264,700 spent on account of education. Some of the principal items on this side were: Public roads and streets, £5,012,361; sewerage and sewage disposal, £2,281,530; public lighting (including expenditure upon public electric lighting not represented by any loan charges), £1,204,374; police (not including payments to or out of police pension funds), £1,619,589; scavenging, £1,230,031; salaries, &c., and superannuation allowances of officers, and certain establishment charges, £1,430,381. There were also amounts transferred to make up deficiencies in the revenue of tramways and light railways, water-works, gas-works, and electricity works, totalling £372,076.

The expenditure during the year by the councils which was charged, or was intended ultimately to be charged, to loan accounts, excluding expenditure in respect of tramway, light railway, and water, gas, and electricity supply undertakings, amounted to £4,298,201. The individual headings were: Education; public roads and streets; sewerage and sewage disposal works; harbours, piers, docks, &c.; parks and open spaces; public offices and buildings; housing of the working classes; bridges and ferries; hospitals; depots, stables, wharves, yards, refuse destructors, and works connected therewith; baths, washhouses, and open bathing places; lunatic asylums; and other purposes. The total amount of loans that were actually raised during the year, excluding tramway, light railway, water, gas, and electricity undertakings, and money borrowed under the Education (Provision of Working Balances) Act, 1903, was £4,568,514; while the repayments of principal and redemption of stock or annuities, and the total sum paid for interest, was £7,385,892. The amount outstanding at the close of the year now under review in respect of the loans owing by councils (excluding tramway, &c., undertakings, but including education) was £124,133,215. Of this, £27,656,764 was for public roads and streets, £20,336,499 for sewerage and sewage disposal works, and £18,983,726 for education. The sums standing to the credit of sinking funds, loan funds, and redemption funds in connection with such of the outstanding loans of the councils as were repayable by means of such funds, amounted at the close of the year to £8,349,312 in the case of county boroughs, and £1,416,871 in that of non-county boroughs.

Turning now to the statistics with regard to accounts of councils in connection with the undertakings excluded from the figures already quoted—namely, tramway, light railway, and water, gas, and electricity undertakings—it is seen that the receipts for the year 1907-8 (excluding sums withdrawn from reserve, &c., funds, and sums transferred from other accounts to make up deficiencies in revenue), other than from loans, and the expenditure not defrayed out of loans, in the different branches, were as follows: Tramways and light railways—Receipts, including £39,644 received from other accounts of the councils, £5,932,265; and expenditure, including loan charges, £5,383,023. Water undertakings—Receipts, including £171,295 received from other accounts of the councils, £4,143,784; and expenditure, including loan charges, £4,244,293. Gas undertakings—Receipts, including £492,095 received from other accounts of the councils, £7,149,090; and expenditure, including loan charges, £6,575,106. Electricity undertakings—Receipts, including £1,133,281 received from other accounts of the councils, £3,644,939; and expenditure, including loan charges, £3,459,238. This gives a total income for the four classes of undertakings of £20,870,078; and an expenditure of £19,661,660. It should be noted that the expenditure excludes sums paid to reserve, &c., funds, and amounts transferred in relief of rates, or to meet deficiency in revenue of another undertaking; but expenditure out of sums withdrawn from reserve, &c., funds is included.

The total amounts expended by the councils out of loans (or intended ultimately to be charged to loan account), and the total amount of loans raised by the councils, during the year under review, for the purposes of the four kinds of undertakings now being considered, were: Tramways and light railways—Expenditure out of loans, £731,187; and receipts from loans, £1,152,604. Water undertakings—Expenditure out of loans, £1,316,692; and receipts, £1,248,500. Gas undertakings—Expenditure out of loans, £355,470; and receipts, £360,539. Electricity undertakings—Expenditure out of loans, £1,135,710; and receipts, £924,848. Thus the total expenditure out of loans was £3,539,059; while the receipts were £3,686,491. The sum applied by the councils in the repayment of principal and the redemption of stock or annuities, in connection with the loans raised for the purposes of the undertakings referred to, was £2,338,634. The total expenditure (including interest and dividends) on account of loan charges was £6,794,444. The loans outstanding were: Tramways and light railways, £21,828,117; water, £60,673,440 (in addition a sum of £13,499 was owing at the end of the year to capital funds of councils in respect of moneys utilized in lieu of borrowing); gas, £19,297,126; and electricity, £20,709,006 (in addition a sum of £16,357 was owing at the end of the year to capital funds of councils in respect of moneys utilized in lieu of borrowing). These amounts made a grand total of £122,507,689 outstanding in the shape of loans. The sum remaining in sinking funds, loan funds, and redemption funds at the end of the year, to provide for the repayment of the outstanding loan debt, was £6,004,953. The reserve funds, depreciation funds, and insurance funds established in connection with these various undertakings were, at March 31, 1908, £3,868,106.

According to the census of 1901 (after taking into account all alterations of area between that time and March 31, 1908), the total population of the 73 county boroughs was 9,679,527, and that of the 254 other boroughs was 4,270,403—making an aggregate of 13,949,930. The total rateable value of agricultural land and other property was £74,409,884. The rates raised during the year by councils of county boroughs averaged 5s. 7·6d. in the pound. In the case of the non-county boroughs, the average was 3s. 9·4d. in the pound where the councils were not the local education authorities, and 4s. 8·4d. where they were. The total amount raised was, in the county boroughs £14,248,922; and in the non-county boroughs, £4,864,545.

The total transfers from the accounts of tramway, light railway, and water, gas, and electricity concerns in aid of rates amounted, as already stated, to £1,051,994; while there were total transfers from borough, district, or other funds to make up deficiencies in the revenue of such undertakings to the extent of £372,076. The former amount was made up as follows: Tramways and light railways, £333,445; water, £116,139; gas

£480,634; and electricity, £121,776. The deficiencies which had to be made good were: Tramways and light railways, £66,633; water, £248,990; gas, £11,480; and electricity, £44,973. These figures show that gas continues to occupy the position of being the most profitable, from a rate-aiding point of view, of the four classes of municipally-managed undertakings referred to; while at the same time it has the smallest amount placed against it under the head of sums transferred from other accounts of the councils to meet deficiencies in revenue.

In looking further into the question of profits, therefore, it is only fitting that gas should be considered first. Of the gas-works profits transferred in aid of the rates in the year under review, the several amounts over £10,000 were: Birkenhead, £11,636; Birmingham, £61,564; Blackpool, £13,640; Bolton, £20,000; Burnley, £12,200; Halifax, £13,670; Leeds, £14,709; Leicester, £34,428; Manchester, £50,000; Nottingham, £28,350; Rochdale, £13,326; Salford, £25,260; Southport, £13,000; Stockport, £15,000; Warrington, £11,368 (including £368 taken out of the reserve fund). In regard to the electric light undertakings, the cases of profits of £10,000 and upwards are not so numerous. They are: Leeds, £20,608 (including £13,687 taken out of reserve, &c., funds); Liverpool, £27,500; Manchester, £10,000; and Nottingham, £10,973. In the case of water-works, of course, large profits are not usually looked for. Brighton, however, figures for £9389; and Leeds for £26,991 (including £7000 taken out of the depreciation funds). All the figures are in connection with undertakings in the hands of county boroughs.

In dealing with the question of losses, we will also take gas first, even though in this connection the figures are so small, compared with those of the other classes of undertakings concerned. At Liverpool there was a trifling sum of £152 charged; the explanation being that under a Provisional Order the Corporation were empowered to supply gas in a small part of the borough, but did not commence the supply during the year. A sum of £8359 was charged at Leigh (Lancashire); this amount representing part of the proceeds of a special general district rate levied to meet accumulated deficiencies in the accounts of the gas undertaking. There was at Morecambe a deficiency of £1981; and at Chard, of £988. Thus the "losses" on gas undertakings owned by the councils of county and non-county boroughs are, apart from the special circumstances explained in connection with Leigh, of a really trivial character. Gas was supplied free to the public street lamps in Oldham, Lancaster, and Dewsbury; while at Colne part of the expenditure on street lighting was borne by the Gas Department. In the cases of some thirty electricity undertakings deficiencies had to be met—the highest amount being £11,358 at West Ham. The total deficiency which had to be made good by the four partners in the Dukinfield, Hyde, Stalybridge, and Mossley Joint Board was £5468. Of the other sums, thirteen ranged between £1000 and £2000. Coming last to water-works, there are found as usual many records of losses; but in numerous instances the amounts involved are quite small. In the statistics now under review the deficiencies of over £10,000 are: Birmingham, £65,000; Halifax, £14,287; Huddersfield, £12,900: Lincoln, £15,687; and Swansea, £28,909.

COLLECTIVE AGREEMENTS.

Much information likely to be of value to employers and men contemplating entering into agreements is to be found in a recently issued report by the Labour Department of the Board of Trade on collective agreements between employers and workpeople in the United Kingdom. A formidable amount of information on the subject has been compiled, with the assistance of Mr. D. F. Schloss; and the number of agreements dealt with is very nearly 1700. The number of workpeople covered by each agreement, of course, varies enormously; and so do the trades embraced by them—from mining and quarrying, to vermin, &c., trap making. Nearly half of the total number of agreements are in connection with the building trades; clothing coming next, and the textile industries occupying fourth place. In the number of agreements, mining is last; but this, it may be pointed out, is owing to the large area covered by individual agreements. This fact will be understood when it is remarked that, of a total of 2,400,000 workpeople coming within the agreements, no less than 900,000 are engaged in mining and quarrying. With reference to the total number of workpeople, it should be remarked that, in addition to those directly affected, there are a large number of other employees whose wages, hours of labour, and other industrial conditions, follow, and are in effect governed by, the collective agreements in force for the time being in the trades concerned. Perhaps it should be explained that the term "collective agreement" is applied to those arrangements under which the conditions of employment are governed by the terms of a bargain made between employers or associations of employers and a group of workpeople employed by them, or an organization of which the workpeople are members, and which represents their interests; and the collective bargains include awards by an arbitrator or umpire.

In some industries, the collective agreements which are in force in relation to each particular establishment are themselves subordinate to a particular standard, and form an integral part of a general wage-scale governing the remuneration of workpeople in the trade concerned throughout a large area. The cotton spinning and coal-mining industries form instances of this. In several important trades, too, there is manifested a tendency to supersede wage-scales having reference only to particular establishments by lists having a wider application—shop lists being absorbed in local lists, and local lists in "uniform" lists, whose operation is coterminous with that of organizations of employers and of employed, and which, indeed, not seldom extend their influence over an area wider than that covered by either of these organizations. It is not alone the members of the Trade Unions which are parties to collective agreements whose conditions of employment are determined by these industrial treaties; for in the majority of cases the conditions there laid down will be found to obtain in practice also in relation to large numbers of non-Unionist workpeople engaged in the trades to which the agreements apply.

Wages and hours of labour are only two of the subjects that are found to be dealt with in the different agreements. The first section of the report alludes to piecework prices; and then come methods of changing wages by means of sliding-scales. Provisions in agreements with regard to hours of labour, in addition to regulating the length of the working day, in most cases fix a special rate of remuneration for work done outside the regular hours, and in some instances limit the amount of such work which shall be performed by the operatives. Then in some agreements provisions are included dealing with the number, and frequently with the class, of workpeople to be employed in carrying out the work. In the general agreement between the Shipbuilding Employers' Federation and the United Society of Boilermakers and Iron and Steel Shipbuilders, with regard to the working of pneumatic chipping, caulking, and cutting tools, an express declaration is embodied that "one workman (journeyman or apprentice) is sufficient to satisfactorily operate each tool." One point upon which stress is laid in framing the collective agreements is that the work shall be shared between the different workpeople in what are considered to be fair proportions. Some of the agreements of this type deal with the equitable distribution of work in slack seasons. Provisions are here and there to be found which are intended to prevent employers from engaging workmen in the service of other employers who have not, by due notice, terminated this employment, or from enticing men away from their present employers by the offer of higher than standard wages. Many agreements relating to the demarcation of work have been settled by arbitration; and in some instances Permanent Boards of Conciliation and Arbitration have been constituted for the settlement of disputes in respect to the allocation of work. Restrictions on the employment of youthful labour is another subject of much importance which in many trades is dealt with in collective agreements.

Finally, we come to schemes of conciliation and arbitration which are in force, by means of collective agreements, in many trades, and which have for their object the pacific settlement of differences arising between employers and employed. In the coal-mining industry, practically the whole of the collective agreements by which the conditions of employment of miners are regulated contain provisions for the settlement of disputes by permanent Joint Committees and Boards of Conciliation; and nearly all these agreements provide for the determination of any differences which these bodies are unable to arrange by the decision of a neutral chairman or an arbitrator. The questions dealt with by the machinery thus provided include not alone those which arise in relation to the general level of wages, but also, in many cases, those which relate to the working of individual collieries. In regard to iron ore mining and limestone quarrying, in several districts the collective agreements between employers and employed provide for the settlement of wages questions by permanent Boards of Conciliation, and for the reference to arbitration of matters as to which these Boards fail to agree. After citing the schemes in operation in other industries, the compiler of the report remarks that the extent to which, under the collective agreements between employers and employed in operation in this country, provision is made for the pacific settlement of industrial disputes, is certainly a fact which merits attention. Leaving out of consideration the numerous cases in which the bodies to which, by virtue of collective agreements, disputes are referred are of a temporary character (being constituted *ad hoc*, as occasion may require), and taking into account exclusively the permanent bodies maintained for the promotion of industrial peace, the total number of Conciliation Boards of this character in existence, so far as known to the Department, is 278, of which 262 deal with particular trades and 16 are District or General Boards.

State and Local Debt.—The second part of the annual report of the Local Government Board, which was issued last Wednesday, shows that the total of the outstanding loans of the local authorities in England and Wales at the end of the year 1907-8 was £503,645,616, of which London was responsible for £128,286,840; while the National Debt stood at £762,326,051. Loans to county councils sanctioned under the Local Government Act of 1888 for purposes other than education during the year 1909-10 amounted to £1,228,239—an increase of £572,061 over 1908-9, and £914,022 in excess of the loans sanctioned in 1907-8. The gross estimated rental of England and Wales at the commencement of 1909-10 was £266,944,896; and the rateable value was £215,309,542.

THE DOHERTY GAS-CALORIMETER.

[From a Communication to the "American Gaslight Journal."]

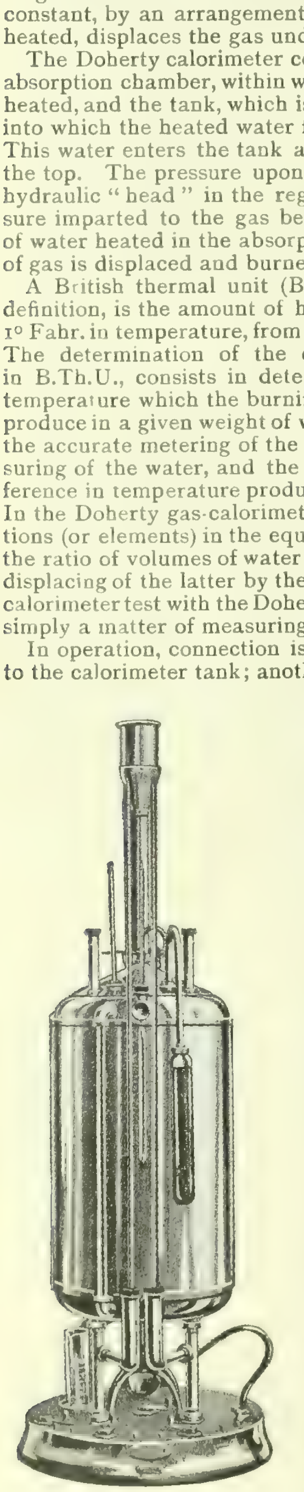
Under the unprecedented growth of gas as a heating and cooking agent (threatening its supremacy as an illuminating medium), the calorific value of gas has become of even greater importance than its candle power. In consequence, a need has been felt for some means of testing the heating power of the gas handled; and the "Doherty Gas-Calorimeter," the invention of Mr. Henry L. Doherty, is the latest device placed on the market for this purpose.

One distinguishing feature of the Doherty calorimeter is the fact that it is a self-contained unit, combining within itself the functions of meter, calorimeter, and all the other accessories required in making a calorific test. The principle upon which it operates is the heating of a volume of water by a gas-flame; the rise in temperature of the water being the measure of the heating value of the burning gas. Its distinctive feature, as compared with other gas-calorimeters, is that the ratio between the volume of gas burned and the volume of water heated is maintained constant, by an arrangement under which the water, after being heated, displaces the gas under test.

The Doherty calorimeter consists essentially of two parts: The absorption chamber, within which the gas is burned and the water heated, and the tank, which is filled with the gas to be tested, and into which the heated water from the absorption chamber flows. This water enters the tank at the bottom, forcing the gas out at the top. The pressure upon this water (which is furnished by a hydraulic "head" in the regulator) is constant, and is the pressure imparted to the gas being burned. For every unit volume of water heated in the absorption chamber an equal unit volume of gas is displaced and burned to heat the water.

A British thermal unit (B.Th.U.), it will be remembered, by definition, is the amount of heat required to raise 1 lb. of water 1° Fahr. in temperature, from an initial temperature of 39·1° Fahr. The determination of the calorific value of a gas, therefore, in B.Th.U., consists in determining the amount of increase in temperature which the burning of a given volume of the gas will produce in a given weight of water. This has heretofore involved the accurate metering of the gas, the accurate weighing or measuring of the water, and the accurate determination of the difference in temperature produced in the water by the burning gas. In the Doherty gas-calorimeter, the first two of these three functions (or elements) in the equation are eliminated by maintaining the ratio of volumes of water and gas absolutely constant by the displacing of the latter by the former in the calorimeter itself. A calorimeter test with the Doherty calorimeter accordingly becomes simply a matter of measuring two temperatures.

In operation, connection is made from a source of gas supply to the calorimeter tank; another connection is made from a water supply to the calorimeter regulator; and a third connection conducts away the overflow water from the regulator. The regulator consists of three concentric pipes, rising to a height slightly above the top of the tank. Water passes up through one pipe to the top, and there overflows; part of it entering the middle pipe, which is a standpipe giving a constant static head or pressure on the tank. The remainder of the water flows to the waste-pipe.



The tank, which is annular in section, surrounds the absorption chamber (also annular in section); the two being thoroughly insulated from each other by a thick layer of felt. The gas is burned in a bunsen burner within the absorption chamber. There are five thermometers on the calorimeter (the two most important of which are tested by the U.S. Bureau of Standards); and the correction sheets for these thermometers is furnished with the calorimeter. The five thermometers measure the following temperatures: Initial temperature of water; final temperature of water; temperature of air surrounding the calorimeter; temperature of the gas in the tank; temperature of waste products of combustion. A pressure U-gauge on the side of the tank registers the pressure on the gas under test; and in making a test it is intended to keep this pressure about that of 2·6 inches of water. Means are also provided in the absorption chamber for adjusting the conditions so that the products of combustion will emerge to the atmosphere at atmospheric or room temperature.

In making a test the tank is filled with gas from the gas supply; the latter then being shut off. Water from the regulation standpipe is turned into the tank, ready to displace the gas, first flowing through the absorption chamber. Adjustments are provided so that the gas pressure can be kept within the desired 2·6 inches of water. The bunsen is lighted, and the water flows through the absorption chamber; being heated as it passes, and expelling the gas from the tank. A gauge glass on the side of the tank shows the water-level; and ten marks are provided, so that temperature readings can be taken at ten equal intervals—the average being employed as the basis of computation. When all the gas has been expelled from the tank, the burner goes out, and the water automatically traps itself from overflowing into the gas-pipe.

The computations necessary in determining the result of a test with the Doherty gas-calorimeter are as follows, the various symbols being as here designated:

V = volume of gas corrected to 60° Fahr., and 30 inches of mercury.
h = barometric pressure, in inches of mercury, at time of test.
h^1 = U-gauge pressure on tank, in inches of mercury.
a = vapour tension, in inches of mercury.
t = temperature of gas in tank.
d = difference in temperature of water before and after heating.

$$V = \frac{17{\cdot}64\,[(h + h^1) - a^1]}{460 + t}$$

$$\text{B.Th.U. in gas} = \frac{62{\cdot}5 \times d}{V}$$

All of these values can be observed on the calorimeter itself, except h and a. The value of h at the time of test can be secured from a barometer at hand, or on application to some local barometer of known reliability. The value a is secured from tables furnished with the calorimeter, and is determined from the temperature of the gas in the tank. The value h^1, as read on the U-gauge, is in inches of water. Multiplying this by 1/13 (or ·769) gives the corresponding pressure in inches of mercury.

This method gives the gross heating effect of the gas under test; but it does not take account of the latent heat represented by the water of condensation produced in burning the gas. To provide for this, and to determine the net heating effect of the gas, a graduate, marked in cubic centimetres and also in B.Th.U., is provided beneath the absorption chamber. When the water-level in the tank is at the lowest of the ten graduation marks on the gauge-glass, the amount of condensed water in the graduate is noted. The distance between the lower and upper gauge-glass marks represents one-third of a cubic foot of tank displacement. When the water level has reached the top mark, the added amount of water of condensation in the graduate, read in B.Th.U., shows the amount of heat given up by this water. Multiplied by 3 (for one-third of a cubic foot of gas was burned), this gives the B.Th.U. per cubic foot of gas represented by the water of condensation. Subtracted from the gross result, this gives the net heating effect or calorific value per cubic foot of the gas under test.

The Doherty gas-calorimeter has many features which appeal strongly to the gas man. Among them may be mentioned simplicity and compactness. There is nothing about it to wear out. Highly finished throughout, in nickel, and contained in a mahogany case, it is ornamental and attractive in appearance.

Bituminous Oils from Coal Tar.—A German patent has been taken out by Herr G. Krojanker for a process for obtaining from coal tar oils which are rich in bitumen. According to an abstract of the specification contained in the "Journal of the Society of Chemical Industry," the processes usually employed for extracting bituminous substances from coal tar are to treat it either with coal-tar oils of very high boiling point, or with a large excess of oils of low boiling-point—*e.g.*, benzene. It has been found, however, that the greater the volume of benzene used, the greater is the insoluble residue. For example, when from 2·7 to 36 parts of benzene are employed to extract one part of tar, the insoluble residue varies between 5 and 6·9 per cent., while when using 0·9 part of benzene to one part of tar, only 3·25 per cent. of residue remains undissolved. The patentee therefore claims the use of very small quantities of benzene—preferably 90 per cent. of the weight of the tar to be extracted; the benzene being distilled from the resulting solution in the usual manner.

Dangers of Crude Oil and Petroleum Spirit.—In the course of a paper, on "The Detection of Petroleum Vapour or Gas," read by Mr. John H. Heck before the Institution of Engineers and Shipbuilders in Scotland, he pointed out that many kinds of crude oil and petroleum spirit, even at so low a temperature as the freezing-point of water, will give off vapour; the amount becoming larger as the temperature increases. A small volume of the liquid will render a large space dangerous. Dr. Dupré, late Adviser to the Home Office, in the case of some petroleum spirit which he tested, reported that 1 cubic foot of the liquid could render about 16,000 cubic feet of air inflammable, and about 5000 cubic feet explosive; while in speaking of a sample of crude oil, which he considered to be of average quality, he stated that one volume would render about 1150 volumes of air inflammable and 350 volumes explosive. Mr. Heck remarked that there is always some vapour in air which is in contact with petroleum; and this is the case even with many kinds of refined oil having a flash-point above the legal standard, though the amount of vapour present may be only small.

WATER AFFAIRS.

Review of the Principal Events of the Year.

In looking back over the twelve months now drawing to a close, it must be acknowledged that the events in connection with the supply of water recorded in our columns have not been of a very conspicuous character. It will nevertheless not be uninteresting to follow the custom of the season, and briefly review them.

Position and Work of the Metropolitan Water Board.

As in previous years, we will commence with the Metropolis, and glance at the year's work of the Water Board. At the meeting after the Christmas recess, Sir Melvill Beachcroft, who was the first Chairman, directed the members' attention to the financial position of the Board. He reminded them that they had had nearly two full years' work under their Charges Act, and he thought they ought to know whether or not they had strained their full income. Up to March, 1908, they had only just paid their way, and their estimates showed considerable deficiency. He submitted a motion to the effect that the Finance Committee should be instructed to prepare and present a full report on the then financial position of the Board as compared with that of the Water Companies. The Chairman (Mr. E. B. Barnard) said he welcomed the proposal, as it would be perfectly simple to show that the working under the Board compared in their favour; and the Chairman of the Finance Committee (Mr. A. H. Tozer) was quite willing to accept the motion. The members saw the advisability of the course suggested; and the motion was agreed to. At the same meeting, there was a long discussion on a proposal brought forward towards the close of last year to acquire a site for the erection of new central offices. The General Purposes Committee recommended one in Kingsway, which would have cost £100,000; but a number of members favoured the utilization of land already in possession of the Board in Rosebery Avenue, and this was decided upon. Sir Melvill Beachcroft, however, thought the time inopportune, in view of the financial position of the Board, for carrying out such a scheme; and he moved that the subject be referred back. The Board were fairly evenly divided on the matter; but Sir Melvill's proposition was carried.

At the meeting of the Board on the 6th of May, the estimates for the year 1910-11 were submitted; and the figures for the preceding financial year fully bore out Sir Melvill Beachcroft's remark in regard to the deficiency, which was shown to be £61,084. This, however, was about £15,000 less than had been expected. The estimates were subjected to a good deal of criticism; but they were eventually received. This being the last meeting of the Board for their period of office, the Chairman took the opportunity of alluding to the magnitude of the undertaking of which they have the control. He mentioned that they supply some 7 million people daily with water, and employ 4000 officers and workmen. In June, 1904, they had 57 storage reservoirs, whereas the number has since been increased to 62; and they have reservoir supplies of 9000 million gallons. The work and financial position of the Board formed the subjects of an interesting paper read by Mr. Barnard at the annual conference of the Sanitary Inspectors' Association early in September; and they were fully set forth in the seventh annual report of the Board (to March 31 last), as issued a few weeks previously. An important department of the Board is that over which Dr. A. C. Houston, the Director of Water Examination, presides. Two additional reports—the fifth and sixth—have been presented by him during the year, on his investigations with river water; and they again bring into prominence the value of storage as an aid to efficient filtration. While referring to river water, it may be mentioned that the Board have got into a little difficulty with the Thames Conservancy on the subject of the abstraction of "excess" water from the Thames, and the matter is to come before Parliament next session, and early next year before the Courts.

The newly constituted Board met for the first time on the 3rd of June; but nothing calls for notice till the meeting on the 7th of October—the first after the summer recess—when the Board's financial position again came under consideration on a motion by Mr. D. R. Paterson that instruction should be given to the Appeal and Assessment and Finance Committees to report as to the propriety of taking steps to ensure that the Board's expenditure in respect of interest and sinking fund and Imperial and local rates should be borne by the ratepayers generally. Mr. Paterson argued that, the supply of water having a distinct sanitary value, and providing a safeguard against fire, the ratepayers should contribute to its cost, whether or not they were consumers. As things were, the water charges were, he said, borne by people interested in property to the value of £37,000,000, against a total rateable value of £45,000,000. Other members expressed the opinion that the general body of ratepayers should contribute to the cost of water, as they do now in the case of lighting, paving, and sewerage. Mr. Paterson's motion was adopted; and the Chairman of the Finance Committee mentioned that a report on the whole subject would shortly be presented.

As bearing upon the financial position of the Board, Sir Melvill Beachcroft referred at this meeting to the loss they were sustaining by the sinking of wells by private parties in various places. His remarks were called forth by the presentation of a report on a Bill dealing with the protection of water supplies which had just left a Committee of both Houses of Parliament, and to which reference will be made later. The speaker said he was disappointed that no expression of opinion was to go forth from the Board on this matter. They were losing £6000 a year by the transfer of supplies and the use of deep wells; and he characterized it as a monstrous proposition that Parliament should have placed upon the Board the legal and statutory obligation of providing 7 million people with water, and at the same time intended that private persons should evade their responsibilities, and supply themselves by sinking wells. He thought something should be done to prevent London having its underground water filched from it. It was eventually decided to adjourn the consideration of the report, in order that an expression of an opinion by the Committee presenting it might be placed before the Board. The extent to which the sinking of artesian wells in the City of London has increased of late years was shown in a report on the subject made to the Corporation by the Medical Officer of Health (Dr. W. Collingridge). Between 1836 and 1907, 14 wells were sunk; whereas between the latter year and the present time, 22 had been put down—making a total of 36. The Public Analyst reported that the waters from these wells were very pure and soft. Reverting to the subject of the Board's financial position, it may be mentioned here that shortly after its consideration by them the London County Council had it brought to their notice in a long report, which concluded with a recommendation that the investigation should include inquiry into the effect on income of the use, as the basis of charge for domestic supplies, of rateable value determined according to two different standards of valuation for London and the other districts within the Board's area.

Notwithstanding their unsatisfactory financial position, the Board have shown no disposition to relax their efforts to meet the present and future demands of the inhabitants of London for water. At their first meeting in March, a very important report on the future water supply of the Metropolis was presented by the Works and Stores Committee. Assuming a population of 12 millions in 1941, and taking 35 gallons per head per day as the basis of consumption, the Committee calculated that the total volume of water that might be required in the year named would be about 420 million gallons daily. Two schemes had been considered by them as alternative sources of the additional supply—viz., the Enbourne Valley and the Staines schemes. The Committee pointed out that the latter could be carried out in stages as the demands of an increased population required. The complete scheme included five reservoirs, having a total capacity of about 20,900 million gallons, and sufficient, with the existing works, to ensure the abovenamed quantity per head even in times of severe drought. The estimated cost of the Staines scheme was £6,273,700, compared with £8,396,820 for the Enbourne scheme; and the Committee decided to recommend the Council to carry out the former, as being the more advantageous one for the Metropolis. They stated, however, that filtration works would be required to meet the probable needs of the London area until 1960; and these would involve an additional expenditure of £9,573,000 in the case of the Enbourne scheme, and of £7,958,000 for the Staines scheme. The Board gave the matter full consideration, with the result that the Committee's recommendation was adopted with only two

dissentients; and the Law and Parliamentary Committee were instructed to prepare a Bill for next session. This has been done; and the notice for it was epitomized, with the other Parliamentary Notices, in the "JOURNAL" for the 29th ult. (p. 653).

These are works for the future. But towards the close of July evidence was afforded that those in hand for meeting present needs are making good progress. In the spring of 1908, a commencement was made with a large storage reservoir, capable of holding 3000 million gallons of water, at Chingford; and as about half the period for the completion of the works had expired, it occurred to the Board that the time was opportune to report progress. They accordingly invited the members of the various Borough Councils and authorities represented on the Board, as well as other guests, to inspect the works. A large number accepted the invitation, and every facility was afforded for enabling the visitors to form an idea of the magnitude of the reservoir and the nature of the attendant works, which included the diversion of the River Lea. The Board's Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.), by whom the works were designed, and under whose supervision they are being carried out, not only explained their engineering features, but also accompanied a small party to the outlet of the new reservoir, and showed them how the water will be conveyed to the extensive group of reservoirs constructed by the East London Water Company, of which Mr. Bryan was the Engineer, lying to the south. The original estimated cost of the reservoir, a pumping-station equipped with machinery for raising 200 million gallons of water per day, and other works, was £550,000; and the contract was let for £340,770. It is a large outlay; but it is for works which will form an important addition to the water storage of the Metropolis. In connection with the Board's works on the River Lea, it may be mentioned that application is to be made to Parliament for sanction to a scheme for discontinuing the use of the Manifold Ditch as an effluent outfall for the sewage of Hertford, of which the Board have to dispose as successors of the East London Water Company.

THE BOARD'S LITIGATION.

As remarked in previous reviews, it is not to be expected that an organization of such magnitude as that of the Metropolitan Water Board can be carried on without litigation; and therefore our pages have contained during the year reports of a good number of cases in which that body has figured, and unfortunately without any very conspicuous success. Many claims made against the Board do not go into Court, but are settled privately, as was done by the late Water Companies. This duty was in the hands of the Works and Stores Committee; but the Law and Parliamentary Committee considered that, being of a legal character, it should be entrusted to them. The other Committee, however, saw no reason for making any alteration in the practice, which, it was stated, had been satisfactory in the past. The question was dealt with in reports by the two Committees; and it was eventually decided to have all claims out of Court settled by a Special Committee, consisting of the Chairmen and Vice-Chairmen of the Board and the two Committees named, subject to a report being made to the Board.

Turning to the cases which went into Court, the claims in respect of injuries arising from accidents caused by stopcock boxes were particularly troublesome. Early in February, Justices Phillimore and Bucknill had before them, in the King's Bench Division of the High Court of Justice, an appeal by the Board against a decision by his Honour Judge Woodfall, at the Westminster County Court, awarding Mrs. Osborne £30 for injuries sustained by her through the cause named. The box had been put in position by the Board's predecessors, the Lambeth Water Company; but the Judge held that it had not been properly maintained by the defendants. Their Lordships upheld this finding, and dismissed the appeal; but they gave leave to further appeal. The same Judge declined to allow a claim against the Board for £50 for damages sustained by a married woman owing to a defective stopcock box, on the ground that they were not liable for keeping it in repair. In another appeal from a decision by the same Judge, which turned upon the question whether, in case of dispute, the annual value of premises had to be fixed by two Justices, or whether the valuation list of the Metropolis was binding, the Board were successful before the two learned Judges above named; but the respondent was granted leave to appeal.

The "stopcock box" question came up again during the summer, when Mr. Justice Channell had before him an action brought by Miss Leah Rosenbaum against the Board for damages for personal injuries sustained by her through catching the heel of her shoe in a stopcock box and being thrown to the ground. The amount claimed and agreed upon between the parties was £150; and the only question for the Court was that of liability—the Board submitting that the stopcock in question was the property of the Marylebone Borough Council, and that it was their duty to keep it in repair. His Lordship decided that this liability rested upon the Board; and he gave judgment for the plaintiff, with costs. Excution was stayed pending an appeal; and this was heard by the Master of the Rolls and Lords Justices Moulton and Farwell on the 24th ult. Their Lordships, however, were unable to decide the case on the evidence already given; and they sent it down for a new trial.

An important appeal from another decision by Judge Woodfall raised the question whether water supplied to railway stations for the purpose of being used in water-closets and urinals is a "domestic" use within the meaning of the Board's Charges Act of 1907. According to the decision appealed from, it is; and Justices Phillimore and Bucknill agreed with this and dismissed the appeal, but gave the Board leave to seek the opinion of a Higher Court. This was done, but without success—their Lordships expressing the opinion that the supply in question came within the category of "railway purposes," which were especially excluded from "domestic purposes" in the Act cited. A very interesting question was raised in an action tried by Mr. Justice Channell, in which the Board sued one Brooks, a receiver, for water-rate as an "owner by statute" of certain flats at the East End. The actual owner, a Mr. Davies, got into arrears with his payments; and possession of the premises was taken by his mortgagees, who appointed Brooks to receive the rents. This, however, in his Lordship's opinion did not make him the statutory owner; and therefore the action failed. The Board appealed; but they were unsuccessful. The respondent's Counsel in the case was not called upon.

The question of the liability for water supplied to the occupants of flats was before the Judge at the Westminster County Court on a reference back to him by the King's Bench Division of a case he had decided adversely to the Board. The tenants paid inclusive rents, and, under a farming agreement, the landlord was to pay all rates. The defendant submitted that he was not liable, as he had paid for the water in his rent. His Honour said a second trial of the case had not caused him to alter his opinion; and he entered judgment for the defendant, and refused leave to appeal. The Board were appellants in yet another action which had been tried at the Westminster County Court, though not by the same Judge, and the question raised was as to what constitutes a separate tenement. The defendants carried on business as carpet manufacturers in two blocks of buildings in Warwick Square, Newgate Street; there being intercommunication between the whole of the premises. For many years water was supplied to only one block, which was separately rated; but when the premises were connected, the Board made a charge on the whole assessment, on the ground that the buildings were occupied as a "separate" tenement. The County Court Judge found that water was furnished to but one house, and that therefore the charge should be levied upon it only. The appeal from this decision was unsuccessful, although one of the learned Judges (Mr. Justice Bucknill) had some hesitation in dismissing it.

An important case which came before the Judge at the Westminster County Court raised the question of the supply of water to factories. The defendants—Colley's Patents, Limited—had been supplied by meter; but when, later, the Board's Charges Act came into force, the factory was rated for a "domestic" supply of water, for which a claim for £21 4s. was made. Defendants paid into Court £9 2s. 1d. for water for a "non-domestic" supply; and his Honour decided that they were justified in so doing. He accordingly entered judgment for them, with costs. It was intimated that there might be an appeal; and this was heard by Justices Phillimore and Coleridge a few weeks ago. It was submitted, on behalf of the Board, that as the water supplied to the premises, where some fifty hands were employed, was used for, among other purposes, drinking, sanitary conveniences, and cleaning, the charge should be on the domestic rate. On the other hand, it was contended for

the defendants that the element of domesticity was wanting, and that therefore the water was supplied for trade purposes. At the close of the arguments, judgment was reserved. It was given last Wednesday; but, unfortunately, it was unsatisfactory, as the two learned Judges came to different conclusions. In accordance with the rule of the Court, the appeal was dismissed; but leave was given to take the matter to a Higher Court.

The Board's liability for reinstating a road was a question which came before Mr. Curtis Bennett, one of the Metropolitan Magistrates, for decision. The proceedings were initiated by Mr. J. W. Bradley, the Engineer and Surveyor to the Corporation of Westminster, who alleged that the Board had not complied, within 48 hours, with a notice he had given them to repair a road which had been injured by the bursting of a water-pipe. The Magistrate convicted them, and imposed a fine of £10. The Board appealed, and the case came before the Lord Chief Justice and Justices Channell and Coleridge, who considered that the view taken in the Court below was right. The appeal was accordingly dismissed. The Board were defendants in two other Police Court cases—one at Old Street and the other at Lambeth. In the first they were fined £3 12s. and £15 15s. costs for cutting off the water supply to certain premises at Hoxton, with the result that they were unlet, and the owner (the complainant in the case) sustained a loss. It was argued for the Board that at the time the water was cut off, the premises were empty, and that they were not bound to go on supplying till the place was relet. The Magistrate (Mr. Cluer) thought the Board had a clear right of action against the complainant. While convicting them, he agreed to state a case on the point of law. The proceedings at the Lambeth Police Court turned upon the date on which the new valuation list came into force. A provisional list came into operation on the 1st of July, and the alteration in the assessment was made on the 28th. The Board claimed for the whole of the September quarter on the old valuation. The Magistrate (Mr. Hopkins) decided that they were not entitled to do this; and he ordered the return of the amount overcharged. In view of this decision, the Board withdrew a summons which they had taken out against a consumer to recover an amount in dispute on the same point.

Schemes of Improved Water Supply.

The schemes for improving the water supply in various parts of the country to which reference has been made in the "Journal" during the year are, with but few exceptions, not of very great magnitude. We will notice first those which have been completed; taking them in the order of their occurrence. Possibly the most important work of the year was the opening by the present King (then Prince of Wales), on the 16th of March, of the final section of the Vyrnwy scheme for the supply of water to Liverpool. The parliamentary powers for carrying out this great undertaking were obtained by the Liverpool Corporation in 1880; and the reservoir was completed and the first instalment of water sent into the city on July 14, 1892. A second instalment was delivered on Oct. 16, 1905; and the final one on the day of the ceremony. The total outlay on the scheme has been £2,936,182; and it has provided an available supply of water equal to from 60 to 70 million gallons per day. Towards the end of March, new water-works which had been constructed for the supply of St. Ives (Cornwall) were formally opened by Mrs. Read, wife of the Chairman of the Water Committee of the Corporation, in the presence of a large gathering. The works are situated on Bussow Moors; and they provide for a supply of 250,000 gallons of water per day. Early in April, Leyland (Lancs.) was provided with a supply of water from the Thirlmere main of the Manchester Corporation, and Salisbury with a water-tower, so that in future all the water sent into the city will come from deep wells. About the same time, the quaint and picturesque town of Wotton-under-Edge, which is within the area of the Dursley (Glos.) Rural District Council, was furnished with an abundant supply of excellent water. On the last day of May, the Mayor of Poole opened the new works constructed for supplying the town with water from the Corfe Hills, some four miles distant. An interesting feature of the scheme, which had involved an outlay of about £53,000, is the employment of gas-engines for driving the pumping machinery. Towards the close of June, the formal inauguration took place of a scheme of water supply for Skipton, which had been carried out at a cost of something like £80,000. About the middle of July, the new water-works of the Corporation of Bacup, commenced in the spring of 1901, were opened by the Mayor (Alderman J. H. Maden), who laid the first stone. They are capable of maintaining a supply of 850,000 gallons of water per day during three consecutive dry years; and the amount sanctioned by Parliament for carrying them out was £215,000. Coincident with this ceremony was the opening by Lord Richard Cavendish of the new Duddon reservoir and other works of the Barrow-in-Furness Corporation, by which the storage has now been increased from 350 to 625 million gallons, at a cost of £55,465 for the dam and intake and £68,375 for the pipe-line. Early in August, new water-works for Howth (Dublin) were opened; and a few days later, a fresh supply was turned on for Minehead. Towards the end of September, a large party accepted the invitation of the Directors of the Portsmouth Water Company to visit the new covered service reservoir, filter-beds, &c., which had been constructed on Portsdown Hill, to the plans and under the entire supervision of their Engineer, Mr. Herbert Ashley, M.Inst.C.E., at a cost of £73,000. A month later, new water-works for the supply of the district of Brampton were inaugurated; and early in November, the prosperous granite village of Enderby, which lies rather more than four miles to the south-west of Leicester, received a much-needed supply of water by means of a connection made with the main of the Derwent Valley Water Board, under an agreement with the Water-Works Committee of the Leicester Corporation, whose Engineer (Mr. Frederick Griffith, M.Inst.C.E.) supervised the carrying out of the whole of the work. The list of schemes completed this year must not be closed without reference to the opening, by the venerable Emperor of Austria, on the 2nd inst., of the new aqueduct by which Vienna has been provided with an additional daily supply of 44 million gallons of water brought from the region of the Seven Lakes, near Hochschwab, about 130 miles from the city. This great work is the result of ten years' labour, and an outlay of about £4,200,000.

New works and extensions of those already existing have been proposed during the year for Abertillery, Axbridge, Barnstaple, Bideford, Beverley, Braintree, Burnley, Chester, Cumberland villages, Fraserburgh, Glenquey (for the whole of West Fife), Gloucester, Hartley Wintney, Hereford, Instow, Ipswich, Ivybridge, Jerusalem, Keighley, Lostwithiel, Maryport, Nantwich, Nuneaton, Oswaldtwistle, Paignton, Paisley, Penrith (western district), Petersfield, Pontefract, Shanklin, Shrewsbury, Strabane, Tiverton, Wallasey, Warminster, Warrington, Weston-super-Mare, and Wolverhampton. Local Government Board inquiries have been held with reference to the water supply of Beverley, Clown (Chesterfield), Faringdon, Handsworth, Heacham, Hereford, Holsworthy, Instow, Kirkby-in-Ashfield, Long Eaton, Northam, Nuneaton, Oxford, Penkridge, Penrith district, Rhondda district, Rotherham district, Warrenpoint, Warrington, and Widnes. Special interest attaches to the inquiry in respect of Clown, as the result of it was the sanctioning by the Local Government Board of a loan for utilizing the water sources of one county for the supply of another. Good progress has been made with the new pipe-line from Thirlmere, as well as with the new works at Elkesley for the supply of Lincoln. Towards the end of September, a commemoration stone was laid by the Mayor (Mr. C. T. Parker) in connection with the latter works. A scheme of water supply for the Rhymney Valley was much discussed during the past summer, and the purchase of certain undertakings was decided upon. Notice has been given of an intended application to Parliament next session for authority to establish a Water Board for the whole district. The quality of the water at Holyhead gave rise to some correspondence between the Water Company and the Local Authority; but the supply was declared by Drs. Thresh and Beale to be excellent. Questions of purchase arose at Clevedon, Slough, and Southampton—in the last-named case in connection with the South Hants Water Company.

Water Legislation.

The water legislation of the year has been so recently noticed, that only brief reference to it is necessary here. Taking the Companies first, the Cambridge Water Company were authorized to construct new works in the rural district of Chesterton, and raise additional capital to the extent of £150,000, with premiums. The East Grinstead Gas and Water Company obtained confirmation of the construction

of their existing water-works at Hackenden, authority to extend and improve them and make new ones, and to raise additional capital to the amount, including premiums, of £40,000. The Slough Water Company were authorized to extend their limits of supply; and they obtained confirmation of their existing works. Provision was made in their Act for the sale of the undertaking to the Slough Urban District Council. The Southend Water Company went to Parliament with an extensive scheme of reservoirs, and it was sanctioned; and the Company were authorized to raise further capital not exceeding £200,000. An Act granted to the South Hants Water Company confirmed the construction of the existing works, and authorized others and the raising of additional capital not exceeding £60,000. The South Lincolnshire Water Company obtained an extension of their limits of supply, and permission to increase their capital to £42,000. A Water Company with a capital of £25,000 was incorporated for the construction of works and the supply of Thorne and other places in the West Riding of York. With regard to the Local Authorities and Water Boards whose Acts were noticed in the "JOURNAL" for the 29th ult., parliamentary sanction was given for the formation of a Joint Water Board for Abertillery and the district, and another for Rhondda and Pontypridd. The Bradford Corporation obtained authority to hold lands for the protection of their water-works; the Exmouth and Mountain Ash Urban District Councils and the Fylde Water Board, to construct additional works and raise more money; and the Worksop District Council, to purchase the undertaking of the Worksop Water Company, and supply water within the urban district and the neighbourhood.

In the Bill promoted by the Bradford Corporation, they sought power to make an extra charge for water supplied to a coach or motor-car house occupied and rated with a private dwelling. The effect of the clause, had it become law, would have been to nullify certain decisions of the High Court of Justice which the Automobile Club were instrumental in obtaining. On the initiative of the Bradford Automobile Club, a petition against the Bill was presented by the Royal Automobile Club; but the Corporation agreed to make certain alterations in the clause which satisfied the opponents. After an inquiry extending over ten days, a Committee of the House of Lords rejected the Avon water scheme of the Corporation of Aberdeen. The cost for the first instalment of 10 million gallons per day was estimated at £1,068,500; but tradesmen in the city, from whom the opposition mostly came, considered that the present supply could be augmented and made quite satisfactory at a cost of £600,000. One of the first Bills to be read a second time after the Easter recess was the South Hants Water Bill; and the Select Committee appointed to consider it were ordered to inquire whether the promoters had made adequate provision for the supply of water at reasonable rates to the agricultural community within the area of supply, and to any person or persons from whom any existing or natural supply was, or might be, withdrawn owing to the works or undertakings authorized by the Bill; and to insert such clauses as they might think necessary to impose upon the promoters the obligation to provide such supply. This instruction was moved for in respect of several Bills.

The Provisional Orders applied for were to obtain confirmation for existing works, and authority to construct others, extend limits of supply, and raise additional capital. The results of the applications were recorded in the "JOURNAL" for the 6th inst. The Bills to confirm the Orders granted received the Royal Assent on the 3rd of August.

In the review of the work of the session of 1909 which formed part of last year's retrospect, it was mentioned that a Bill was introduced into the Upper House by Lord Desborough to determine the rights and liabilities of persons supplying water under the authority of Parliament in certain cases. It never got beyond the second reading; but it was brought forward again by his Lordship early in the past session, and with more success. He explained that the first principle of the measure, the title of which was the Water Supplies Protection Bill, was that no water company should sink wells or construct works for obtaining a supply unless these and their sites had been expressly approved by Parliament; the second, that compensation should be due to owners of private supplies which were injured by the abstraction of water for a public supply by means of future works; and the third, that districts whence water might be taken, and through which it might be conveyed by means of future works, should have a right to a share of the water on terms to be either agreed upon or fixed by the Local Government Board. It was stated that the Government had no objection to the Bill, provided it was referred to a Committee of both Houses of Parliament; and this was done. The Committee, under the presidency of Lord MacDonnell, commenced their sittings on the 20th of April, and continued them at intervals till the 7th of July, when the Chairman intimated that they did not desire to take further evidence. The Committee then proceeded to consider their report, the full text of which was given in the "JOURNAL" for the 26th of July. They recommended the establishment of a Central Administrative Water Authority, the division of the whole country into watershed areas, and the appointment in respect thereof of local Representative Boards, who, subject to the guidance and control of the Central Authority, "should prosecute systematic and continuous inquiries into the water supply of their jurisdiction, take all necessary measures to husband such supplies, both surface and subsoil, secure their preservation from pollution, and advise on their allocation for sanitary, industrial, and other purposes." No action was taken upon the Committee's report; but, in answer to a question put to the Prime Minister on behalf of Mr. J. G. Butcher, Mr. Asquith stated that he understood that, prior to the appointment of the Committee, the President of the Local Government Board (the Right Hon. John Burns) had decided to introduce a Bill to give effect to the recommendations of the Royal Commission on Sewage Disposal, which had been endorsed by the Committee; and he said the recommendations would be carefully considered by the Government in connection with the Bill. Evidence that the Local Government Board were moving in the matter was afforded just before the dissolution of Parliament, when, on the motion of Mr. Herbert Lewis, the Parliamentary Secretary of the Board, the House of Commons made an order for a comprehensive return in regard to every water undertaking and every water-supply district in England and Wales.

LEGAL PROCEEDINGS.

Beyond the cases in which the Metropolitan Water Board were concerned, which have already been dealt with, there has not been a great amount of litigation in connection with the supply of water during the year. Mr. Justice Swinfen Eady had before him an application made by certain parties against the Great Western Railway Company for a declaration that the plaintiffs had a right to a good and adequate supply of water, "fit for drinking purposes," to their school at Malvern Link, under certain long-standing covenants. The water, which came from springs in the Malvern Hill tunnel, was found to be contaminated; and the plaintiffs cut it off, and asked for an injunction to restrain a breach of contract and damages. The defence was that the covenants were *ultra vires*, and that the water was required for the purposes of the railway. His Lordship decided that the defendants were only bound to supply water that was running to waste; and as they had done this, there was no breach. The plaintiffs consequently failed in their action. The disputed liability for maintaining water-pipes from mains to residences gave rise to two days' litigation in the Portsmouth County Court. The action was brought by Mr. Thomas Parnell, who claimed 10s. 8d. from the Portsmouth Water Company for repairing a pipe between the main and his house; the Company having threatened to cut off the water in consequence of leakage. In support of the claim, it was argued that the plaintiff had no power to open the public road, and that the defendants having placed a tap outside each house in the borough, showed that tenants were liable only for pipes under their own roofs. For the Company it was contended that all the repairs from the mains devolved upon the consumers. His Honour Judge Gye decided in favour of the plaintiff, with costs; but, in view of an appeal, he stayed execution. The appeal was heard by Justices Phillimore and Avory early in the Michaelmas sittings. The questions submitted for the decision of the Court were whether the payment was made by the plaintiff under duress, and whether the liability to repair the pipe rested upon the owner or the Company. Their Lordships had some difficulty in coming to a conclusion on these points; but they eventually allowed the appeal, with costs. Mr. Justice Avory said the plaintiff was bound to satisfy the Court that the money claimed was really payable by the Water Company and not by him; and this he had failed to do.

It may be remembered that in the summer of last year

Mr. Justice Ridley had before him an application by the Attorney-General, at the relation of the Marquis of Salisbury, for an injunction to restrain the Barnet District Gas and Water Company from constructing or using, upon a piece of land acquired by them at Colney Hatch, "a well or other works for the purpose of raising, collecting, or storing water, and for carrying the same away for the general purposes of their undertaking." It was contended, on behalf of the plaintiff, that the Company had no statutory power to sink a well at Colney Hatch, which was 6½ miles from the nearest "authorized works," except as part of such works, which it was not; and, further, that no power was conferred by the Water-Works Clauses Act on people to wander about a district, purchase lands, and construct works to draw water from an unauthorized source. It was submitted by Sir Alfred Cripps, K.C., that the case was undistinguishable from the now well-known one of the Frimley and Farnborough Company; whereas it was contended by Sir Robert Finlay, K.C., for the defendants, that it was of a totally different character. Putting the matter shortly, Sir Robert said that the question for the Court was whether Parliament had or had not authorized the works in respect of which the injunction was applied for. His Lordship said it certainly had not. Under these circumstances, he must grant the injunction; but he consented to a stay of execution, pending an appeal, provided the defendants would undertake to stop the work at the well. The undertaking was given, and the notice of appeal was duly lodged. It came before Lords Justices Vaughan Williams, Buckley, and Kennedy in the Michaelmas Term last year, and at the close of the arguments judgment was reserved. It was given a few weeks later in favour of the Company; but, unfortunately, their Lordships were not all agreed—Lord Justice Vaughan Williams dissenting from his learned brethren. The case was then taken to the House of Lords, where about the middle of April it came before the Lord Chancellor, the Earl of Halsbury, Lord Shaw, Lord Atkinson, and Lord Mersey. After hearing Sir Alfred Cripps, K.C., and Mr. Danckwerts, K.C., for the appellant, their Lordships dismissed the appeal without calling upon the respondents' Counsel (Sir Robert Finlay, K.C., Mr. Balfour Browne, K.C., and Mr. J. D. Crawford).

The Lexden and Winstree Justices were asked to decide a lengthy legal argument, when George Littlewood was summoned by the Brightlingsea Urban District Council for the non-payment of £2 expenses incurred by the Council in executing certain works on his premises. The case arose out of an action taken by the Council under the Public Health Act of 1875. It was admitted that, in consequence of a report made to the Council by their Surveyor, notice was served on defendant to obtain a proper supply of water; that the notice was disregarded; that the Council then did the work; and that their charge was a fair and reasonable one. It was submitted, on behalf of the defendant, that the premises in question had a perfectly wholesome water supply, and that it was mere "temper" on the part of the Council to try to force him to take their water. The Bench decided that they had no power to question the authority of the Surveyor; and they made an order for the payment of the amount claimed, with costs.

Proceedings against water consumers for using domestic water for trade purposes were taken in several cases during the year; and one specially calls for notice. A dairyman was summoned by the Cambridge Water Company for using domestic water for his business, and for fixing a pipe to a certain tap used in connection with the water supply to the premises. Water from the tap, obtained through a hose-pipe, was employed for washing a brick-paved yard and a milk-float; and water was seen running from the hose into a cattle-trough. The Justices held that the use of the water by the defendant's servants on four occasions for the above-named purpose was not a use for other than domestic purposes, and that causing or permitting water to flow into the cattle-trough was merely incidental to the washing of the milk-float. Upon the second summons, they came to the conclusion that a temporary attachment of the hose to the pipe was not an attachment within the meaning of the Water-Works Clauses Act, 1863, under which the proceedings had been taken. The Company appealed, and the matter came before the Lord Chief Justice and Justices Pickford and Coleridge, who decided that the Magistrates had come to a wrong conclusion in the matter. They allowed the appeal, and sent the two cases back—the first to be dealt with upon its merits; and the second, upon the ground that the temporary affixing of a hose to a service-pipe might be as much an offence as if it was permanent. On re-hearing, the Magistrates inflicted a fine of 5s. in each case, but remitted costs.

A rather interesting question recently came before the Judge at the Truro County Court. The Rural District Council sought to recover from Lord Falmouth £1 6s. 3d. as water-rate for two houses in the parish of St. Agnes. His Lordship disputed his liability on the ground that, under a lease he granted to the Council of certain lands on which water-works had been constructed, his tenants were to have a supply from the stand-pipes. Under the Public Health Act, 1875, the owner or occupier of a dwelling-house within 200 yards of a stand-pipe provided by the rural authority is liable to pay a water-rate; and his Honour decided that the Council had no right to enter into an agreement by which they were prohibited from complying with the terms of the statute. The declaration in the lease was *ultra vires*; and, in consequence of this, judgment would be for the Council.

Rating questions, being in the nature of legal proceedings, may be conveniently referred to here. The Justices at the Preston Quarter Sessions had before them a test case to determine whether the Corporation of Liverpool were liable to be rated for the gathering-ground of their water-works, and how far a general principle in respect thereto could be laid down. Originally some seventeen items were to be appealed against; but all except the first one—as to whether or not the land in question was assessable, and, if so, to what amount—had been struck out. The Court were asked by the Chorley Union and by the Overseers of Withnell to declare that the Corporation were owners and occupiers of the land, and that £1 per acre was a fair value to place on the acreage with which they were concerned. For the Corporation, it was submitted that the mere enclosure of property, as in this case, did not amount to rateable occupation; and even if it were otherwise decided by the Court, the land was not worth £1 per acre per annum. Judgment was reserved; and it was eventually given by Mr. H. Worsley-Taylor, K.C., the Chairman, in favour of the Corporation on both points. He, however, consented to state a case for appeal.

A feature of the legal proceedings of the year has been the liquidation of several small companies formed for the supply of water.

Technical Business.

Coming to the technical matters connected with water supply which have engaged attention during the year, the two meetings of the Association of Water Engineers must be noticed first. At the summer meeting, which was held in York, under the presidency of Mr. W. H. Humphreys, Assoc.M.Inst.C.E., the Engineer of the York Water Company, the Association had a cordial reception by the Right Hon. the Lord Mayor (Alderman James Birch, J.P.), who expressed the special pleasure he felt in welcoming the members, inasmuch as his training as a plumber and sanitary engineer had brought him into almost daily contact with matters pertaining to water supply. He heartily congratulated the members upon their choice of his friend Mr. Humphreys as President for the year. The Lord Mayor was present at the annual dinner of the Association; as was also Sir J. Sykes Rymer, J.P., the Chairman of the York Water Company. The President's address was devoted mainly to the subject of mechanical filtration; the gravity filters at York being fully described. The papers read comprised the subjects of "Reservoir Outlets," "The Effect of Sinking Head on Large Castings," "The Permanency of Overflow Springs," "The Colour of Water," and "The Wellingborough Water-Works and Softening Plant." Abstracts of the papers and notes of the remarks to which they gave rise appeared in our pages at the time. An important feature of the proceedings was a discussion on the Water Supplies Protection Bill, to which reference has already been made, and to which the Association are very strongly opposed. While they are of opinion that the existing general water-works law urgently requires revision and consolidation, they think such revision should be preceded by the fullest inquiry into the whole question by a specially appointed Royal Commission. In connection with the meeting, visits were paid to the York Water-Works (claimed to be the oldest incorporated water-works in the country), and to the Leighton reservoir of the Leeds Corporation, which, when completed, will have a capacity

of 1136 million gallons. The meeting was brought to a close with an excursion to Castle Howard.

At the winter meeting of the Association—held on the 9th and 10th inst., in London, under the presidency of Mr. Humphreys—the above named Bill was again under discussion on reports presented by Mr. Easton Devonshire, the Chairman of the Water Areas and Statistics Committee. They submitted certain recommendations; and practical effect was given to them in a resolution moved by Mr. Devonshire and unanimously adopted. It recorded the satisfaction with which the Association noted the ordering by the House of Commons of the statistical return in regard to water supply proposed by the Local Government Board, to which reference has already been made; and requested the Council, in view of the introduction of a Bill dealing with matters affecting the national water supply, to take steps to protect the interests of water undertakings, so as to secure the amendment, consolidation, and uniformity of legislation. The technical business of the meeting included consideration of the paper on the Wellingborough Water-Works, submitted at the summer meeting, and papers on "Gauging and Recording the Flow of Streams," "The Eliminating Effect of Chlorine on the Bacteria of a River Water," and "The Advantages of Co Operation in Rural Water Supplies." These matters have been so recently dealt with in our pages that further reference to them is unnecessary. The new President is Mr. Edward Sandeman, the Engineer of the Derwent Valley Water Board; and the meeting next year will be at Buxton. The members will be afforded an opportunity of inspecting the works for carrying out the important scheme of water supply with which their President has from the outset been associated.

In connection with the proceedings of technical societies, it may be recorded that early in the year an interesting paper was read by Mr. William Whitehouse, at a district meeting of the Institution of Municipal Engineers, in which he recorded his twenty-five years' experience as an engineer and surveyor in a rural district in Gloucestershire, and then described the difficulties he had to overcome in meeting the increased demand for water, improved drainage, &c. At a meeting of the Society of Engineers, Mr. Percy G. Scott presented a paper descriptive of the Moulheim Water-Works. Before the Institution of Civil Engineers, Mr. L. S. M. Marsh read a paper of a statistical character on the Sheffield water supply, and Mr. W. R. Baldwin-Wiseman one containing statistical and experimental data on filtration. At a Home Counties District meeting of the Association of Municipal and County Engineers, Mr. H. F. Rutter described the Barnes, Barn Elms, and Hammersmith stations of the Metropolitan Water Board, which were visited by the members. At the meeting of the Association at Plymouth in the summer, Mr. Frank Howarth, the Water Engineer to the Corporation, read a paper descriptive of their water undertaking. A few weeks later, the members of the Western and Southern Districts of the Institution of Municipal Engineers held a joint meeting at Paignton, when a description of the water-works was given by Mr. J. C. Hawkins, the Water Engineer to the Urban District Council. Before the Engineering Section of the Royal Sanitary Institute, at their congress at Brighton, Mr. H. C. H. Shenton read a paper on the subject of the sterilization of water; and Professor Sims Woodhead laid before the Cambridge Philosophical Society the results of experiments on the sterilization of the water supplied to the city by chlorine and its compounds. At the congress just now referred to, Mr. H. Rofe dealt in the course of his Presidential Address with the question of loan repayments on water undertakings and economy in supply. The subject of the use of reinforced concrete for water-works was dealt with in the address of Mr. Harold J. F. Gourley, the Student President, to the University of Liverpool Engineering Society, at a meeting held in the summer. Sir Oliver Lodge, F.R.S., the Principal of the Birmingham University, made a report on the subject of the protection of water-works from lightning, with special reference to the requirements of those of the Birmingham Corporation in the Elan Valley.

Casualties.

The list of accidents in connection with the supply of water during the year is happily a short one. But, unfortunately, one fatality has to be recorded. It occurred towards the end of August at the Conder syphon on the Thirlmere pipe-line of the Manchester Corporation. A labourer was black-varnishing the joints and bevels of a length of pipes; the spot where he was at work being 110 yards from a manhole. As he did not respond to the call for breakfast, a youth was sent up the pipe, and the man was found unconscious. He was brought by a rescue party to the manhole, where all the men forming the party collapsed. They were brought round by the aid of artificial respiration; but the young labourer was quite dead. The Coroner, in summing-up at the close of his inquiry, said it was evident the man had died from lack of proper precautions being taken for the ventilation of the pipe when he was at work with the varnish, which it had been admitted was not safe to be used in such a place. He added that the engineer who neglected to see to the ventilation of the pipe was the man really to blame; and the neglect of an obvious duty became criminal. The Jury returned a verdict of "Death from misadventure," and attributed the fatality to want of ventilation in the pipe. Towards the end of May, a 12-inch main belonging to the South Staffordshire Water Company, near Hill Crest, Heath Hayes, burst, as was supposed, through subsidences due to mining. On examination, a rent about 4 feet long was found in the main. Owing to subsidence of ground causing burst pipes, there was a scarcity of water in the Rhymney Valley in the spring; but there has been rather too much lately in that part of the country. In consequence of the heavy rains of the past few weeks, the reservoir dam at Deri (Cardiff) burst on the 17th inst., and everything appertaining to the reservoir was destroyed. The water rushed down the mountain side, uprooting many trees in its course; but the whole volume was safely carried off by the river. The main water supply of the Fochriw and Rhymney Valleys was fortunately not affected. As the result of the bursting of a water-main on the afternoon of the 28th of October, the Maida Vale portion of the Edgware Road was flooded for a distance of more than a quarter-of-a-mile. A burst occurred on the 29th ult. on the Liverpool water-pipe line at Cotebrook, a village about seven miles from Northwich. A fissure 5 feet in length was caused in the pipe, which is 3 feet in diameter and 1¼ inches thick, through which large volumes of water rushed, tearing up a field for 30 yards, and forming a chasm 20 feet deep and 30 feet wide, and another of smaller dimensions. The main road was torn up, and the Northwich Council's water-works were flooded. The Liverpool mains being in duplicate, the supply of water to the city was not affected.

Personal Matters and Deaths.

Before closing this retrospect, a few personal matters which have occurred during the past twelve months call for brief notice. Early in the year, Mr. E. B. Barnard, the Chairman of the Metropolitan Water Board, was elected Chairman of the Lea Conservancy Board. Alderman James Birch, J.P., the Lord Mayor of York, who hospitably welcomed the Association of Water Engineers to the city in June, had conferred upon him the freedom and livery of the Plumbers' Company, and was admitted as a freeman of the City of London. Mr. H. W. B. Cotterill was appointed Resident Engineer for the new reservoir works which are being carried out by the Cardiff Corporation. Mr. W. Boyd Dawkins, formerly Professor of Geology in the University of Manchester, had the degree of Doctor of Science conferred upon him by the University. Mr. James Gray was appointed Water Engineer to the Warrington Corporation, in succession to the late Mr. James Deas. Mr. I. Hooper resigned the position of Water Inspector to the Corporation of Dorchester. Mr. J. Weir M'Kerrow, of Morpeth, was appointed Secretary and Manager of the Water Department of the Tynemouth Corporation, in succession to Mr. Henry Clarke. Mr. J. Chapman Mount resigned the position of Borough Surveyor and Water Engineer of the Lancaster Corporation. Mr. G. H. Raddin, of Lincoln, was appointed Assistant Water Engineer to the Bolton Corporation. Mr. W. P. Sinclair, of the Metropolitan Water Board, obtained the position of General Manager and Secretary of the Colne Valley Water Company, in succession to Mr. W. Verini. Mr. William Tomlinson, the Manager of the Rochdale Corporation Water-Works, resigned on account of ill-health. At the meeting of the Metropolitan Water Board on Feb. 25, the salary of Dr. A. C. Houston, the Director of Water Examination, was increased by £100 per annum. Another pleasant incident to record is a recognition of the services of Mr. F. W. Macaulay and Mr. W Gray, Engineers connected with the Elan Valley Water-Works of the Birmingham Corporation, by the granting of increases of

salaries at the beginning of the year. Extra services rendered at Taunton by Mr. H. T. Coles were rewarded by a unanimous grant of £100.

In the course of the year we have unhappily had to record the removal by death of several gentlemen who were closely connected with water-works undertakings. They were: Mr. Richard Darlington, formerly of the Kent Water Company's works at Shortlands; Mr. James Deas, the Water Engineer to the Warrington Corporation; Alderman Gainsford, for many years Chairman of the Water Committee of the Sheffield Corporation, and Chairman of the Derwent Valley Water Board from its formation; Mr. R. H. Haynes, the Borough and Water-Works Engineer at Newport (Mon.); Professor Koch, the eminent bacteriologist; Mr. C. D. Main, one of the oldest officials of the Newcastle and Gateshead Water Company; Mr. J. Chapman Mount, Borough Surveyor and Water Engineer to the Lancaster Corporation; Mr. George Newell, Manager of the water-works of the Aldershot Gas and Water Company; Mr. W. G. Peirce, Water Engineer to the Corporation of Richmond; Mr. Joseph Quick, the well-known water engineer; Mr. J. Shiress Will, K.C., whose work on "The Law Relating to Gas and Water Supply" is well known; and Mr. D. Doull Wilson, the General Manager of the Tees Valley Water Board.

ELIMINATING EFFECT OF CHLORINE UPON THE BACTERIA OF RIVER WATER.

By Leslie C. Walker, of Reading.

[Extracts from a Paper read before the Association of Water Engineers, Dec. 10.]

The author's intention in preparing this paper is to confine himself to a statement of the facts that have been proved and ascertained during a prolonged trial carried out with a view to testing the efficiency of a new system of water purification—the De-Clor system—that claims to accomplish one of the most difficult tasks presented to the water engineer—viz., the removal of excretal bacteria from water intended for domestic consumption. This system was installed early in the present year, at one of the filtration and pumping stations under the author's control.

The principal feature of the De-Clor system is the destruction of objectionable bacteria through the agency of a minute dose of chlorine. The author is fully aware that the use of chlorine is not new; but the system offered to him was a complete process, embodying the automatic addition of the chlorine, the provision of a contact period (planned to ensure uniformity) between the water and the chlorine, and last, but not by any means least, the total elimination from the water of the residual chlorine, after it has performed its function of destroying the bacteria—the said elimination being accomplished by means of a non-soluble agent in granular form placed within the filter.

The quantity of water treated by the trial plant is approximately 200,000 gallons per day of 24 hours. After passing through a series of chambers designed to act as "pre-filters," the water is pumped continuously (night and day) through the De-Clor filter into one of the service reservoirs. The filter is circular in cross section; the top and bottom being domed or dished. Internally the top portion forms a chamber about 10 ft. 9 in. in depth, through which the incoming water passes in a downward direction, this occupying about 30 minutes, during the whole of which time the chlorine is in contact with the water. At the top of this chamber is a tray, over and through which the inflowing water is equally distributed in order to ensure a uniform flow. The lower portion of this filter, for the depth of about 5 ft. 3 in., is divided horizontally into three compartments, the first and last of which are filled with layers of specially graded silica, while the central compartment holds a layer of 20 inches of specially granulated and prepared "carbon" or "charcoal," which (as used in this filter) possesses the invaluable property of destroying the free or available chlorine and converting it into fixed and innocuous compounds. No trace of free chlorine remains in the chlorine treated water after it has passed through the filter.

The chlorine apparatus consists of two cylindrical mixing and settling tanks (one in operation and one in reserve, each having a capacity of 250 gallons), a regulating device, and a small three-throw pump, driven off a pulley attached to the main pump shaft, for pumping in the chlorine solution. The requisite quantity of chloride of lime is first mixed into a liquid or slurry, in a hand mill; and this mixture is allowed to run into one of the cylindrical tanks, from which, after settling, it flows through a regulator, where sufficient water is added for constant working of the chlorine injecting pump. On leaving the regulator, the mixture passes, by means of the small three-throw pump, into the filter inlet main.

This system was put into operation at the Southcote works of the Reading Corporation, by the Candy Filter Company, under the supervision of the author, in March, 1910; and its working was formally taken over by the Water-Works Committee on May 9, for a trial period of six months—arrangements having been previously approved of by them for the collection of samples of water at regular intervals for bacteriological examination and chemical analyses. These examinations have been conducted by the Royal Institute of Public Health, under the direct supervision of the Principal, Professor W. R. Smith, M.D., during a period of twenty-two weeks. The results were so satisfactory that the author considered it unnecessary to await the expiration of the full contract period of six months before recommending to his Committee the adoption of the system.

The average quantity of water passed through the filter is 192,000 gallons per day, or at the rate of 8000 gallons per hour. At this speed, the filter, which has a superficial area of nearly six square yards of filtering media, is working at the rate of 32,000 gallons per square yard per day, or eighty times the usual rate of sand filtration—viz., 400 gallons per square yard per day of 24 hours.

The results of the bacteriological examinations of samples of water, collected weekly from May 9 to Oct. 5 inclusive, show that the river water contained an average of 4234 colonies of bacteria per cubic centimetre; the water after its preliminary filtration through Walker pre-filters, prior to passing through the De-Clor filter, 421 per cubic centimetre; and the water at the outlet of this filter, an average of 32 per cubic centimetre. The *Bacillus Coli Communis* was always present in 1 cubic centimetre of the river water, and on many occasions in 0·1 cubic centimetre; in the pre-filtered water, it was always present in 10 cubic centimetres, and sometimes in smaller quantities. In the water after treatment by the De-Clor filter, it was always absent from 100 cubic centimetres. These results have also been confirmed by Drs. Thresh and Beale at the London Hospital Public Health Laboratories. The finely filtered water is therefore always beyond suspicion from a bacteriological point of view, and above the standard of purity generally recognized as desirable.

Chemically, the condition of the water before passing through the De-Clor filter leaves little room for improvement, owing to the preliminary filtration through polarite and sand in the Walker pre-filters. Chemical analyses have, however, been regularly made, and, in addition to showing an excellent standard of purity, prove conclusively that the free chlorine is entirely removed by the carbon. This matter of the elimination of the free chlorine is of great importance, as, unless it is eliminated as soon as the bacteriacidal action is complete, it may impart a taste and odour to the water.

In practice, it is always desirable to employ a slight excess of chlorine, as it is difficult to ascertain readily and exactly on the works how much is required to kill the bacteria. It is known, however, that, with a plant such as is in operation at Reading, designed to meet the requirements of the case, and with the reagent there in use, one part of available chlorine per million parts of water is sufficient under all ordinary conditions; and the apparatus being adjusted to deliver this quantity, an unskilled man only is required to attend to it.

In the author's opinion, the value of a chlorine process entirely depends upon its possessing simple and reliable means of absolutely removing or destroying any excess of chlorine left in the water after it has effected its object of destroying the *Bacillus Coli*, and other objectionable bacteria. The carbon used for the dechlorinating can be revivified. It has been removed once during five months, and as regards the cost of revivifying, this is a point now being investigated. It is anticipated that it will work out at an infinitesimal figure per million gallons.

The cost of chloride of lime applied as in this plant works out at 2s. 2d. per million gallons of water treated; but with a larger plant, requiring proportionately a greater quantity of chloride of lime, the author could purchase at a cheaper rate, and reduce the cost still further, low though it now is.

The author was led to try the De-Clor system chiefly on account of its economy in respect both of cost and of space, and also by reason of its reputed efficiency from a bacteriological point of view. As regards economy in first cost, this works out at quite 50 per cent. less than that of a sand filter. As regards floor space, it does not require more than 25 square yards per filter of the working capacity herein described; whereas a sand filter of similar capacity would require not less than 480 square yards of filtering surface.

The author may add that the main through which he is pumping the water treated by the De-Clor system is tapped for service connection to dwelling-houses; and from the occupants of these he has not received any complaint of taste in the water.

Since the foregoing was written, the results for the complete period of twenty-six weeks, during which the filter was upon its trial, have been obtained, and they show that the average number of colonies of bacteria in the river water was 6775 per cubic centimetre; the *Bacillus Coli* being present in 0·1 cubic centimetre on fourteen occasions, and in 1 cubic centimetre on twelve occasions. In the pre-filtered water, the average number of colonies of bacteria was 579 per cubic centimetre; on two occasions, *Bacillus Coli* was present in 0·1 cubic centimetre; on ten occasions, it was present in 1 cubic centimetre; on eleven occasions it was present in 10 cubic centimetres; and on one occasion, it was reported as having been present in 100 cubic centimetres. In the water from the De-Clor filter, the average number of colonies of bacteria was 33 per cubic centimetre—this giving an average percentage of purification of 99·5; while on all the twenty-six

occasions upon which this water was examined, the *Bacillus Coli Communis* could not be found in 100 cubic centimetres.

Discussion.

Dr. J. C. Thresh (Chelmsford) said that he had taken a great interest in the experiments carried out at Reading, because he was the first to show that such infinitely small quantities of chlorine would purify water, providing it had been clarified beforehand. If the sedimental matter were thoroughly removed, then it was found that a very small quantity of chlorine sufficed to kill the particular bacteria of which they were wishful to get rid. There seemed to be no question that, with clarified water, the addition of the small quantity of chlorine would conduce to better purification than could be depended upon by the most efficient of slow sand filtration. The process was simple in the extreme; but they had to make sure that the excess chlorine was got rid of. He thought this treatment of water was going to assume much greater importance than was at the present time anticipated. It was found that, when purer water was supplied, not only did typhoid decrease, but the death-rate went down, especially among children. The chlorine process was the one which had the field at the present time; and he was inclined to think it would retain it. But the effect of electricity upon the purity of water was being tried. The ultra-violet rays of light were easily generated; and it was simply extraordinary the power they had in destroying bacteria. He did not think that, however cheap electricity was, they would ever be able to get it down to do the work so cheaply as by chlorine. He believed it was not professed that the work could be done by electricity at less than ½d. per 1000 gallons, as against $\frac{1}{30}$d. by the chlorine process.

Dr. Smith, under whose supervision the bacteriological trials have been carried out, bore testimony to the results having been eminently satisfactory.

Mr. Easton Devonshire stated that for several years at the Antwerp Water-Works they had been using chlorine introduced in quite a different way. At Antwerp it was practically impossible, so far as he could see, to effectively clarify the water before the chlorine treatment. It was only in the last stages of their elaborate process at Antwerp that the water was clear. They therefore introduced the chlorine as the water flowed from the river into the settling reservoir; the water being taken in at each tide. He quoted information from Dr. Kemna which showed the efficiency of the treatment.

Mr. E. Sandeman (Derwent Valley Water-Works) questioned the correctness of calling this process a filter.

Mr. C. F. Gettings (Teignmouth) regarded the cost of working the process—$\frac{1}{30}$d. per 1000 gallons—as very moderate.

Mr. M'Cullough (Belfast), referring to Dr. Thresh's remarks, observed that, with long storage and efficient sand filtration, there need be no fear of typhoid through the water supply.

Mr. W. Matthews (London) did not think the giving of averages in connection with the bacteriological results was sufficient; and he should like the author to show them within what range the results fell.

Mr. S. R. Lowcock (London) thought it a pity to give statements in percentages. He was pleased to hear Dr. Thresh refer to the electric treatment by the ultra-violet rays. As to the cost of the electric treatment, he was not sure that it was necessary to remove the whole of the bacteria; and possibly the harmful ones offered the least resistance to the ultra-violet rays. If this was so, by dealing only with these, the cost might be enormously reduced.

Mr. A. B. E. Blackburn (Sunderland) asked whether the author had had any bacteriological examinations taken of the water (after the process) at the consumers' taps—to see whether there was any deterioration. It was well known that with deep-well waters the water did not improve bacteriologically between the wells and the taps. Another point was as to whether the process affected the hardness of the water.

Mr. C. Sainty (Windsor) asked how the process worked at the present time now that the Thames was in flood.

Mr. C. C. Smith (Wakefield) questioned the wisdom of relying upon a single line of defence. The weak links were the automatic parts. They all knew that automatic machinery might get out of order, and men might neglect some portion of their duty. In dealing with water this was dangerous; and here they had two possible sources of danger. The process, to his mind, made an excellent second line of defence; but he did not think at the present time they could advise its substitution for existing filtration methods.

Mr. H. Preston (Grantham) inquired whether the author had tried the system on raw water.

Dr. Thresh said, as to the question referring to hardness, if experiments were conducted with extreme care, it might be found there was, through the use of the process, an increase of hardness of only about ½°.

Mr. Walker, in reply, said he had not made any experiments with chlorine on the crude water. They had, in fact, no huge settling-tanks in which they could make such an experiment. With regard to the averages, he had the full particulars from which they were compiled, and would be pleased to supply them (both bacterial and chemical) for publication in the official transactions. The chemical analysis showed there was no increase in hardness so far as his experience had gone. The experiment had extended from February to the present time, so that he had had knowledge of the process at all states of the river. Mr. Sandeman seemed to consider this process was not a filter. If he could see the wash-water and the matter that was arrested, he (Mr. Walker) thought he would agree that it was a filter, and a much more effective one than the sand filter. Up to the present, he had not taken any samples of the tap water with the process in use. With reference to the capital and labour costs of the filters, they were 50 per cent. less than with sand filters. The cleaning occupied practically no time.

ADVANTAGES OF CO-OPERATION IN RURAL WATER SUPPLIES.

By F. Graham Fairbank, M.Inst.C.E., of York.

[Extracts from a Paper read before the Association of Water Engineers, Dec. 10.]

Having been invited by your President (Mr. W. H. Humphrys) to contribute a paper to the Association, the author selected the above subject, having had considerable experience in the development of rural water supplies on co-operative lines, and being therefore able to speak from personal experience of the advantages accruing therefrom. The rural district of Easingwold has been chosen as a typical instance. In 1898, the Rural District Council determined to consider the practicability of a co-operative scheme for a number of villages; and the author's firm was instructed to report on a combined scheme for the supply of Husthwaite, Raskelf, Alne, Carlton Husthwaite, and Thormanby, capable of supplying 2000 persons at the rate of 15 gallons per head per day for a total supply of 30,000 gallons per day. It was recommended that a supply be obtained from the foot of the Hambleton Hills; and the scheme was estimated to cost £6546. Subsequently the Council decided to extend the scheme to Tholthorpe, Flawith, Tollerton, Youlton, Aldwark, Sutton, and Huby; and (striking out Thormanby) the estimated cost of the works amounted to £14,445. Owing to the addition of so many villages beyond the original five, it was necessary to seek a further supply beyond that originally intended to be taken; and this was obtained from some springs called the Cragg Hall Springs. The combined water supply thus obtained was of excellent quality, with a total hardness of only 9°. At the time of the Local Government Board inquiry, certain additions were made to the original estimate, which increased the amount proposed to be borrowed from £16,000 to £17,600.

The total supply available from the combined sources at the time the works were completed was 80,000 gallons per 24 hours. The scheme was designed to supply up to 4000 persons at 15 gallons per head per day—a total of 60,000 gallons per day. But as the population of the villages to be supplied amounted to 3625 persons, a maximum of 54,375 gallons per day only was required for the supply—the balance of 25,625 gallons being returned to the original water-courses.

The covered storage reservoir was constructed ¾ mile to the north of the village of Kilburn. The reservoir is 77 ft. long by 25 ft. broad, with 10 ft. of water, and holds 120,000 gallons, which is equivalent to two days' supply for a population of 4000 persons at 15 gallons per head. The reservoir is constructed entirely of Portland cement concrete, and covered by a self-supporting galvanized iron roof; the gables being filled in with brickwork, and provided with louvred doors for the purpose of ventilation and inspection. At the west end of the reservoir, an inlet chamber was constructed of Portland cement concrete, provided with cast-iron covers and a valve-controlled bye-pass, which was laid clear of the reservoir banks to join the delivery main, so that water might be delivered direct to the villages without passing through the reservoir, when necessary. There is also a valve in the inlet chamber for cutting out the reservoir for cleansing, for which a wash-out is provided at the lowest point. Adjacent to the reservoir is a valve chamber for controlling the supply from the reservoir to the villages; and immediately behind this valve is a stand-pipe, at the highest point of the delivery main—thus providing an exit for any air that might accumulate in the pipes. The water is drawn off from below the surface of the reservoir by means of a floating arm, which is connected to the delivery main to the villages.

The water is conveyed from the reservoir by a 5-inch cast-iron delivery main. The main at present extends as far as the village of Flawith, whence a 4-inch main continues to Huby, and then a 3-inch main to Sutton. In the villages themselves, 3-inch mains have been laid. Numerous valves are provided *en route* to divide the delivery main into workable sections, and control the supply; and washouts and air-valves are also provided in suitable positions. The total length of mains in connection with the system is about 30 miles.

As the top-water level of the reservoir at Kilburn is some 400 feet above the surface of the ground at the lowest part of the area of supply, it was found necessary to relieve the lower parts of the system by means of a break-pressure tank—the pressure here being reduced to zero; so that the area supplied is divided into two zones—each with a pressure sufficient for the proper supply, but not enough to put undue pressure on the fittings.

Since the works were completed, careful gaugings have been taken of the quantity of water actually used; and the consumption has been found to be slightly under 10 gallons per head per

day for all purposes. As the co-operative scheme was based on a provision of 15 gallons per head per day, the district is in an excellent position with regard to the quantity of water available. As the whole of the water could be collected at such an elevation as to supply the villages by gravitation, the annual upkeep has been reduced to a minimum.

The estimated cost of the works was originally £16,000; but, as already stated, this amount was afterwards raised to £17,600. This increase of £1600 was made up by £940 additional cost of purchasing the mains on a rising market, and £660 due to the Local Government Board insisting upon 3 feet of cover to the pipes, instead of the 2 ft. 6 in. they had been satisfied with previously. When the works came to be carried out, the Council were fortunate in being able to let the contract for the mains when iron was on a falling market, with the happy result of saving something like £1000 on the Local Government Board estimate. The actual cost was therefore equivalent to £4 3s. per head for the 4000 persons for whom the scheme was designed.

In considering the advantages accruing from a co-operative scheme, the first cost per head is not the most important consideration; indeed, so long as this cost is kept within such limits as not to unduly press on the villages, it may be regarded as negligible. Apart, however, from this question, the advantages are: (1) That by co-operation a sufficient sum of money can be raised to enable a source of water to be tapped, unquestionable as to purity, softness, and quantity. (2) Extreme economy in maintenance and management. (3) Co-operation enables the smallest community to be provided with a really good water supply.

The author is a great advocate of co-operative schemes of water supply, and is confident that, if Rural District Councils could be induced to study the lessons to be learnt from a scheme like the one described, or from others of a similar character, many outlying hamlets, which are scourged from time to time with preventable diseases consequent on bad water, and whose chance of ever having such a curse removed from them is very remote under the usual "unitary" system, could have good and ample supplies readily enough by the adoption of the co-operative principle.

Discussion.

Mr. James Dewhirst (Chelmsford) said the scheme described rather followed on the lines of one that he had under his control. There could be no doubt that, in poorly scattered rural districts, if they could unite parishes under one scheme, it was the best possible thing. In his own case, the scheme was started for one parish. The benefits derived were so considerable that it had been extended from time to time; and they were now supplying seven parishes with over 30 miles of mains. The cost of carrying out the scheme piecemeal was heavier than it would have been had it been executed completely in the first instance; but still the cost compared well with the scheme described by the author. He should like to know the basis on which each parish contributed to the cost of the scheme. This was one of the most difficult problems in connection with a scheme of the kind; for it was evident that while a certain size of pipe might be sufficient to take a supply of water a given distance, if water had also to be supplied 10 miles further on, a much larger pipe was required in the first part of the system, but the near places did not require this larger pipe. Therefore, the difficulty was experienced of getting a fair and proper basis on which to charge each parish.

Mr. E. J. Silcock (Leeds) remarked that the members must all be in agreement with the author in his view that co-operation among villages was likely to increase the probability of them being able to secure a proper supply of water. It was only in this way that strict economy could be obtained in the supply of water to a large number of small places. It would have been interesting if the author had told them how he had been able to overcome the difficulty of dealing with riparian owners when he constructed the works, and apparently abstracted water from a running stream. This was one of the things that militated against these small schemes, that they were unable to get water by gravitation unless it was taken from a running stream. He thought the law required amending, so that they could get water rights, the same as land rights, by Provisional Order. As to the basis of contribution to the cost of the scheme by the several parishes, he found that the ordinary basis adopted by the Local Government Board —that was, the rateable value—worked out inequitably to certain parishes. In making a final apportionment in a scheme he had been carrying out, he was now submitting to the Local Government Board a proposal in which he had taken into consideration what the cost would have been to each parish, if it had adopted an independent supply. This was a basis which showed that each parish by joining in the co-operative scheme obtained a supply for less money than would have been involved by an independent scheme. Generally speaking, the number of people supplied was a better guide than the rateable value. But water consumption was a very personal matter; and it depended upon the character of the population as to what the expenditure might be. It was, however, a question if co-operation was suitable in every case; they must consider each case on its merits. He knew of an instance where co-operation was forced by the Local Government Board to the detriment of one of the districts.

Mr. W. Phelps (Shepton Mallet) observed that he had tried to introduce co-operation into rural districts. His hope was concentrated very much in Government action, which was obviously before them, and which would compel co-operation where it would be practically impossible to get it without. He had carried out schemes where two or three parishes had been got together; but only the last month or two he had shown two parishes that it would be a good thing for them to go in jointly for a supply, but because they did not love one another they would not unite. Again and again he had found this same tendency. There must, in his view, be compulsory co-operation; and the sooner it came the better. One way would be by the Local Government Board forcing some supervision upon districts, and ascertaining what they were doing in the matter of water supply. Regarding the apportionment of the cost, this was a difficult question; and it could only be settled by somebody outside the bodies concerned. One would have liked to have learned from the author the way the water rights had been acquired from the landowners. This was a matter involving a considerable amount of trouble. He found there was a general tendency during the last few years to drop the system that was formerly prevalent, of just selling a piece of land, in favour of a royalty per 1000 gallons.

Mr. C. F. Gettings (Teignmouth) pointed out that water engineers were too apt to add to the cost of schemes for rural districts by allowing for a larger quantity of water per head per day than was necessary. It was a failing they seemed to have. He knew of a case in which as much as from 20 to 25 gallons per head per day had been allowed for; but he had proof that the consumption had only amounted to 8 or 9 gallons.

Mr. C. H. Roberts (Southampton) remarked that, looking at the capital cost with practically no working expenses, he should think an average rate of 2d. per head would be more than sufficient. It struck him that the last village was a long way from the reservoir; and the author did not tell them what means he had provided for supplying the villages in case of a breakage of the main in the north where the pressure was considerable. It seemed to him (Mr. Roberts) that stand-pipes or service-tanks would be advisable in some of the villages; so that in case of a breakage of the main, the people would have a supply for a few hours. The author had incidentally referred to the township of Easingwold making overtures for surplus water; and it appeared to him (Mr. Roberts) that, if the reservoir could have been constructed in the neighbourhood of the place, a better arrangement of mains would have been possible. Speakers had referred to difficulties with riparian owners at the source of supply. He took it that the scheme was carried out under the provisions of the Gas and Water Works Facilities Act, so that some arrangement was made before the scheme was proposed.

Mr. W. F. Bird (Midsomer-Norton), in a written communication, said he endorsed generally the conclusions at which Mr. Fairbank had arrived. His own experience showed that it would be wise for public authorities, wherever it was at all practicable, to arrange a combination of villages to secure a thoroughly satisfactory and permanent supply, and that this plan would generally be found most economical. In a scheme he had recently completed, the area supplied was about 21 square miles, and was hilly. The total population was 8320, divided into eight parishes. The cast-iron trunk and distributing mains were from 8 inches to 3 inches in diameter; the total length being about 32 miles, with a further 2¼ miles of wrought-iron branches to some outlying farms. The scheme was designed to provide about 15 gallons per head for a population of 8000; but the actual consumption during the first eighteen months of working was only 9⅔ gallons per head per day. To provide for variation in levels, and to ensure continuity of supply to four outlying villages, a compensation reservoir in block concrete, with a capacity of 170,000 gallons, was built. The works included distribution to cottage consumers by means of 205 pillar and wall fountains, and 383 connections to private dwellings, with 126 meter supplies to farms and small tradesmen. The total cost of the works, including reservoir, Deacon meters, all fittings, fountains, and connections, was £21,817, or £2 13s. 2d. per head of the population supplied. Including easements, supervision, clerk of works, and legal expenses, the outlay worked out at £2 19s. 6d. per head.

Mr. Fairbank not being present, there was a promise on his behalf by the President (Mr. Humphreys) that a reply should be communicated.

Mr. W. H. Batchelor, Chairman of the Gas Committee of the Coventry Corporation, has just been elected to a vacant aldermancy. In virtue of his long service on the City Council, Mr. Batchelor is considered fully entitled to this honour. During his tenure of office as Chairman of the Gas Committee, he has seen the successful completion of the new gas-works at Foleshill.

Consequent on the appointment of Mr. Valon to Stafford, as already announced, some changes have been made in the staff of the Engineer (Mr. T. H. Duxbury) of the South Shields Gas Company. The Directors have raised Mr. W. A. Howie, the Chemist and Junior Assistant, to the position of Assistant-Manager, in succession to Mr. Valon; Mr. Merrell, the present Superintendent of the Jarrow works of the Company, has been made Superintendent of both the Shields and Jarrow works; while Mr. Ingham, the present Chief Draughtsman, is to be Engineering Assistant. Mr. Howie was a pupil of Mr. Duxbury; and on the expiration of his articles, he was entrusted with the duties he has just relinquished. He gained the silver medal, with first-class honours, in the City and Guilds of London examination in "Gas Engineering" last year.

SULPHUR COMPOUNDS IN GAS.

An Investigation at Newcastle.

The following is a report of some experiments undertaken by Professor P. Phillips Bedson, M.A., D.Sc. (of Armstrong College, Newcastle-upon-Tyne), on behalf of the Newcastle-upon-Tyne and Gateshead Gas Company, to demonstrate whether the air in consumers' premises is rendered injurious to the occupants, during the burning of coal gas, by the presence of sulphur compounds in the gas.

The investigations of Mr. Otto Hehner and Dr. Rideal, made some six years ago, show that when coal gas containing sulphur compounds is burnt in the ordinary way in a dwelling-room, the proportion of sulphur acids that find their way into the air of the room is such that the sulphur content of air of the room is not materially increased beyond the sulphur content of the outside air. These investigations have proved, by an extended series of experiments, "that the sulphur content of the air is invariably much smaller than the calculated amount," and have demonstrated that this arises from the fact that in the case of an ordinary room there are in operation conditions which naturally tend toward the removal of the sulphur acids which are produced by the combustion of a gas containing sulphur. First, ventilation, by which the vitiated air is removed and replaced by fresh air. This is, however, a factor which does not adequately explain the discrepancy between the calculated vitiation and the actual experimental results. The investigations of Messrs. Hehner and Rideal show a second factor contributing to the removal of the sulphur acids thrown into the air by the combustion of coal gas. This is found in the material used in the construction of the walls and ceilings, consisting, as it does, largely of carbonate and caustic lime, both of which absorb sulphur acids. That these materials play a most important part in this removal has been proved by direct experiment. A third factor, the action of which tends in the same direction, is the condensation of moisture. In the burning of coal gas, there is a considerable amount of water vapour formed, which condensing carries down with it the acids in the products of combustion. So much water is formed that in a well-ventilated room the "water condensing on the windows is not appreciably acid to litmus paper;" but in experiments made in a room varnished, to impede the ventilation, "the condensed water was found to be distinctly acid."

The amount of sulphur found by these investigators, when burning different kinds and quantities of gas in an ordinary small room, varied from one-sixth to one-twentieth of the quantity actually introduced. In no case have they found an amount of sulphur impurity which would suffice to produce irritation of the nose and throat—an amount which, according to Lehmann, must be of the order of 5 parts per million; whereas the highest amount they have found is 1·23 parts per million, or less than one-fourth of the proportion set down by Lehmann as producing the above effects. Hehner, from a consideration of the question and the results of his experiments, concluded that it would be utterly immaterial to the consumer of gas if the then present regulations as to purification were abolished, and the amount of sulphur allowed to rise to 50 or 60 grains per 100 cubic feet. Though the account published by Messrs. Hehner and Rideal of their investigations contains abundant evidence in support of their conclusions, and demonstrates how small is the vitiation of the air of a room by the sulphur acids produced by burning gas, still it has been deemed desirable to submit this question to a further experimental verification. With this object in view, I have made the following series of experiments.

Description of the Place Selected for the Tests.

For the purpose of these experiments, the upper flat No. 26, Rose Street, Gateshead, was rented. The house is the end one of the row. The flat contains four rooms and a scullery. Before commencing the experiments, these were all thoroughly cleansed, the walls repapered, and the ceilings whitewashed. The large front room was set apart as a test-room. In it was erected a two-light chandelier, and a fan worked by a water-motor controlled from the back room. The fan was erected in a position a few feet from one of the walls of the room, about 3 feet from the floor, and was employed in some few cases for the purpose of mixing the air of the room, but not for the purposes of ventilation. The front room has a fireplace with a recess on the right-hand side, and a low cupboard on the left-hand side opposite the door. In the middle of the partition wall between the front and back rooms, a 12-inch square opening was made, which was fitted with a window, through which the burning of the gas, the working of the fan, &c., in the test-room could be noted without entering. The partition wall was pierced at three points; and into these openings were fitted iron pipes 1½ inches diameter. The heights of the openings above the floor were 2 feet, 5 feet, and 8 ft. 8 in. respectively. The height of the room is 9 ft. 8 in. The iron pipes were closed on the laboratory side by rubber stoppers, through which glass tubes passed into the room, and by these samples of air were drawn through the absorbing towers and meter in the back room. The back room was fitted up and used as a laboratory.

In the small front room over the doorway were placed the meters and pressure-gauges, which were connected up with two distinct gas supplies, and so arranged that the chandelier in the front room could be supplied with gas from either of these supplies, and the amount of gas burnt measured. Further, in this room was erected the apparatus for the Gas Referees' sulphur test; so that a determination of the sulphur content of the gas burning in the test-room could be made concurrently with its use. As already mentioned, the back room was used as a laboratory, and in it were erected the absorbing towers, which could be connected with one or other of the openings into the test-room according as it was desired to sample the air in the upper, lower, or middle part of the room. The absorbing towers were connected with a meter, and this again with a water-pump aspirator, by which the air was drawn from the room through the towers and meter, and thus the volume of air so extracted ascertained.

Method of Estimating Sulphur Compounds.

The estimation of the sulphur compounds in the air is most readily effected by drawing the air through towers filled with glass beads, over which a solution of hydrogen peroxide is allowed to trickle. In this way, the gaseous sulphur compounds are absorbed and oxidized, and converted into sulphuric acid. The amount of this acid so produced is readily and accurately determined by converting it into the insoluble barium sulphate, which is collected, washed, dried, ignited, and weighed. From the weight of barium sulphate, the amount of sulphur which it represents is calculated. This, with a knowledge of the volume of air extracted from the room, enables one to calculate the proportion of sulphur acids in the air, which throughout is expressed in grains of sulphur per 100 cubic feet of air.

The towers used in this investigation were 28 inches high, with a diameter of 1¼ inches, and were filled with glass beads; the hydrogen peroxide solution, free from sulphur, being run from a tap funnel fixed in the top of the tower. At the end of the aspiration, the tower was drained, and washed with water. The sulphur in these liquors was then converted into barium sulphate, and its amount determined, as described above.

Method of Procedure in Making a Test Run.

For the purposes of a test, the front room was put into the condition of an ordinary living-room, the windows were closed, the gas lighted, and the door locked, and not opened until the end of the test run. In some instances, the gas was allowed to burn for several hours before a sample of air was drawn from the room; and thus a more or less stationary condition of the air, as regards contamination by the products of combustion, was secured. During a test run, air was drawn for several hours through the absorbing towers and meters; and at intervals small samples of air were withdrawn in which the proportion of carbon dioxide was determined. From the results of the determination of the carbon dioxide, coupled with the knowledge of the amount of carbon dioxide produced by the gas burnt, the changes in the air produced by the ventilation can be calculated. In all the experiments, the ventilation was entirely natural, and in no way aided artificially. By the use of the ventilation constant, the amount of sulphur put into the air by the burning of the gas and that removed by ventilation can be calculated.

The amount of sulphur compounds found in the air proved in every instance to be much below the proportion which can be accounted for in this way, showing that ventilation alone does not effect the removal of these compounds—a conclusion which finds ample justification in the experiments of Hehner and Rideal; and further, that the alkaline materials of the walls and ceilings, and the condensation of the moisture, contribute to the elimination of sulphur compounds from the air of a room in which coal gas is burnt. Hence it is that the proportion of sulphur contained in the gas which finds its way into the air, to constitute an aërial contamination, is only a small percentage of the sulphur acids thrown into the air of the room by combustion of coal gas.

Recognizing these facts, I have, in the statement of the results of the several tests made in the flat at Gateshead, dealt only with the amount of sulphur acids found in the air of the room, and have stated these amounts in the form of percentages of the total sulphur derived from the gas burnt during the test run.

Description of a Test Run.

In the first test, air was drawn from the top and bottom openings simultaneously, through glass tubes extending for some 8 feet into the room; the upper one being at a height of a few inches above the gas-burners. The gas was burnt from two incandescent burners, and was kept continually burning for 48 hours; the total consumption being 445·652 cubic feet. The aspiration of the air from the room through the towers was started after the gas had been burning for 24 hours, and continued for 10 hours 20 minutes, during which period 56·674 cubic feet of air were drawn through the towers. During the 24 hours, 222·8 cubic feet of gas were burnt; and during the 10 hours 20 minutes, 95·9 cubic feet.

At the conclusion of this long and unusually severe test, the room was entered, and it was found that, while the air was undoubtedly foul and uncomfortable to breathe, there was no evidence to the taste or smell of the presence of sulphur acids. The water which had condensed on the window pane was acid in reaction to litmus.

Calculation and Interpretation of the Results.

During the progress of the test, determinations of the amount of sulphur contained in the gas used were made by the Gas Referees' sulphur test apparatus in the adjoining room. In this particular case, the amount of sulphur found in the gas used was

25·19 grains per 100 cubic feet. During the withdrawal of air from the room, 95·9 cubic feet of gas were burnt. This, therefore, would represent 24·1 grains of sulphur, which, in the form of sulphur acids, were discharged into the air of the room. The capacity of the room being 1442 cubic feet, and assuming the acids from the 24·1 grains of sulphur to be distributed through the air of the room, then there should be present in the air 1·671 grains of sulphur per 100 cubic feet of the air of the room. The amount of sulphur actually found in the air withdrawn from the room was, however, 0·0258 grain per 100 cubic feet. This represents, therefore, an amount equivalent to 1·54 per cent. of the sulphur thrown into the air by the gas burnt during the period in which the sample of air was withdrawn from the room.

Another Method of Calculation and Interpretation.

It will be noted that in this test the gas was kept burning in the room for some 24 hours before commencing to withdraw samples of the air, for the purpose of estimating the sulphur; the object of this mode of procedure being to establish a condition of maximum vitiation as regards the sulphur prior to extraction. The gas burnt during this preliminary period of 24 hours was 222·8 cubic feet, and that consumed during the extraction of air from the room was 95·9 cubic feet. Consequently, we may say that the gas burnt for the test is made up of that burnt before extraction was commenced, *plus* the half of the gas consumed during the withdrawal of the sample of air. This is, therefore, 222·8 + 47·95 cubic feet—*i.e.*, 270·75 cubic feet. Since the gas used contained 25·19 grains of sulphur per 100 cubic feet, the 270·75 cubic feet would represent 68·1 grains of sulphur, which as sulphur acids would be thrown into the air. Assuming, as before, that during this period there had been no ventilation or absorption, and that the sulphur acids had accumulated in the air of the room, then, since the capacity of the room is 1442 cubic feet, there should be present in the air of the room sulphur acids equivalent to a total sulphur of 4·72 grains per 100 cubic feet of air. The amount of sulphur found in the air withdrawn was equivalent to 0·0258 grain per 100 cubic feet of air, which represents, when expressed as a percentage, 0·54 per cent. of the sulphur thrown into the air by the gas burnt in the period extending over 34 hrs. 20 mins. The results of this test run are summarized in Series I. of the table of results.

In the subsequent statements, both methods of interpretation of the results have been adopted. In some instances, the time of collection of air samples is practically coincident with the time of burning. In these cases, therefore, the sulphur contamination is calculated on half the volume of gas burnt. Consequently, when the contamination is expressed as a percentage, it appears higher than when calculated on the volume of gas actually burnt.

Second Series.

A further series of three tests was made under conditions similar to those of the first test, save that the air was drawn from the top opening only. The results of these observations are given in the table of results under Series II.

Undoubtedly, the lower result of sulphur found in the first test is in part to be attributed to the air drawn through the lower opening, as this was in a position on a line between the door and fireplace, and therefore not likely to be in any way contaminated. The air drawn through the lower tube would, therefore, dilute that drawn through the upper opening, and serve to give a low result.

Third Series.

In a third series of tests, started on Aug. 23 and continued until Aug. 25, two burners were used, as in the previous instances; and the air was drawn from a tube placed in the middle opening —*i.e.*, at a height of some 5 feet from the floor, and extending into the room for a distance of 5¼ feet (about 1 foot from the centre of the room). After the gas had been burning in the room for a space of 8 hours 50 minutes, the extraction of air from the room was started, and continued for 14·8 hours. Then a second sample was extracted during a period of 9·5 hours; and finally a third sample was drawn through the towers for 15 hours. Estimations of sulphur in the gas supplied to the burners were made during these intervals. At the end of the 48 hours' run, the room was opened. The atmosphere of the room was found to be distinctly oppressive and lacking in freshness; but no odour of sulphur acids was observed. Strips of blue litmus paper, which had been suspended from the ceiling at different points of the room, showed, by their reddening above the burners and remaining blue for 5 feet from the floor, that the air rising to the upper part of the room soon loses its acidity. Again, the passage of air up the chimney was traced by the change of colour in the strips of litmus paper hung over the hood of the fireplace. These were reddened slightly in the upper part, but remained blue from the bars to within a couple of inches of the hood.

The results of the determination of sulphur in the air are given in the table of results under the heading Series III.

Fourth Series.

A fourth series of tests was made; and in this series gas was burnt at one jet only. The samples of air were drawn simultaneously from three points in the room. For this purpose, three glass funnels were placed at a height of 5 ft. 6 in. from the floor, one in the south-east corner, one in the centre, and the other in the north-west corner of the room. The three were connected with glass and rubber tubing to a four-way piece made of glass; the fourth branch being connected up with a glass tube passing through the middle opening on the wall, and through it the air was drawn through the towers and meter.

In each of these tests, the extraction of samples of air was commenced shortly after the lighting of the gas and the closing of the room. Further, as will be noted from the table of results, the sulphur content of the gas was lower than in the previous cases. In the first two tests, the gas was burnt for 9·25 hours and 7·9 hours respectively. Simultaneously with the third test, an estimation of the sulphur in the outside air was made, by drawing the air through an absorbing tower connected with a glass tube passing through an opening in the scullery window at the back of the flat. The result of this determination gave 0·0152 grain of sulphur per 100 cubic feet, from which it will be seen that the proportion of sulphur found in the outside air is greater than that contained in the air of the room in which one gas-jet had been burning for 23½ hours. Assuming the sulphur content of the outside air to be the same on the first and second occasion, it would form 71 per cent. of the sulphur found in the first test and 89 per cent. of that found in the second one. The amount of sulphur in the outside air in a situation such as that of the Rose Street flat will undoubtedly vary very considerably; and in short test runs, such as the first and second of Series IV., the influence of the sulphur found in the outside air would be such as to make the relative proportion of sulphur found in the air of the room to that thrown into the air by the combustion of the gas appear higher. The results of the determinations are given in the table of results under the heading Series IV.

Discussion of the Results.

The results of these experiments show that the sulphur remaining in the air forms but a small proportion of that given to the air by the gas burnt—a result the more remarkable considering the conditions under which the experiments in the several series of tests were performed. In the first place, two gas-jets were burnt in a room, which in practice would be amply illuminated by one burner. Again, in Series II. the air was withdrawn from the top of the room, at a height a little above the burners. Moreover, the gas was in all cases burnt for such lengthened periods as are seldom, if ever, likely to occur in practice. In fact, the tests were made under conditions exceptionally severe from the point of view of the contamination of the air by the sulphur acids discharged into it by the combustion of coal gas, yet the results give evidence that these acids are removed as quickly as they are produced. Ventilation, the alkaline materials of the walls and ceilings, the condensation of moisture, each and all contribute to this rapid and steady removal of the sulphur acids from the air. Again, by the amount of water produced by the burning of the gas itself, the gas burnt serves, as it were, to effect purification of the air. The absence of any indication of sulphur dioxide in the air at the end of the tests indicates that the sulphur is completely oxidized. This complete oxidation would undoubtedly contribute to the ready removal of the sulphur acids by the moisture; and in this oxidation the incandescent mantle of the gas-burner would doubtless assist—an action which may possibly constitute one of the advantages incidental to the use of the incandescent mantle, though the use of flat-flame burners, instead of incandescent burners, in the experiments would not have influenced the results.

Comparison with Outside Air.

A comparison of the sulphur content of the air of the room with that of the outside air affords further evidence of the efficiency with which the sulphur acids are removed by the agencies already mentioned. During the progress of this work, I have made, at various times, some six determinations of the sulphur in the outside air. The situation of the Rose Street flat would lead one to expect the sulphur content of the outside air to be somewhat high, and to exhibit considerable variations. The maximum amount found in these determinations is 0·0542 grain of sulphur per 100 cubic feet of air, the minimum 0·0152 grain, the mean of the six estimations 0·0339 grain per 100 cubic feet.

In Series II., the average of the total sulphur found in the air of the room, after the gas had been burnt in it under the conditions described, is 0·083 grain per 100 cubic feet, the average in Series III. is 0·0326 grain, while in Series IV. the average is 0·0168 grain per 100 cubic feet. It will be seen, therefore, that the amount of sulphur in Series II. is about double that in the outside air; but it must be remembered that in this case the air was drawn from a level a little above the gas-burners. In Series III., the amount of sulphur in the air of the room is practically the same as the average content of the outside air; whereas in Series IV. it is about half this amount.

In this connection, the results of some of Hehner's experiments made in 1904 in London, to which reference has already been made, may be cited. From the data given by Hehner, it will be found that, when gas of given sulphur content is burnt in a varnished room, made as air-tight in other ways as is compatible with the condition of the work, the average weight of sulphur found in the air is 0·0265 grain per 100 cubic feet of air; while in an ordinary living-room the average amount of sulphur found is 0·0278 grain per 100 cubic feet. The sulphur in the outside air estimated simultaneously gives an average of 0·023 grain per 100 cubic feet of air; thus showing that, as concerns the sulphur in the air, there is no material difference between the outside air and the air of a room in which gas had burned for some hours.

It is well known that the air of towns, receiving as it does the products of combustion of coal and other fires, may contain a

TABLE OF RESULTS.

	Room 9 ft. 5 in. high: capacity, 1442 cubic feet; windows and door closed; fireplace without fire.										Coke-oven gas. Room 1200 cubic feet capacity; walls distempered; ceiling papered with brown paper whitewashed; one closed window, and one closed door, no fireplace.		
	Series I.	Series II.			Series III.			Series IV.			Series V.		
1 Date 1909	..	Aug. 4th	Aug. 12th 13th	Aug. 16th 17th	Aug. 23rd	Aug. 24th	Aug. 25th	Sept. 1st	Sept. 4th	Sept. 9th	Oct. 24th 25th	Nov. 12th 13th	Nov. 19th/20th
2 Cubic feet of gas burnt	222·80 95·90	64·4	142·0 79·0	137·67 70·0	76·03/128·3	204·33 82·00	286·33/129·60	12·1/27·9	7·75 27·5	2 12 97·9	148·25	37·2	242·7
3 Hours	24·00 10·33	7·25	15·5 7·5	15·5 8·25	8·83 14·8	23·65 9·5	33·13/15·0	1·75 7·5	1·59 6·33	0·5 23·0	22	17	18
4 Grains of sulphur per 100 cubic feet of gas	25·19	47·8	37·23	38·71	31	31	31	14·25	21·5	17·83	45·3	37·5	35·1
5 Cubic feet of air drawn through the towers	56·674	56·44	77·03	80·2	74·06	47·5	63·36	21	26·2	77·16	88·8	61·36	34·57
6 Time of extraction in hours . . .	10·33	7·25	7·5	8·25	14 8	9·5	15	7·5	6·33	23	22	17	18
7 Cubic feet of gas burnt during time of extraction	95·90	64·4	79·0	70·0	128·3	82	129·6	27·9	27·5	97·9	148·25	37·2	242·7
8 Grains of sulphur found per 100 cubic feet of air	0·0258	·0713	·0668	·1135	·0335	·0321	·0321	·0212	·0169	·0123	·0343	·0127	·0809
9 Grains of sulphur per 100 cubic feet of air calculated on gas burnt during extraction	1·671	2·13	2·039	1·88	2·758	1·762	2·786	·276	·409	1·21	5 58	1·16	7·09
10 Sulphur found expressed as a percentage of calculated (No. 9) . .	1·54	3·35	3·27	6·04	1·21	1·82	1·15	7·69	4·11	1·0	0·61	1·10	1·14
11 Grains of sulphur per 100 cubic feet of air calculated on gas burnt from starting	4·72	1·06	4·68	4·63	3·02	5·26	7·54	·258	·32	·631	2 79	0·58	3·54
12 Sulphur found expressed as a percentage of calculated (No. 11) . .	0·54	6·72	1·42	2·45	1·11	0·60	0·43	8 21	5 28	1·95	1·22	2·20	2·28

Remarks.

Series I.—Air drawn from top and bottom openings simultaneously; tubes extending 8 feet into the room, the upper one at a level of some few inches above the height of the burner; two burners burning continually for 48 hours; aspiration starting after the gas had burnt 24 hours.

Series II.—Air drawn from top opening only; two burners.

Series III.—Two burners; air drawn from a tube placed 5 feet from floor and 5½ feet into room. After burning, Aug. 23, 8 hours 50 minutes, the withdrawal of air was started, and continued for 14·8 hours. Aug. 24, the second sample was withdrawn for 9·5 hours; and Aug. 25, the third sample was withdrawn for 15 hours.

Series IV.—One burner; air drawn from three points 5½ feet from the floor in different corners of the room shortly after the gas had been lighted. Sulphur in outside air during third test was 0·0152 grain per 100 cubic feet.

Series V.—Air drawn from centre of room a little below burner; first test, two incandescent burners; second test, one incandescent burner; third test, two flat-flame burners.

large proportion of sulphur, while the air of our dwellings contains less, owing to the absorption of the sulphur acids by the materials of which our houses are built. As an illustration of the condition of the air of a large city, I may quote the results of experiments made by the Town Gardening Section of the Manchester Field Naturalists' Society in 1891. The mean of four examinations of the air in the centre of the city—viz., at the Town Hall—in the month of February, gave 0·24 grain of sulphur per 100 cubic feet, whereas the mean of ten determinations in the air at Owens College, about 1½ miles from the Town Hall in a southerly direction, was 0·123 grain per 100 cubic feet. These results are exceptionally high, which is, no doubt, due to the fact that fog prevailed in many instances. They may serve, however, to show to what the proportion of sulphur in the air of a town may rise, and represent a condition which it would be very difficult to attain by burning gas in an ordinary living-room.

Fifth Series.

By the kindness of the Priestman's Colliery Company, I have been able to make a further series of tests; using for this purpose coke-oven gas, which had not been submitted to any process of purification beyond that which it undergoes in the scrubbing for ammonia—in fact, the gas would rank as unpurified gas. The experimental tests were conducted in a room of about 1200 cubic feet capacity. The walls were distempered, the ceilings papered with brown paper which was whitewashed, the room had one window, tightly closed, there was no fireplace, and the door fitted fairly tightly. So, it will be observed, in this room there were no means of ventilation. The mean of the three tests, the results of which are given in the table of results, shows the air to contain 0·043 grain of sulphur per 100 cubic feet; and this result was obtained with a gas which contained sulphur varying from 35 to 45 grains per 100 cubic feet. In these experiments, the air was drawn from a point in the centre of the room at a height a little below the burners. In the first test, two incandescent burners were used; in the second, one incandescent burner; and in the third, two ordinary flat-flame burners were employed. In no instance on entering the room after the completion of the test was any odour of sulphur compounds perceptible. The water which had condensed on the window panes was acid. In the series of experiments in this room with unpurified gas, it will be noted that the conditions were such as to throw the entire burden of the removal of sulphur acids on the ceilings and walls and the condensation of moisture; and, from the results, it is at once evident how efficiently these agencies effect this removal.

The details of this series of experiments are given in the table of results under the heading Series V.

Conclusion.

If the results of all these experiments are regarded from the point of view of averages, it will be seen that using gas which contained amounts of sulphur ranging from 14 to 47 grains per 100 cubic feet, the average amount of sulphur found in the air of the rooms is, even under the exceptionally severe conditions of the tests, only 2·64 per cent. of the sulphur discharged into the air by the gas burnt. In other words, instead of every 100 cubic feet of air in the room containing 1·62 grains of sulphur, which would be the case were the sulphur acids not removed, the amount found is 0·043 grain. It will be noted this amount is little above that found in the outside air at the Rose Street flat (about 1/100 of a grain of sulphur per 100 cubic feet); while the estimations of sulphur in Manchester air give amounts which are from three to six times the amount found in the air of the rooms in which

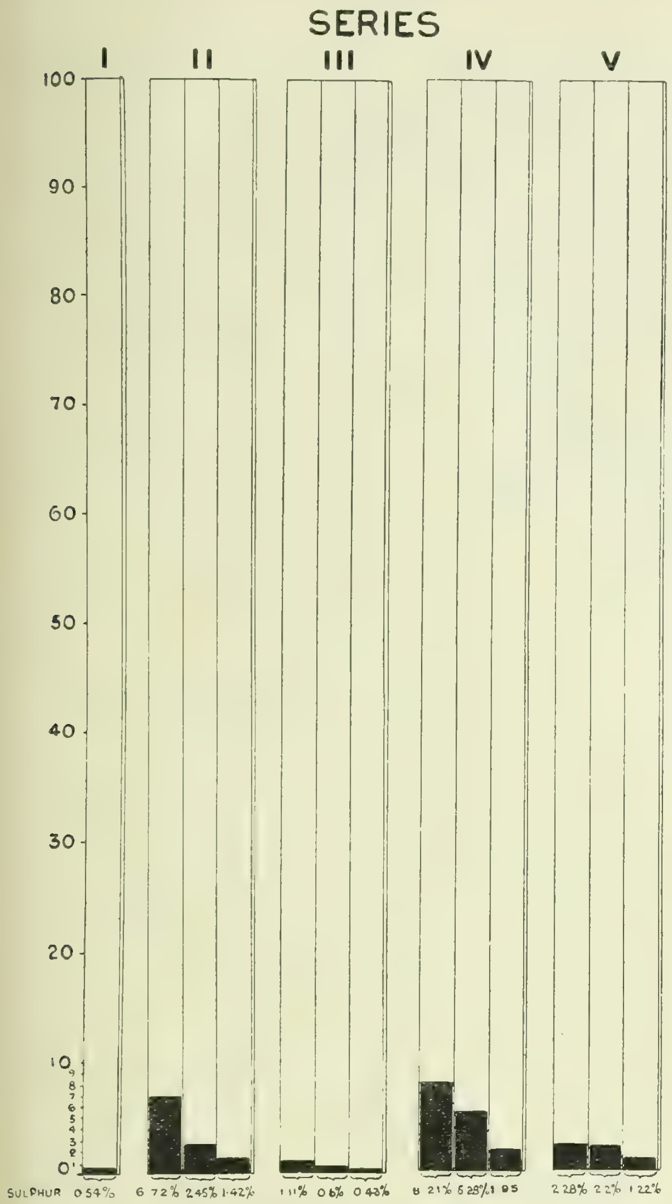


Diagram showing the Percentages of Sulphur obtained upon the Amount introduced into the Room.

the gas had been burning for such lengthy periods. It is abundantly evident that the natural processes affecting the removal of the sulphur compounds are efficient and active, removing as they do 97 per cent. of the sulphur acids produced.

If we assume, for the sake of argument, that in the Rose Street flat we had been using a gas containing as much as 50 grains of sulphur per 100 cubic feet, and, further, that the gas was burnt at the rate of 5 cubic feet per hour and kept burning for six hours —conditions which would represent fairly well the ordinary practice—then, assuming in other respects the conditions of the room were such as obtained in the experiments I have made, calculation shows that the amount of sulphur thrown into the air would be 15 grains. This, diffused through the air of the room, would represent 1·04 grains of sulphur per 100 cubic feet of the air of the room, of which again only 2·64 per cent. would remain in the air of the room to constitute an aërial impurity; and this would therefore be represented by an amount of 0·027 grain per 100 cubic feet, which is less than is found in the outside air. This is a quantity which would be materially reduced in ordinary living conditions, as the natural ventilation produced by a draught of air up the chimney, actuated by the fire in the fireplace, would be in active operation, which was not the case in the experiments detailed above. It is, in fact, evident that the air of living rooms, under any ordinary reasonable conditions of everyday life, is not so polluted by the sulphur acids produced by the burning of coal gas as to be injurious to the inhabitants—a conclusion amply supported by the researches of Mr. O. Hehner and Dr. Rideal to which I have referred.

The diagram represents the results of the several experiments in a graphic form. The scale is such that the columns represent the amount of sulphur thrown into the air by the gas burnt, which is taken as 100, while the black portions show the percentage of sulphur actually found in the air.

A RÉSUMÉ.

The report is accompanied by the following *résumé*: In the burning of coal gas, the sulphur compounds contained in it produce sulphur dioxide and sulphur trioxide, which with water form sulphurous and sulphuricacids respectively. A consequence of the properties of these substances is that they are removed from the air of the rooms in which the gas is burnt, not only by ventilation, but also by the condensation of water vapour, and, further, by absorption by the materials used in the construction of the ceilings and walls of our buildings.

The researches of Mr. Otto Hehner and Dr. Samuel Rideal demonstrated how amply sufficient are these conditions to prevent the sulphur acids, discharged into the air by burning coal gas, from becoming an aërial impurity. Further, that in consequence of this absorption by the materials used in building our houses, the sulphur content of the air in dwelling-rooms is less than that found in the outside air of our towns.

My experiments at the flat in Rose Street, with purified gas, and the experiments at Messrs. Priestmans' works at Ottovale, in which unpurified gas was employed, give evidence in support of the conclusions of Messrs. Hehner and Rideal, affording illustrations of the efficiency with which these causes operate, and demonstrating how small a proportion of the sulphur contained in the gas becomes a source of contamination of the air of a dwelling-room, even when such rooms are practically devoid of ordinary means of ventilation.

In illustration, the test run of Aug. 16 and 17 (*vide* table of results) may be cited. In this instance, the gas used contained 38·71 grains of sulphur per 100 cubic feet; and the gas was continuously burnt in the closed room for $23\frac{3}{4}$ hours. The amount of sulphur thrown into the air during this period was 66·84 grains; whereas the sulphur found in the air was 1·636 grains, or an amount approximately $\frac{1}{40}$th of the quantity expected.

The results of the experiments of Sept. 4, treated similarly, show that using a gas containing 21·5 grains of sulphur per 100 cubic feet, which was burnt continuously for 8 hours 32 minutes, the amount of sulphur discharged into the air was 4·622 grains; whereas the weight of sulphur found was only 0·243 grain—an amount approximately $\frac{1}{19}$th of that expected.

Possibly these results will be more readily appreciated when it is remembered that a grain of sulphur has a volume of $\frac{1}{2000}$th of a cubic inch.

The experiments show how small a proportion of the sulphur of a coal gas becomes an aërial impurity, and consequently how insignificant is the question of whether oxide of iron or lime be adopted as a means of purifying the gas.

PHOTOMETRIC UNITS.

Suggestions by a Committee of the Illuminating Engineering Society of America.

Some time ago, the Committee on Nomenclature and Standards of the Illuminating Engineering Society of America appointed a Sub-Committee to deal with the question of photometric units. At the meeting of the Society at Baltimore in October, the Committee (of which Dr. Alex. C. Humphreys, of New York, is the Chairman) presented a report, in which they stated that they had received from the Sub-Committee a "progress" report in which they suggested certain definitions of photometric magnitudes and units. It was not submitted in time to allow of action being taken in advance of the meeting; but it was laid before the members of the Society with a suggestion by Dr. Humphreys that the proposals contained therein, which, he pointed out, covered questions of vital importance to their profession, should be carefully considered between that and the next annual meeting, in which interval the Committee themselves would, he said, have an opportunity of looking into the subject. The Sub-Committee, in their report, stated that they had continued their work on the lines indicated in their report of Sept. 22, 1909, and, as a result, submitted the definitions referred to. It was acknowledged that they were incomplete and probably open to objection; but the Committee expressed the hope that the material of their report might be subjected to a great deal of critical scrutiny by members of the Society and others, so that, benefiting thereby, they might be better able to frame a final report next year. The following is the text of the report, as given in the "Transactions" of the Society for last month.

Light (flux) is the stimulus produced by radiation which excites vision. It is proportional to the rate of flow of radiant energy and to a stimulus coefficient, which depends chiefly on the spectral distribution of that energy. The presence of a flux of light is recognized by the illumination which it produces. The illumination is proportional to the flux per unit area of the illuminated surface, or to the flux density incident on that surface.

The luminous intensity of a point source of light is measured by the luminous flux per unit solid angle in the direction in which the intensity is taken. Two point sources of light are said to be equal in intensity when they produce equal illuminations at equal distances. Owing to the fact that standardized point sources of light of unvarying intensity are obtainable while it is not practicable to obtain a standardized luminous flux or a standardized illumination without a standardized source of light, the unit of luminous intensity has become the fundamental photometric unit from which the values of the unit of flux, of illumination, &c., are derived—that is to say, the unit of intensity is the fundamental photometric unit, though flux is the fundamental photometric magnitude.

The unit of luminous intensity is the candle. By "candle" is

meant the common candle of Great Britain, France, and America, for which the name "International Candle" has been proposed. The term "candle power" is used as the equivalent of the term "luminous intensity in candles."

The unit of luminous flux is the flux of light produced in a unit solid angle (one steradian) by a uniform source of one candle placed at the apex of the angle. This unit is called the "lumen." The unit of illumination is the illumination which is produced by a flux of one lumen falling on a unit plane area. This is equivalent to the illumination produced by a source of one candle at unit distance. The unit of illumination in the "c. g. s." (centimetre-gramme-second) system is the "lumen per square centimetre." As a practical unit, the millilumen per square centimetre is recommended.

In English-speaking countries, the unit of illumination commonly employed is the "foot-candle" (lumen per square foot). This designation is preferable to "candle-foot." The corresponding metric unit, "metre-candle" (lumen per square metre), is called the "lux" (plural lux). It is desirable that all values of illumination should be expressed in terms of lumens per unit area; the unit of area being chosen in accordance with the requirements of the situation.

By the specific intensity of a luminous surface or body is meant its apparent luminous intensity per unit area expressed in candles per square centimetre of apparent area, or area projected on a plane perpendicular to the direction in which the measurement is made, and including only a surface of small dimensions in comparison with the distance at which the measurement is made. By the specific radiation of a luminous surface or body is meant its total luminous flux per unit area expressed in lumens per square centimetre, or millilumens per square centimetre.

By the mean spherical intensity of a source of light is meant the average value of its intensity as taken in all directions in space. It is equal to its total luminous flux in lumens divided by 4π. By the spherical reduction factor of a source of light is meant the ratio of its mean spherical intensity to its mean horizontal intensity.

The names of these units in the "c. g. s." system, and their mathematical relations to each other, are shown in the accompanying table.

Photometric Magnitudes.		Name of Unit.	Equation of Definition.
1.—Intensity of light or strength of luminous source		(International candle)	$I = \frac{dF}{d\omega}$; $I_s = fI$
2.—Luminous flux		Lumen	$F = 4\pi I_s$; $F = I\omega$
3.—Illumination	Specific flux or flux density	$\frac{\text{Lumens}}{\text{cm}^2}$ of $\frac{\text{Millilumens}}{\text{cm}^2}$	$E = \frac{Fi}{S} = \frac{I}{r^2}$
4.—Specific radiation	Specific flux or flux density; Brightness	$\frac{\text{Lumens}}{\text{cm}^2}$	$R = \frac{Fe}{S} = mE$
5.—Specific intensity	Brightness	$\frac{\text{Candles}}{\text{cm}^2}$	$f = \frac{I}{S^* \cos e}$
6.——		Lumen-hours or lumen-seconds	$Q = FT$

* S refers to surface seen from the point at which I is taken.

International candle abbreviated to C.
International lumen abbreviated to L.
Hefner unit abbreviated to HK, as now used in Germany.
f is the spherical reduction factor of a light source.
ω is a solid angle $= \frac{\text{area on a sphere subtending the angle}}{\text{square of radius.}}$
r is the distance from the light source in centimetres.
m is the coefficient of reflection or radiation ($1 - m$ = absorption).
S is an area in square centimetres.
e is the angle of emission.
i is an angle of incidence.

In the course of the discussion upon the report,

Dr. E. B. Rosa suggested that the meeting should ask the Sub-Committee to present a final report a year hence, and that in the meantime they should be instructed to correspond with certain societies and individuals in Europe with regard to the matter of nomenclature. He pointed out that they had not made any approaches towards Germany or its representatives. If it were possible, by making some slight changes, to get Germany to agree to the nomenclature proposed, it would be of very great advantage. Some of the letters and names proposed were now, and had been, in use in Germany, while others were not in use; and certain of the letters were different from those now employed. It seemed to him that it might be possible to obtain nomenclature more widely international than that proposed was likely to be, without the action suggested. He put his proposal in the form of a motion.

Dr. A. S. M'Allister remarked that, as the report stood, selection had been made of the symbols E and I. He pointed out that E was the well-recognized symbol of electromotive force, and I that of current; and he said it seemed to him that, unless there was some very important reason for using these symbols for photometric quantities, they should not be selected.

Mr. P. S. Millar said Dr. Rosa had spoken of securing international co-operation in the matter under discussion; and he rather intimated that the concurrence of England and France, either official or unofficial, had been secured or promised. The speaker thought it would be interesting to learn whether or not this was the case.

Dr. Sharp said the Sub-Committee had not endeavoured to get any action by foreign bodies on the question. Fortunately, one very influential foreign member was on the Sub-Committee—viz., Professor Blondel, of Paris, who was the originator of the system of units given in the report. His original proposals had been slightly modified by some valuable suggestions emanating from other members of the Sub-Committee; but, fundamentally, they were his. Professor Blondel carried a great deal of weight, more particularly in France; so that it was hoped that the Sub-Committee could influence the French scientists through him. As to England, he believed it was the intention of the Illuminating Engineering Society there to appoint a Sub-Committee or a Committee somewhat similar to their own. He trusted that they would do so, and that the two Committees would be able to co-operate and get a common system of symbols in both countries.

Mr. F. J. Pearson asked if the system selected had for its basis the "c. g. s." system. Were they to use the metric system in calculations, or the English equivalent of it?

Mr. G. H. Stickney pointed out that in the report no mention was made of the unit of specific consumption as used in electrical literature—for instance, the watts per candle power, or something of that sort. He thought that it would be well for them to define such a unit.

Mr. E. L. Elliott asked, in connection with the question concerning the use of I and E, if it would be practicable to use the letter J in place of I. He thought this was the German practice at the present time; and adopting their letter might assist in getting German co-operation.

Dr. Sharp said, with regard to the conflict of new with old symbols, it was not considered that there was sufficient liability for any confusion to arise to discontinue the use of the letters mentioned. E and I had been employed in illuminating work for a number of years; and it was hard to see how anybody could confuse electromotive force with illumination or the intensity of electric current with the intensity of a source of light, as they were so radically different. It might be a good thing to avoid the use of the letters E and I, because they were used for electromotive force and current; but the Sub-Committee had not considered this argument very seriously. As to the use of "c. g. s." system or of the French metric units as against the English, it was to be noted that in the report the English units had been defined, and that the unit of illumination was the only important one that was distinctly English. The lumen was independent of the unit of length. The candle, being the fundamental unit, was the same in all countries; so that this question concerned the units of illumination, specific radiation, and specific intensity only. In the report, the unit of illumination commonly used was referred to as the "foot-candle," which was defined as the lumen per square foot; and the report further set forth that this designation was preferable to "candle-foot." If they were to make a choice, they would prefer foot-candle to candle-foot, as the plural of foot-candle was foot-candles, whereas the plural of candle-foot was candle-feet, which was rather bad. Corresponding reference was made to the metre-candle, and the name "lux" was sanctioned. The significance of this was that they all understood by "lux" 1 metre-candle, and not 1 Hefner-metre. The term "lux" was originally defined in Blondel's work as metre-candle—the candle in that case being the *bougie décimale*, or the one-twentieth part of the platinum unit. The Photometric Congress at Geneva in 1896, to which Blondel's recommendations were presented, adopted the term "lux," as defined in this way—*i.e.*, in the terms of the *bougie-décimale* metre. They knew now that the *bougie décimale* was 10 per cent. larger than the Hefner unit; but the Germans had used "lux," with reference to the Hefner unit placed at a distance of a metre. In France, the term "lux" meant the *bougie-mètre*. In America, too, it was used in that sense, because they had adopted a unit of the same size as the *bougie décimale* as the fundamental unit. Where "lux" was used in reference to the Hefner unit, the qualification "Hefner lux" could be employed. Similarly, in the case of the lumen, the qualification "Hefner lumen" could be used. As to the use of "c. g. s." and English metric units, there was nothing in the report which said that a person must employ one or the other. Use could be made of whichever one was the more convenient; but the report was intended to make concrete and specific those which were employed. There was no chance of confusion. He might point out that the Sub-Committee recommended illumination to be expressed in terms of lumens per unit area. For example, if the illumination was 2 lumens per square foot, it was the same as 2 foot-candles. Thus there was no chance for any confusion. Similarly, if the "c. g. s." system were used, the illumination would be expressed in terms of millilumens per square centimetre—that was to say, 1-1000th of a lumen per square centimetre. It happened that the millilumen per square foot was a unit of about the same size as the foot-candle. However, there was nothing in the report to compel anybody to use either the metric system or the common English system in the expression of his results. With regard to the suggestion of Mr. Stickney, that specific consumption should be defined, he thought it was a good one. He presumed that the Sub-Committee should define specific consumption with reference to gas as well as to electricity; and this matter would receive their attention. As to the suggestion that J should be used for I, he did not know whether or not the members of the Society would like to use J for the intensity of light.

If they would, he was sure there would be no objection. The Sub-Committee desired to make recommendations which would be acceptable to practising engineers of the Society, nd would be very glad indeed to receive advice and instructions.

Dr. Rosa's motion was then put to the vote, and carried.

UTILIZING WASTE HEAT IN WATER-GAS PLANT.

By J. Hawley Taussig, of Philadelphia.

[A Paper read before the American Gas Institute.]

The demand for further economies in the manufacturing departments of the gas business has grown more insistent during the past few years, with the increasing costs of labour and materials and the tendency to lower selling prices. In the manufacture of carburetted water gas, many improvements have been made in appliances designed to facilitate operation and to secure more uniform working conditions. There has been but little practical effort, however, to utilize the considerable quantity of sensible heat which is known to be wasted in the off-going products. While several writers have called attention to this waste and calculated its magnitude, and a number of theoretical discussions have appeared showing some of the economies that might be secured by making use of this heat, yet until within the past few years there has been very little practical work done to effect its utilization.

In the average operation of carburetted water-gas sets, we may expect to find the following heat quantities leaving the apparatus with the products, calculated per 1000 cubic feet of illuminating gas made: In the blast products as sensible heat, 62,400 B.Th.U.; in the illuminating gas, 48,230 B.Th.U.—total, 110,630 B.Th.U. This is assuming that all the carbon monoxide made in the generator in blasting can be burnt and utilized in the fixing vessels. Practically, however, this is somewhat difficult; and we frequently find appreciable quantities of unburnt carbon monoxide in the blast products discharged into the atmosphere. This, of course, results in very considerable loss of fuel. Thus, assuming the blast products to contain 3 per cent. of carbon monoxide, we should have as latent heat of combustion about 21,800 B.Th.U., or the equivalent of 1·5 lbs. of carbon in the off-going products. If this carbon monoxide be burnt, it brings the sensible heat to a total of 132,430 B.Th.U., equivalent to 9 lbs. of carbon. The recovery and utilization of the foregoing large quantity of waste heat evidently afford very promising fields for work when we consider the time and money that have been expended in endeavouring to perfect methods of operation that will reduce the generator fuel consumption by only a few pounds at best.

Since the blast products and the illuminating gas that are leaving the set at an elevated temperature enter the apparatus as air, steam, and oil at atmospheric temperature, or but slightly above it, the first thought would be to preheat them with the outgoing products, and thus prevent the loss of sensible heat from the apparatus, or at least reduce it. This phase of the subject was discussed very fully in a paper read before the American Gaslight Association in 1891 by Mr. Rollin Norris, on "The Theoretical Effect of Preheating Blast, Steam, and Oil in Water-Gas Manufacture."* He showed that but little may be expected from preheating the steam and oil (slightly over ½ lb. of carbon utilized by each), and there are some operating difficulties that might have to be considered; but by preheating the blast he finds promise of considerable saving. His calculations show the following saving on heating the blast to different temperatures: To 500° Fahr., 2·39 lbs.; to 1000° Fahr., 4·07 lbs.; and to 1500° Fahr., 5·39 lbs.

It will be noted that a rather high temperature is required to accomplish much of a saving. While we understand that the preheating of the blast is now in a few cases being successfully carried on at moderate temperatures, yet there are a number of practical difficulties that must be anticipated in case the temperatures were carried high enough to secure the maximum possible saving. These difficulties are the large size and initial cost of the heaters and their high maintenance cost, unless brick-filled stoves were used, which latter, however, would have to be made double. Larger blast openings would be necessary, and very much larger blast piping, which should be fire-brick lined. Increased blast pressures and more power would be required to force the expanded volume through the fuel-bed; and the effect of a highly-heated blast on the grates and on fire conditions and clinkering is somewhat uncertain. Should the temperature of the blast reach 1200° Fahr., which is probably the maximum practically attainable, only about 50 per cent. of the available heat would be absorbed; while the further addition of devices to preheat the steam and oil would raise this figure to about 61 per cent. It seems, therefore, when we consider the complexity of such several combined devices, their probably high aggregate cost, and the care that would be required to keep them in efficient condition, that such methods would not be advisable or practical for routine operation.

On the other hand, if an additional air-blast connection is made at the top of the superheater, so that any carbon monoxide there present in the blast gases may be burnt, and then the blast products and the illuminating gas passed in turn through a properly designed boiler, we at once secure the most complete utilization of the sensible heat in the cheapest, simplest, and most efficient manner. Such boiler, when properly designed, may be placed in almost any position, and elevated above the floor line or placed below it; and it does not require any increase in the size of the building. Its operation is practically automatic, and proceeds with a minimum of labour cost and a maximum of safety and efficiency. It effects a net saving of almost the entire labour and fuel cost of the same horse power ordinary installation in the regular boiler-room. Thus, in a simple, cheap, compact, and convenient form of apparatus, we may recover the greater portion of the total available heat that has heretofore been allowed to pass off into the air, or had to be removed, at considerable expense for plant, labour, and water, in the condensers.

There are several features suggested in the foregoing, in the utilization of heat with boilers, which will be taken up separately. They are: Utilization of sensible and latent heat in blast gases; utilization of sensible and latent heat in illuminating gases; effect on condensation and pumping equipment and water requirement of cooling illuminating gases; and labour saving, and investment costs—*i.e.*, under what conditions it will pay to instal boilers.

Blast Gases.

The temperature of the blast gas leaving the superheater is usually between 1300° and 1400° Fahr. In our calculations, let us assume 1300° Fahr. With a boiler of proper design, its outlet temperature of blast gas would be about 600° Fahr. We should therefore reduce the temperature 700° Fahr.:

$$100 \times 0{\cdot}083 \text{ weight} \times 0{\cdot}275 \text{ spec. heat} \times 700 = 1600 \text{ B.Th.U.}$$

Or the water evaporated from and at 212° Fahr. would be $1600 \div 965 = 1{\cdot}66$ lbs.

In our best practice in making 24-candle power water gas, we use about 2100 cubic feet of air per 1000 cubic feet of gas made; discharging the same volume of blast gas at the stack. This figure, however, is only reached where the best generator fuel is used and the best results are obtained; the average volume of air and of blast products being greater. The heat recovered in this case would be $2100 \times 1600 = 33{,}600$ B.Th.U.; and the evaporation from and at 212° Fahr. will be 34·8 lbs. of water per 1000 cubic feet of gas made. These figures would be increased by 965 B.Th.U., or 1 lb. of water evaporated, for about every 20° rise in the temperature of the gases leaving the superheater, or for every 60 cubic feet of additional air used in blasting the set. We have obtained in actual practice, with good generator fuel conditions, 38 lbs. evaporation (from and at 212° Fahr.) from the sensible heat in the blast gases.

As before stated, the average gas-works run their sets with some carbonic oxide in the blast gases as they leave the superheater. In some cases this is done purposely, in order to be in a position to handle variable quantities of oil in the carburettor. The quantity of heat to be recovered in such a case is calculated as follows: Let us assume, for instance, that there is 3 per cent. of carbonic oxide in the blast gases at the top of the superheater, and that this is burnt before entering the boiler. If we assume that with no carbonic oxide we would use 2100 cubic feet of air, then with 3 per cent. we should require to have about 2175 cubic feet, or 2222 cubic feet of products, in which there would be 66·7 cubic feet of carbonic oxide, weighing 4·93 lbs. The latent heat of combustion of this quantity of carbonic oxide would be $(4{\cdot}93 \times 4368)$ 21,834 B.Th.U. The weight of the products of combustion would be 4·93 lbs. + 12·18 lbs. of air = 17·11 lbs. The heat units of these products that are not absorbed in the boiler would be:

$$17{\cdot}11 \text{ lbs.} \times 0{\cdot}275 \text{ specific heat} \times 650° \text{ Fahr.} = 3059 \text{ B.Th.U.}$$

[It is assumed that the temperature of the gases leaving the boiler will rise, with the increased temperature and volume of the inlet gases, to 650° Fahr.] Heat absorbed from 3 per cent. of carbonic oxide burned, $21{,}834 - 3059 = 18{,}775$ B.Th.U.; evaporation from and at 212° Fahr., $18{,}775 \div 965 = 19{\cdot}5$ lbs.

We can, therefore, expect an evaporation of about 6¼ lbs., from and at 212° Fahr., for each 1 per cent. of carbonic oxide burnt. A waste-heat boiler is an efficient generator of steam, and can always be so used, either in case of emergency or in regular operation, by making excess carbonic oxide. As a rule, however, it would pay, on account of difference in price, to burn boiler fuel instead of generator fuel; but there are many cases, such as a large regular works' boiler working under small load, where it would pay to burn generator fuel.

Illuminating Gas.

The quantity of steam made by passing illuminating gas through a boiler is greater than is generally supposed. This is due to the high specific heat of the gas itself and that of the undecomposed steam which always passes through the generator fire. In carburetted water gas, there are two variables that will affect the quantity of heat to be recovered—the temperature of the gas leaving the superheater and the quantity of excess steam. In our calculations, we will assume a temperature of 1300° Fahr., which is the same as has been assumed for the blast gases. The quantity of steam used in the generator per 1000 cubic feet of gas varies considerably with the kind of fuel and the other operating conditions. With no steam escaping undecomposed, we should require only 16 lbs. per 1000 cubic feet. In practice, however, we seldom get much below 30 lbs. Assuming, therefore, 14 lbs. of excess steam, and a temperature of 500° Fahr. at the boiler outlet, we should absorb from the excess steam:

$$14 \text{ lbs.} \times 0{\cdot}55 \text{ spec. heat} \times (1300° - 500°) = 6160 \text{ B.Th.U.,}$$

* See "Journal," Vol. LVIII., p. 1180.

or an equivalent evaporation, from and at 212° Fahr., of 6·4 lbs. We can thus expect to recover in evaporation 0·46 lb. of steam per pound passing undecomposed through the generator fire.

The total weight of 1000 cubic feet of 24-candle power water gas and tar vapour (exclusive of undecomposed steam) is about 59·5 lbs. Therefore the heat absorbed in the boiler would be:

$$59{\cdot}5 \text{ lbs.} \times 0{\cdot}49 \text{ spec. heat} \times 800^\circ = 23{,}320 \text{ B.Th.U.},$$

or an equivalent evaporation of 24·2 lbs. The total evaporation under these conditions would be $24{\cdot}2 + 6{\cdot}4 = 30{\cdot}6$ lbs. There would be an additional evaporation of 1 lb. for every 33° Fahr. rise in temperature at the outlet of the superheater. In practice, we get an evaporation of about 32 lbs. from the illuminating gas.

Condensation.

The lowering of the outlet temperature of the illuminating gas by the use of a waste-heat boiler has a very important effect on the subsequent condensation of the gas. Since the highly-heated gas from the take-off pipe passes over water in the washbox, it is cooled to a considerable extent by the latent heat of the water absorbed, and leaves the box approximately saturated. Knowing the initial temperature of the entering gas and water in the box, we may calculate very closely the final temperature of the gas as it leaves.

Assuming inlet temperatures of 500° and 1300° Fahr. as representing the average observed with and without a boiler, and a water temperature of 150° Fahr., we should have outlet temperatures of 165° and 183° Fahr. respectively. Direct observation has given results slightly higher by a few degrees; but we believe this is caused by the very rapid flow through the washbox, resulting in some of the gas passing off in a partially saturated condition. However, as far as the heat quantities are concerned, the calculated temperatures may be taken to be very closely correct.

Assuming, then, that we shall have to condense the gas to 100° Fahr., the following data will show the effect of lowering the initial temperature by the use of the waste-heat boilers on the volume of the gas to be handled, the heat to be extracted, and the water taken up in the washbox, calculated for 1000 cubic feet of gas.

Inlet Temp.	Outlet Temp.	Volume Cub. Ft.	Water Absorbed.	Total Heat Above 100° Fahr.	
1300°	183°	2662	5·02 galls.	58,138 B.Th.U.	without.
500°	165°	1849	1·50 ,,	27,838 ,,	with.
..	18°	813	3·52 galls.	30,300 B.Th.U.	
Reductions of		30·5 p.c.	70 p.c.	52·2 p.c.	

While the saving in water supply to the washbox is of rather small moment, the reduction in volume of the gas would permit the installation of plant of 30 per cent. more gas-generating capacity without increasing the size of the works connections to the relief holders; while the reduction by upwards of 50 per cent. of the total heat to be extracted in the condensers would effect considerable saving in the cost of condensation, installation, and pumping plant. The saving in condenser water alone in some plants where the water must be paid for would amount to a considerable figure, especially during the summer months.

Summary.

Though the minimum theoretical evaporation from both blast and illuminating gases, as calculated in the foregoing, is only 65 lbs., in a number of tests of boilers utilizing both gases none gave less than 70 lbs. of water from and at 212° Fahr. per 1000 cubic feet of gas. It is, therefore, conservative to assume an average evaporation of 70 lbs. per 1000 feet in figuring the actual saving in boiler fuel. Assuming an evaporation in works' boilers of 8 lbs. of water from and at 212° Fahr. per lb. of coal, 70 lbs. of water are equivalent to 8·75 lbs. of boiler fuel per 1000 feet, which, with coal at $3 per net ton, is worth 1·3 c. per 1000 feet. Besides this, there is a saving in boiler firing, labour, &c., which we will assume to be 0·2 c. per 1000; and this added to the above gives a total saving of 1·5 c. per 1000 feet. This means $15 per million cubic feet per day capacity of the set, or, assuming a set runs for 300 days, a saving of $4500 per annum, or equivalent to $4·50 per 1000 cubic feet of daily capacity.

Though the cost of a waste-heat boiler installation will vary with local conditions, it is conservative to estimate such an average cost at $8 per 1000 cubic feet per day capacity of the set. If the installation were run to its full capacity of 22 hours (exclusive of cleanings) each day for 300 days, we would save 56 per cent. of the investment in one year; if to half its capacity, or 11 hours daily, 28 per cent.; or to earn 15 per cent. interest and depreciation, it needs to be operated only about 6 hours daily.

When an extension is made to a plant, or a new plant is erected, waste-heat boilers will displace, to a considerable extent, the usual works' boiler plant. Such plant would cost about $25 per horse power, or, assuming that it requires 0·12-H.P. per 1000 cubic feet daily capacity to operate a water-gas set, $3 per 1000 cubic feet of daily capacity. This, of course, does not include any reserve boilers. It is evident that a certain amount of reserve must be provided for either the waste-heat boilers or the regular works' boilers; and the same reserve would be sufficient in either case. Therefore, in a new boiler plant or in an extension we could deduct from the investment cost of the waste-heat boilers this amount ($3) per 1000 cubic feet capacity per day; making our total net investment only $5 per 1000 feet per day. Under these circumstances, the installation would be paid for in a year.

There are few progressive gas managers who would not go to the considerable trouble and expense to save (say) 6 lbs. of generator fuel or ½ gallon of oil per 1000 cubic feet; but, for some reason or other, a saving of equivalent boiler fuel does not seem to appeal to them. Why is this? The only reason the writer can see is that there are standards for oil and generator fuel efficiencies, but equally none definite for boiler fuel. This matter is, however, certain to receive in the future the much greater attention which it deserves. The adoption of the methods above presented is capable of giving a boiler coal consumption of from *nil* up to 5 lbs. per 1000 cubic feet, instead of the high quantity of 10 to 20 lbs. at present often required.

AMERICAN COMMERCIAL GAS ASSOCIATION.

Annual Meeting in Boston.

The Sixth Annual Meeting of this Association was opened in the Mechanics' Building, Boston, on the 6th inst., and closed the following Friday. In connection with it, an exhibition of gas appliances was held, which was continued till the 13th inst. There was a large attendance.

After the meeting had been opened by the President (Mr. E. N. Wrightington, of Boston), the report of the Directors was submitted by Mr. W. J. Clark. It was stated therein that in the course of the twelve months covered by it the membership had increased by upwards of 1000, and that the total now exceeded 2000. The Chairmen of several Special Committees reported progress; the work of the Illumination Committee being conspicuous in the lighting of the building in which the meeting was held and its approaches. The statement presented by the Treasurer (Mr. P. S. Young) showed the Association to be in a very flourishing condition. The routine business having been disposed of, the President delivered his Inaugural Address, in which he dealt successively with the numerical progress of the Association, the work of its various Committees, the question of amalgamation with the American Gas Institute, illuminating engineering, municipal ownership, the taxation of gas companies for the use of the streets, public regulation and control, and the sliding-scale. In conclusion, he said the Association had a great future before it; and he thought it was no stretch of the imagination to look for a membership of 5000 by the time of the next annual meeting. The address was received with many expressions of approval.

After the disposal of a few other matters, the office-bearers for the ensuing year were elected as follows:—

President.—Mr. C. N. Stannard, Denver (Col.).
Vice-Presidents.—Mr. L. S. Bigelow, Buffalo (N.Y.), Mr. Glenn R. Chamberlain, Grand Rapids (Mich.), and Mr. R. C. Frampton, Pittsburgh (Pa.)
Treasurer.—Mr. P. S. Young, Newark (N.J.).
Secretary.—Mr. Louis Stotz (N.Y.).

Mr. Stannard expressed his thanks for his election; and it was announced that the meeting next year would be held in Denver in December. This brought the morning sitting to a close.

In the afternoon, the following papers were read: "Manufacturers' Paper," by Mr. W. T. Barbour, of Detroit; "Compensation of Representatives," by Mr. J. D. Shattuck, of Chester (Pa.); and "Service," by Mr. C. W. Hare, of Philadelphia (Pa.). These and the discussions to which they gave rise occupied the members till five o'clock, when they proceeded to visit the exhibition, in which there were about sixty participants. Though not so large as that held in New York last year, it is stated to be very creditable to the care and skill of those who arranged it.

The second day's proceedings opened with a paper on "All-Gas Hotel Kitchen," by Mr. C. R. Graves, of Atlantic City. This was followed by one on "Industrial Fuel," by Mr. A. V. Wainwright, of Philadelphia. After the midday interval, a paper on "Lighting and Fuel Maintenance," by Mr. F. J. Rutledge, of Philadelphia, led to a good discussion. The day's proceedings closed with a lecture, illustrated by lantern slides, on "Illumination," by Mr. Norman Macbeth, of Gloucester (N.J.).

The remaining papers on the programme were: "Rates," by Mr. Henry L. Doherty, of New York; "A Travelling Salesman's Views of the Commercial Department," by Mr. H. L. Schutt, of Buffalo (N.Y.); "Water-Heaters," by Mr. R. C. Frampton, of Pittsburgh (Pa.); "Relations with Customers," by Mr. V. A. Henderson, of Memphis; and "Office and Accounting Methods," by Mr. Harry Hughes, of Denver (Col.).

Opportunity will be taken for noticing some of these papers at greater length in subsequent issues.

An Air-Cooled Gas-Scrubber.—Mr. W. M'Arthur, of Tenino, Washington, has taken out a patent in the United States for an air-cooled scrubber. From an abstract of the specification contained in the "Journal of the Society of Chemical Industry," the apparatus comprises a cylindrical casing divided by three horizontal plates into four chambers—viz., an upper conical hood connected with a smoke-stack, a central chamber containing coke, a drainage chamber, and an air chamber at the bottom. The middle plate is perforated, and pipes connecting the air chamber with the hood pass completely through the central chambers. The gas to be scrubbed enters the drainage chamber, and passes up through the coke and out through a pipe opening near the top of the coke chamber.

REGISTER OF PATENTS.

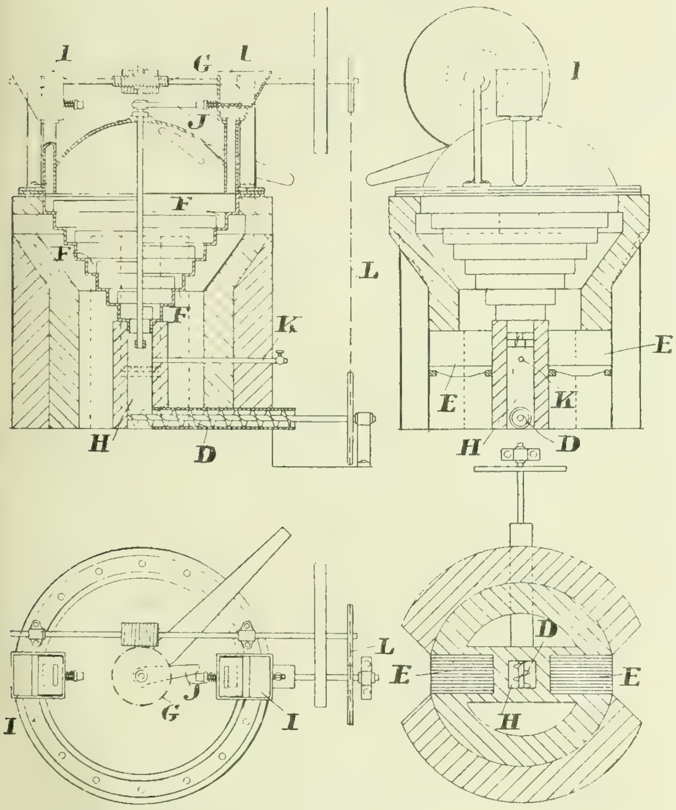
Distilling Shale and Other Bituminous Substances.

NOAD, J., of East Ham, Essex.

No. 18,334; Aug. 9, 1909.

This invention has for its object "to ensure the gradual and uniform heating of the shale or the like being treated, and to avoid the uneven heating which occurs at the sides and centre of the customary vertical retorts, and the difficulties of firing incidental to the use of horizontal retorts."

The retort or still has sides of a stepped cylindrical formation, and is arranged with its widest diameter uppermost and its smaller diameter lowermost; so that its inside presents a series of horizontal, or approximately horizontal, concentric ledges. The retort is set in the combustion chamber or flue of a furnace so that the outside of the retort is exposed to the heat—the lowest part of the retort being subjected to the greatest heat. Inside the retort are arranged rotary rakes or arms to sweep round the ledges and gradually work the substance under treatment (which is fed on to the highest ledge through suitably placed hoppers) downwards from ledge to ledge. The exhausted shale is discharged at the bottom of the retort, and the vapours as evolved are led off from the still-head to condensing apparatus, wherein the products are recovered. The substance under treatment is thus caused to take a prolonged path in descending through the retort to the discharge outlet, and "its whole mass is gradually and evenly subjected to the increased temperature."



Noad's Vertical Retort for Shale Distillation.

The illustrations are two sectional elevations at right angles to each other, and a plan and sectional plan.

The retort, of stepped cylindrical formation, is set in a fire-brick chamber, having its upper inside part of inverted conical formation, and its lower inside part of cylindrical formation; so that a combustion space or flue is left between the retort and the chamber wall. The retort is made with a central discharge at its lower end leading into a pit H, fitted with a conveyor D for removing the spent shale from the apparatus. Furnaces E are fitted on each side of the pit, and underneath the combustion or flue space for heating the retort, and are connected to a chimney (not shown). F are rakes or arms mounted on a vertical shaft passing axially through the retort and supported in upper and lower bearings, and driven externally by a worm wheel G and worm in any convenient manner. The shaft is adapted to drive the conveyor, by wheels or pulleys and a chain or belt L, at a suitable speed. I are hoppers for feeding the shale into the retort, furnished with slides or other arrangement for ensuring a regular supply of the substances to be treated, which is preferably broken up before being introduced into the retort. The slides are normally closed by springs, and are adapted to be moved inwards so as to uncover the openings in the hoppers by a rotary arm J on the shaft. Steam may be fed into the lower part of the retort through a pipe K, to aid in conveying the oil vapours from the head of the retort, and, by becoming superheated, to aid in heating up the substance in the upper part of the retort.

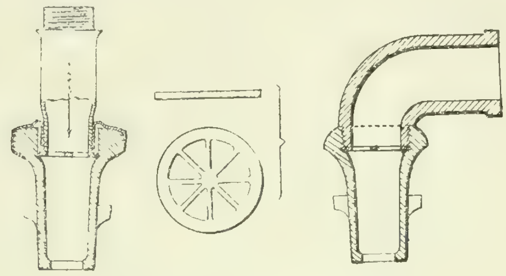
Inverted Incandescent Gas-Burners.

ROSE, A., and BELLAMY, W., of Birmingham.

No. 27,868; Nov. 30, 1909.

This invention is designed to effect a proper and efficient mixing of the gas and air in the mixing-chamber of the burner before issuing at the outlet nozzle, and thus "a more perfect combustion and better light are obtained."

There is provided in the mixing-chamber of the burner, a perforated diaphragm of the type having radial slots and a solid central boss; the diaphragm being fixed within the nozzle and between the inlet and the outlet ends of the burner. It is retained in the nozzle at a short distance above the outlet end of the burner by the inturned end of the usual metal mount pressing the diaphragm on to a seating or flange formed within the interior of the nozzle, or by the diaphragm being inserted within the nozzle before the nozzle and upper portion of the burner (which are of earthenware) are fixed and fired together, so that as the air and gas pass through the perforations in the diaphragm they are properly mixed together.



Rose and Bellamy's Inverted Burner.

The illustration shows a part sectional elevation of so much of the burner as is necessary to illustrate the invention, together with an elevation and plan of the perforated diaphragm part of the burner drawn on an enlarged scale; also a sectional side elevation of another kind of inverted incandescent burner with the invention applied to it.

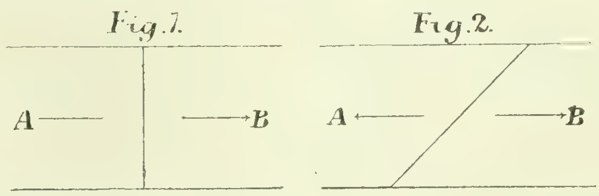
Joints for Gasholder Tanks.

ROBERT DEMPSTER and SONS, and H. J. TOOGOOD, of Elland.

No. 26,964; Nov. 20, 1909.

The patentees claim "the application to the construction of the tanks of gasholders of inclined or diagonal joints." They point out that the radial or bursting pressure of the water at the bottom of such tanks being considerable, the walls are necessarily made thick and strong; and the strength of the vertical joints between the plates forming the wall being naturally less than the average strength of the whole plate, the plate "is usually made of a thickness in excess of that which would suffice if the loss of strength at the joints could be reduced."

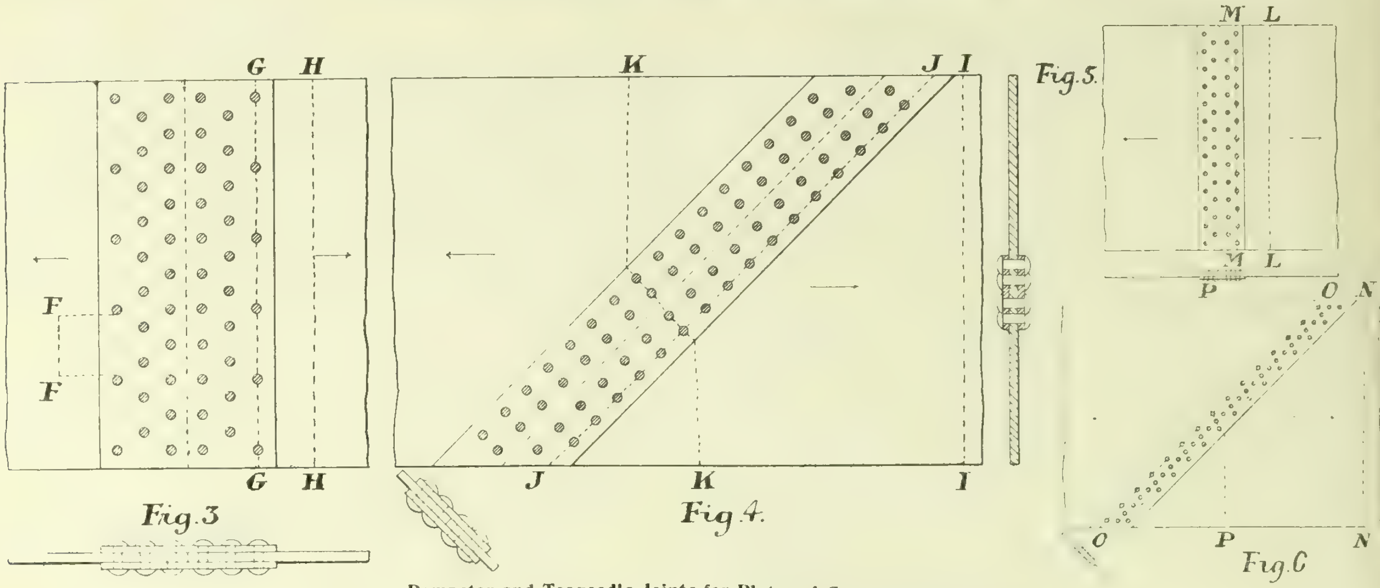
They propose, therefore, to form the joints at an angle to the vertical —of (say) 45 degrees—thereby obtaining a greater length of meeting surfaces of the plates in comparison with a vertical joint; and as a consequence, rivets occupying the same total area can be accommodated with less reduction of the strength of the plates at the joint. Since the forces tending to sunder the plates act horizontally, or at right angles to a vertical line drawn through any rivets in the joint which are placed directly over one another, in a vertical joint an entire row of rivets forms a line of weakness, while in an inclined or spiral joint such a line of weakness only extends through one rivet in each row—that is, in the case of three rows of rivets, through three rivets only. By this means, lighter plates may be used, with equal strength at the joints. Also, simple and cheaply-constructed lap or simple butt joints may replace the complicated butt joints now necessary in the case of large tanks; and "the force of the wind blowing against one side of the tank and holder, instead of exerting a strain upon the line of the joint, exerts a strain across the joint at an angle of 45 degrees." The slight bending of the plates which occurs parallel to a vertical lap joint "being thus distributed or obviated, the localized corrosion of the plates due to such bending is also obviated."



Figs. 1 and 2 are diagrams of joints set at angles of 90 degrees and 45 degrees respectively. Fig. 3 is an example of an ordinary vertical butt-joint suitable for the lower plates of the tank of a large gasholder. Fig. 4 shows the patentees' diagonal or spiral joint applied to plates in a similar situation. Fig. 5 is an example of an ordinary vertical butt-joint as at present used for the higher plates of such a tank. Fig. 6 is a lap joint, which, according to this invention, can be substituted for the butt-joint shown in fig. 5.

In such structures as the tank of a gasholder, the patentees point out, the joints are principally required to resist the radial pressure tending to expand the tank, and therefore tending to sever each plate from its neighbours laterally—that is, the disruptive forces act almost entirely (as indicated by the arrows in figs. 1 and 2) across the joint represented in fig. 2 at an angle of 45 degrees above and 135 degrees below at one side, and 135 degrees above and 45 degrees below at the other side. The joint in fig. 2 is therefore much the stronger of the two, in proportion to thickness of metal, as will be obvious upon a calculation of the comparative shearing resistances of the joints detailed in figs. 3 and 4.

In the typical joint (shown for purposes of comparison) fig. 3, the plates are $1\frac{1}{2}$ inches thick, with double butt-straps treble riveted; the rivets appropriate for a plate of this thickness being of $1\frac{5}{8}$ inches diameter. The holes drilled for the rivets are 1·69 inches diameter; so that the diameter of the rivets after closing will be 1·69 inches, and the area occupied by each rivet $2\frac{1}{4}$ square inches. The tenacity of the



Dempster and Toogood's Joints for Plates of Gasholder Tanks.

plates may be taken as being 28 tons per square inch; the resistance to shearing of the rivets at 21 tons per square inch; and the crushing resistance of the rivets (say) 1¾ times the shearing resistance, or 37 tons per square inch. In order to obtain the maximum efficiency of the joint, the portion F F of the plate between two rivets in the outer row should be equal in strength to five rivets in double shear—namely, three rivets and four half-rivets. The calculation necessary for obtaining the length of the line F F is as follows:—

Rivets 5 × 2·25 × 21 × 2 — 472.

Plate $\dfrac{472}{28 \times 1\cdot5} = 11\cdot24 =$ F F.

Therefore, to obtain the maximum efficiency of this joint, the pitch of the rivets should be 11·24 + 1·69 = 12·93, or (say) 13 inches. In practice, however, with rivets at so great a pitch, the plates could not stand the caulking necessary in building such tanks to make them watertight and keep them so for a number of years against the pressure caused by a head of water of (say) 40 feet, in a tank which may be 200 feet or more in diameter, *plus* the effect of the straining of the holder in a storm. Hence the pitch of the rivets in the outer row should not be greater than (say) 11½ inches; and the strength of the joint along the line G G is thus reduced below 84 per cent. of the strength of the plate along the line H H. This is demonstrated by the following calculation, in which the plate on the line H H is assumed to measure 62½ inches, and on the line G G (after deducting six rivets each of 1·69 inches diameter), 52·36 inches:—

Plate at H H: 62·5 × 1·5 × 28 = 2625 tons = 100 per cent.
Rivets in double shear: 27 × 2 × 2·25 × 21 = 2551 tons = 97 per cent.
Resistance of rivets to crushing: 27 × 1·69 × 1·5 × 37 = 2532 tons = 96 per cent.
Plate at G G: 52·36 × 1·5 × 28 = 2198 tons = 83¾ per cent.

Or, approximately, five-sixths. So that, as the strength of the tank is the strength of its weakest points—*i.e.*, the joints—these 1½-inch plates with vertical joints would only be equivalent to 1¼-inch plates with joints of 100 per cent. or greater efficiency.

Fig. 4 represents diagonally jointed plates which are assumed to be only 1¼ inches thick, with double butt-straps ⅞ inch thick and double (instead of treble) riveted. The rivets are in this case of 1⅜ inches diameter, or 1·43 inches after closing; each rivet then having an area of 1·61 square inches. The pitch of the rivets is 5 3/16 inches only. The strength of this joint may be calculated as follows:—

Plate at I I: 62·5 × 1·25 × 28 = 2187 tons = 100 per cent.
Rivets in double shear: 33 × 2 × 1·61 × 21 = 2231 tons = 102 per cent.
Resistance of rivets to crushing: 33 × 37 × 1·43 × 1·25 = 2183 tons = 100 per cent.
Plate at J J: 65·5 × 1·25 × 28 = 2293 tons = 105 per cent.
Strength at K K—
Plates: 61·25 × 1·25 × 28 = 2144 tons = 98 per cent. } 2648 tons =
Butt straps: 10·28 × 2 × ·875 × 28 = 504 tons = 23 per cent. } 121 per cent.

It will thus be seen that whereas the joints represented in fig. 3 are the weakest parts of the tank, those represented in fig. 4 will be the strongest parts of the tank (the metal between the rivets being stronger than the cross-section of the plate itself), and approach much more nearly to the ideal of the perfect oint, which should be of a strength equal to that of the plates it joins. The structures in figs. 3 and 4 being of practically equal strength, the advantages on the side of the latter include a saving in weight of one-sixth, or (say) 15 tons in the bottom row of plates alone in a 200 feet tank, and a saving in drilling and riveting of 10 per cent. The butt-straps are also, in fig. 4, more fully utilized to stiffen the tank.

In the typical joint represented in fig. 5, the plates are assumed to be 4 ft. 6 in. across and ⅞ inch thick; and as ¾ inch, or in some cases ⅞ inch, is generally considered to be the limit of thickness up to which efficient lap joints can be made, these plates would require a butt-joint, which is shown with double butt-straps and double riveted; the 1 inch rivets being, when closed, expanded to 1·04 inches diameter, and each occupying an area of 0·85 inch. The strength of the joint is ascertained as follows:—

Plates at L L: 54 × ⅞ × 28 = 1323 tons = 100 per cent.
Rivets in double shear: 25 × 2 × ·85 × 21 = 892½ tons = 67½ per cent.
Resistance of rivets to crushing: 25 × 1·04 × ·875 × 37 = 842 tons = 63½ per cent.
Plate at M M: 40½ × ⅞ × 28 = 992 tons = 75 per cent.

This ⅞ inch joint being of only 67½ per cent. of the strength of the plates (leaving out of consideration its resistance to crushing), the structure is only equal in strength to one built of 19/32 inch plates with joints of 100 per cent. or greater efficiency. Plates of the latter thickness are suitable for lap joints, as illustrated in fig. 6, which is triple riveted with 15/16 inch rivets (0·975 inch when closed, ¾ inch area) and of the following strength:—

Plates at N N: 54 × 0·594 × 28 = 898 tons = 100 per cent.
Rivets in single shear: 59 × 0·75 × 21 = 929 tons = 103½ per cent.
Resistance of rivets to crushing: 59 × ·975 × 37 × ·594 = 1264 tons = 140 per cent.
Plate at O O: 61·7 × 0·594 × 28 = 1022 tons = 114 per cent.
Plates at P P: 57 × 0·594 × 28 = 948 tons = 105½ per cent.

In this last joint, there are 118 holes to drill, of 15/16 inch diameter, as compared with 150 holes of 1 inch diameter in the joint shown at fig. 5—the lap-joint thus effecting a saving of 40 per cent. in drilling area.

It is to be noted that the broken lines K K in fig. 4 and P P in fig. 6, which might otherwise be the lines of least resistance to disruption, pass through the butt-straps and the lap respectively; so that the strength of the butt-straps and of the cross section of the lap are added to the resistance, and the strength on the lines is thereby increased to over 100 per cent. of the strength of the solid plates.

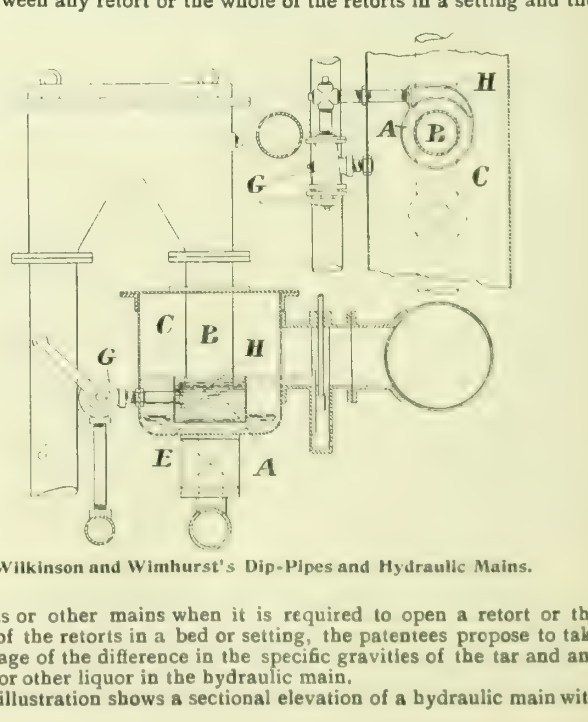
In building spirally-guided gasholders, the patentees say that the strength of the tank must be relied upon to provide adequate resistance against wind pressure acting on the holder. It is obvious that the force of the wind acting against one side of the vertical circular metal wall tends to flatten that side; and, in fact, an imperceptible flattening, with a corresponding expansion in width preserving the full perimeter of the wall, does take place. Such movements—increasing or reducing the curvature of each curved plate—act longitudinally of each plate, and therefore at right angles to vertical joints; "every vertical joint in the structure becoming a line of weakness at which the bending principally occurs."

Dip-Pipes and Hydraulic Mains.

WILKINSON, H., and WIMHURST, F. L., of Cambridge.

No. 30,244; Dec. 28, 1909.

To facilitate the flow of gases from the retort to the foul gas or other mains, and also to provide ready means of closing direct communication between any retort or the whole of the retorts in a setting and the



Wilkinson and Wimhurst's Dip-Pipes and Hydraulic Mains.

foul gas or other mains when it is required to open a retort or the whole of the retorts in a bed or setting, the patentees propose to take advantage of the difference in the specific gravities of the tar and ammonia or other liquor in the hydraulic main.

The illustration shows a sectional elevation of a hydraulic main with

one dip-pipe and the position of the chamber A and three-way cock G, the means for lowering the level of the liquor in the chamber A to unseal the dip-pipe B; also a part sectional plan showing how the liquor is conducted by way of the three-way cock from the hydraulic main C into the chamber A, so sealing the dip-pipe.

The means adopted consist of providing a large chamber A having attached to it a small side chamber H (which has a sloping bottom) for each dip-pipe. The chamber H communicates with A by a weir provided to allow the ammonia or other liquor being quickly drawn off to a definite level below the extremity of the dip-pipe B. The sloping bottom on the smaller chamber is to allow a cleaning rod to be used when removing a stoppage.

The larger chamber A is open top and bottom, surrounding each dip-pipe B, and so fixed as to allow free communication of the tar E to the interior. The liquor in the hydraulic and exterior to the chamber A is maintained at a constant level by any of the usual means.

The tar E, which (by reason of its higher specific gravity) is in the lower part of the hydraulic, is kept at a suitable level below the extremity of the dip-pipe and above the lower edge of the chamber A.

A three-way cock G is provided for raising or lowering the level of the liquor in the chamber A, so that the extremity of the dip-pipe may be sealed or unsealed. The liquor used to raise the level in the chamber A and to seal the extremity of the dip-pipe is taken from that which is exterior to the chamber.

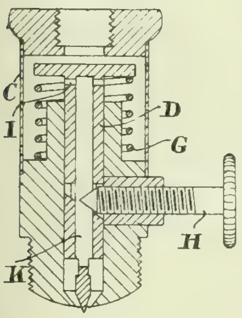
When the liquor floating on the top of the tar in the chamber A and sealing the dip-pipe is drawn off by way of the three-way cock (connected to a waste-pipe), the dip-pipe is unsealed; and owing to its higher specific gravity, the tar does not rise sufficiently high in the chamber A to seal the dip-pipe.

Gas-Burner Regulators.

Grüder, Blank, and Co., G.m.b.H., of Berlin.

No. 10,907; May 3, 1910.

According to this invention, the interior of the nozzle is shut off from the gas-conduit by the head of the controlling cylinder in one of its terminal positions. The body of the nozzle stands in communication with the inlet pipe through the tube C. In the nozzle is a controlling cylinder D, against the head of which presses the spring G. The controlling cylinder is pressed down by the screw H against the action of the spring; the conical end of it sliding on a slanting surface of the cylinder. In the upper terminal position of the cylinder, its head is pressed against the bottom surface of the inlet piece; so that in this position the interior of the nozzle is shut off from the gas inlet. The screw H can therefore be screwed entirely out of the controlling body without the gas streaming out of the opening. In the middle positions of the cylinder, the gas streams out of the inlet into the tube E; and from there, through the openings I and the cavity K in the cylinder D, to the opening of the nozzle.



Gruder-Blank's Gas-Burner Regulator.

Pyrophoric Metal Alloys.

Beck, H., of Oberhausen, Germany.

No. 2876; Feb. 5, 1910. Date claimed under International Convention, Feb. 5, 1909.

It is known, the patentee remarks, that alloys of rare earth metals with iron (which metal can also be partly replaced by nickel, cobalt, or manganese) show a high degree of pyrophoric power. The alloys have already been used for kindling and illumination in technical industries in consequence of their intense spark and flame formations, which are produced by friction. By reason of the well-known alloying capability of cerium-metal with mercury, it will be also possible, he points out, to produce pyrophoric cerium-mercury-alloys. The pyrophoric capacity of these alloys containing cerium to the amount of 10 to 16 per cent. gives them the remarkable power of igniting by themselves solely through the influence of the oxygen in the air, so that mechanical ignition will not be necessary. If an alloy of the above-mentioned composition comes into contact with the air, an intense glow appears in a very short time, while the cerium will be burnt and the mercury evaporated.

The experiments which he has made in this direction show that the pyrophoric state of the alloys of cerium and mercury takes another form as soon as the percentage of cerium exceeds 40 per cent. With this increase of cerium percentage, the alloy spontaneously burns in the air "with great spluttering and intense formation of sparks, whereby an exceedingly brilliant illumination is produced." The intensity of the spark formations increases as the proportion of cerium rises, until it reaches its maximum with about 80 per cent. of cerium. A further increase of the cerium percentage weakens the pyrophoric power of the alloy, and with this strong cerium alloy quick decomposition takes place under development of heat and evaporation of the mercury. However, the heat is not sufficient to produce a glow or a spark or spluttering of the alloy.

The alloys of other rare earth metals with mercury, which similarly are most active with a percentage of mercury from between 60 per cent. down to 20 per cent., show the same pyrophoric action as the alloy before mentioned. It is consequently not necessary to use the very expensive pure rare earth metals for the practical application of these pyrophoric alloys. "The use of a mixture of rare earth metals is rather to be recommended for practice; such mixtures being readily obtained commercially."

The alloys are made in the following manner: The rare earth metal in a finely-divided form—*e.g.*, as very fine chips—is heated under exclusion of air in mercury vapour to 500° to 600° C. The metal under these conditions easily alloys with the mercury; the amount of mercury entering into the alloy depending upon the length and intensity of the heating within the prescribed temperature limits. As the alloys ignite solely in the presence of air, and in burning produce intense spark and flame formations, they can be utilized for the kindling of combustible gases and other inflammable materials. The only requisite for practical preservation of the alloys is to keep them air-tight, which can be done without difficulty with the simplest contrivances. The igniting can take place at any moment by the admittance of air.

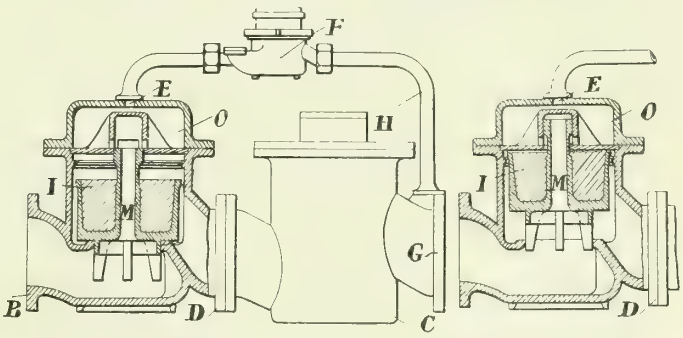
Change-Over Valves for Water-Meter Connections.

Siemens and Halske Aktien-Gesellschaft, of Berlin.

No. 15,960; July 4, 1910. Date claimed under International Convention, July 15, 1909.

This invention relates to change-over valves for water-meter connections, which serve to direct the flow of a water supply (which may vary considerably in volume) either to a large or to a small water-meter, according to the amount to be measured.

The general action of the device is that a loaded valve shuts off the entrance to the large meter and opens the way to the small one; but if the volume of the supply increases, the valve will be raised, in consequence of pressure differences, and will open the entrance to the large meter. In order that, on the one hand, the valve should lift at a definite pressure and, on the other hand, to avoid too much pressure loss through the valve, mechanically-operated balancing arrangements have been devised, by which the valve is heavily loaded in its closed position, and this load is gradually compensated while the valve is being raised. This method is not free from objection, the patentees point out, since the valve, if balanced so as to be almost free from any force tending to close it, may easily stick in its highest position, in consequence (for instance) of impurities in the water, and so fail to bring about the desired change over. To avoid this, such valves have been made very heavy, which, again, has led to the disadvantage that, owing to the weight, a loss of pressure occurs, which considerably diminished the efficiency of the whole arrangement.



Siemens and Halske's Change-Over Valve for Water-Meters.

The present invention provides a middle way, since at the moment of lifting it brings about a reduction of the load on the valve by means of the loss of pressure due to the water flowing through the valve-seating and, consequently, lessens the pressure loss occasioned by this weight, while before the fall of the valve the balancing effect is removed and the weight of the valve acts unbalanced for the purpose of closing it. The valve movements are accordingly "energetic," and it is impossible for it to stick.

This result is obtained in the present invention by causing the difference of pressure at the entrance and exit from the large meter (which difference is due to the flow through the latter) to take effect above and below the body of the valve, and to give rise to an upward thrust on the valve which varies with the volume of flow at any instant.

This is brought about, in practice, by connecting the upper part of the valve casing (as shown) by means of a conduit to the small meter and to the discharge side of the large meter, and arranging that the valve, as it moves to the upper part of the casing, should shut off this part from the space leading to the large meter. Consequently, the upper part of the valve body is exposed to the pressure existing at the exit of the large meter; the lower part of the valve, to the entrance pressure. Then, since the pressure loss in the meter varies according to the strength of the flow through it, the balance of the valve will also be adjusted according to the supply. The gradation of the balance will depend upon the dimensions given to the upper surface of the valve body.

In order to prevent the valve from oscillating up and down when the water supply is excessive, and also to prevent the valve from being driven upwards with too much force at any sudden increase in the output, it can be arranged that the water shall find a path shortly before the valve reaches its highest position through the small meter, and set it in action, although it is not otherwise acting during the operation of the large meter. This not only increases the capacity of the system, but a pressure equilibrium is reached which prevents any excessive upward force and allows the valve to take a position of equilibrium in which it "floats."

In the illustration, a change-over valve is shown in connection with the other parts of such a combination, in which, by way of example, devices are arranged to work according to the above-described method. The valve-casing is provided with three orifices opening outwards, the inlet branch B, the outlet branch D leading to the large meter C, and the opening E, to which is connected the conduit H leading to the small meter F and, further on, to the exit branch G. Inside the casing is the cylindrical valve body provided with the ballast weight I; the valve body being guided at one end to the valve seating, and at the other end is provided at the circumference with a thickened portion acting as a guide-surface in conjunction with the projecting ring on the valve-casing.

The middle part of the valve M is tubular (open at each end), and

extends above the rest of the body. It slides at its upper end in a disc, which is fixed in the valve-casing and closes a chamber O, which is always connected, through the conduit, with the small meter and with the space behind the large meter. The disc carries also a box in which the tubular piece M is guided in its upward movement, and a number of openings in the box serve to communicate with the entering liquid.

The action of the arrangement is as follows: When the valve is in its closed position, the water flows from the entrance branch B, through the tubular piece M, into the compartment O, and then, through the conduit H, to the small meter F, in which it is measured, and then into the exit branch G of the large meter. The space above the valve is then in communication through the large meter with the exit branch G, so that the valve is acted on by the pressure existing in this latter. When the water supply increases beyond a certain limit, and when the pressure difference in the small meter (and, consequently, between the spaces above and below the valve) exceeds a certain amount, the valve lifts and opens when in a certain position the entrance to the large meter C. At the same time, the guiding surface of the valve comes in contact with the projecting ring and cuts off the upper space from the underlying parts. Also, as the valve lifts, the middle part M is pushed up, so that the water can no longer flow through the openings to the small meter.

Gas-Engines.

Kessler, M. C., of Denver, Colorado, U.S.A.

No. 3485; Feb. 12, 1910. Date claimed under International Convention, Feb. 23, 1909.

This invention relates to internal combustion engines of the type wherein means are employed for introducing compressed air into the cylinder in addition to the charge drawn in by the piston on its suction stroke, for the purpose of augmenting the charge. The patentee has described one way of effecting this in his patent No. 21,558 of 1907—means being described whereby the opening of the valve controlling the inlet of the compressed air may be varied in amount.

The main feature of the present invention lies in the provision of means whereby the time at which the compressed-air valve is opened to admit the additional air to the charge may be varied.

A further feature lies in the construction of the cam, and in arranging it so that it can be controlled during the running of the engine for effecting this result; these parts being so arranged that the amount of opening, as well the time at which the compressed-air valve is opened, may be varied to admit air to suit the conditions under which the charge is drawn in by the piston.

The purpose of providing for an earlier or later opening of the compressed-air valve (which should be entirely within the control of the operator while the engine is running) is to insure the greatest possible volume of mixture in the cylinder; "the tendency at high speed being to reduce the volume of charge taken in, because the time of admission is shortened." To offset this effect, the air-valve is opened earlier, but at slow speeds, and the air-valve opening is retarded; otherwise the air pressure coming into the cylinder from the crank case would blow the mixture coming in through the intake valve back through the carburettor, and the engine would not run, because it would destroy the efficiency of the mixture.

Shrewsbury Town Council and the Local Government Board.

In moving the adoption of the Water Committee's minutes by the Shrewsbury Town Council, Alderman Morris said the Local Government Board, after their inquiry at Shrewsbury, had intimated that they were not prepared to accede to the request of the Town Council to sanction a loan of £7084 for further improvements to the Severn water supply. They had been advised that their system of mechanical filtration and treatment with chlorine of the water taken direct from the River Severn could not be regarded as being an adequate means of purifying the water, hence their refusal to comply with the application so far as it related to the proposed installation of a new engine and pumps. The Board were prepared, however, to sanction a loan of £2071 for the laying of new mains. Alderman Morris said that in all their difficulties connected with the water supply of the town, while the Local Government Board had been ready to point out flaws, they had never made one helpful suggestion. As the town was provided with a drinking supply of water quite independent of the river, and the townspeople were not likely to use this for such a purpose, to any extent, the Committee recommended that the Council should, in spite of the Board's refusal to sanction a loan, go on with the scheme, and meet the cost out of the surplus income derived from the water undertaking. The recommendation was adopted.

Charge of Stealing a Gas-Meter.—At the Old Street Police Court, last Friday, Alfred Deleaney, 37, was brought up on remand charged with being concerned with another man, not in custody, in stealing a prepayment gas-meter and £1 2s., of the value together of £3 2s., the property of the Gaslight and Coke Company. The prisoner, who protested his innocence, was committed for trial.

Berwick Water Supply.—A report on the Berwick borough water supply, by Mr. E. M. Eaton, embodying proposals discussed at a conference held at Berwick last month, between the Town Council and Mr. Eaton and a Local Government Board Inspector, was to come before a special meeting of the Council last Friday. Mr. Eaton says that the necessity for providing an efficient water supply for Tweedmouth and Spittal is obvious; and it cannot be denied that the present supply for Berwick requires considerable improvement without delay. He does not favour any separate scheme for Tweedmouth and Spittal; and he says that the scheme would be of no practical assistance to the Berwick supply, either now or in the future. He points out that Nine Well Eyes and Hope Springs are exposed to considerable risk of serious pollution. He recommends the carrying out of a joint scheme at an estimated cost of £19,000, and annual expenses of £2990, including those in connection with the outstanding loan on the Berwick Water-Works.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Dr. Lessing on Refractory Materials and Their Testing.

Sir,—In your last issue, you did me the honour of referring, in the editorial columns, to my paper on "Refractory Materials and their Testing," read before the Liverpool Engineering Society.

May I be allowed to defend the statement with which you expressed dissatisfaction, as it might lead the unsuspecting reader to assume that I had sought to excuse the general inadequacy in the study of refractory materials.

I think that the purport and tenor of my paper, and more especially the concluding remarks, made it sufficiently clear that I should be the last to accept any excuse for deficiency in this direction. Moreover, I fail to see how an apology could be read into the sentence quoted: "The fact that the study of refractory materials has not up to now been a very general one is evidently due to the difficulties of their examination under the conditions under which they are used in practice—viz., at high temperatures." This is merely one explanation of the undoubted lack of scientific methods hitherto applied to this class of materials.

Far from attempting to defend the untenable position of the past, I endeavoured, both in the paper and in the discussion following it, to acquaint manufacturers and users with what you so aptly describe as the "confluence of opportunity."

I would further point out that the sentence quoted by no means referred to gas-works practice in particular, but to the whole field of application of refractory goods.

I think, on the contrary, that I gave due praise to the attitude of gas engineers in having been the first to recognize the shortcomings of the past, and in finding means of paving the way for a beneficial co-operation with their purveyors of materials.

R. Lessing.

317, High Holborn, W.C., Dec. 22, 1910.

[It is quite true that gas engineers were the first to recognize the shortcomings of the past, and to find means for paving the way for the beneficial co-operation with their purveyors of material. But until this happened, the "shortcomings" were there; and one of the "shortcomings" was that production and use had not a sufficiently proper relationship, through the want of investigation, though the makers had on their part good material, and gas engineers on their part the high temperatures. That is our point; and we do not see that our esteemed correspondent's letter does anything more than confirm it.—Ed. J.G.L.]

Newcastle Fire-Bricks.

Sir,—I have read with interest the paper on "Fire-Bricks," by Mr. E. M. Stewart, in your issue of the 20th inst. In the midst of the very valuable matter that the paper contains, however, there is a table giving the composition (I presume the average composition) of different classes of bricks, which I think must not be allowed to pass without comment. I assumed at first that the very extraordinary figures there given for Newcastle fire-bricks were simply the result of misprint or clerical error, until I saw from Mr. Stewart's answer to a question in the discussion, that this was not the case. There may be bricks made in the Newcastle district having the composition quoted by Mr. Stewart; but that composition is not in the least representative of the bricks of the district. I have taken out the figures for alumina, ferric oxide, and alkalis, from analyses made in this laboratory (J. & H. S. Pattinson) during the last few years of eighteen different Newcastle bricks. The figures are:

	Maximum. Per Cent.	Minimum. Per Cent.	Average. Per Cent.
Alumina	35·68	24·34	31·77
Ferric oxide	3·71	1·57	2·10
Alkalis	3·40	1·53	2·21

From Mr. Stewart's remarks, in reply to the discussion, on the effect of ferric oxide and potash on refractoriness, I infer that he is of opinion that the Newcastle bricks are not refractory—that this is why users in this district "who have intense heats" have bought Scotch material, and that the low heat-resisting power is due to the nearly 13 per cent. of ferric oxide and alkalis (including also "loss and &c.") which, according to him, they contain. I have for some years given special attention to determining the melting-points of fire-bricks, and have determined the melting-points of nearly all the bricks the analyses of which I have quoted above, besides many others which I have not analyzed, and, of course, great numbers of duplicates of the same make of bricks. The lowest figure I have recorded for the melting-point of a Newcastle fire-brick is Seger cone 30; the highest, Seger cone 34. My experience of Scotch bricks is more limited; but I have determined the melting-points of a good many, and of them the range is almost exactly the same.

I hold no brief for Newcastle fire-brick makers, and have no interest in the manufacture of fire-bricks. It may be that users find Scotch bricks to be better than Newcastle bricks for certain purposes; but that is not because Newcastle bricks contain more iron and alkalis than Scotch bricks, nor because they are as a whole less resistant to high temperature. It is because Mr. Stewart's paper, and his remarks in the discussion, give an erroneous impression as to the character of Newcastle bricks as a whole in these respects that I think it my duty to correct that impression.

J. T. Dunn.

Public Analysts' Laboratory, 10, Dean Street,
Newcastle-on-Tyne, Dec. 22, 1910.

LEGAL INTELLIGENCE.

WATER SUPPLY TO FACTORIES.

The Question of "Domestic" or "Trade" Purposes.

In the "JOURNAL" for the 6th inst. (p. 727), we reported the arguments in an appeal by the Metropolitan Water Board from a decision of His Honour Judge Woodfall, at the Westminster County Court, that water supplied to factories is a "trade" purpose, as maintained by the defendants (Colley's Patents, Limited), and not a "domestic" supply, as was contended by the Board. The case came before Justices Phillimore and Coleridge, who reserved their judgment, which was delivered last Wednesday.

Mr. Justice PHILLIMORE said in this case the Court had to determine whether or not the Metropolitan Water Board could recover from the defendants for the supply of water to their premises according to the rateable value of them, or whether the defendants could claim to pay by meter. The defendants carried on a factory, and required water for their employees to use for drinking, washing, and for cleansing the urinals and closets. No one resided upon the premises. The Board contended that this was a supply of water for domestic purposes under section 8 of the Board's Charges Act, 1907. The defendants submitted that it was not, and that even if it might appear to be so under section 8 standing by itself, it was declared otherwise by section 25 of the Act, which said that the expression "domestic purposes" should not include a supply of water for any trade, manufacture, or business. The points raised appeared to be two: First, was this use of water such as would be deemed to be a use for domestic purposes according to the general legislation in these matters? Secondly, if so, did section 25 take this use, though domestic, out of the category of domestic purposes, as dealt with by the Act, or declare that it was not a use for domestic purposes? As to both of these questions, the decision of Mr. Justice Neville in *South Suburban Gas Company v. Metropolitan Water Board* was in point, and was adverse to the defendants. The case named was discussed before the Divisional Court in the case of *Metropolitan Water Board v. London, Brighton, and South Coast Railway Company*, and was considered when the decision came before the Court of Appeal. He had doubted whether he ought not simply to shelter himself under that judgment; but, after reference to his previous criticism, he considered he ought to give his decision independently. Having thought the matter over again, he retained his opinion that "domestic" did not mean civilized or domesticated, or something appertaining to man, but something to do with man as occupying or using a house or dwelling. If a man were brought upon premises, not for residential but for railway purposes, or in connection with any trade, manufacture, or business, was his use of water for the same objects as those for which, if he were at home, he would use it, a use for domestic purposes? If the use could be brought under the expression "railway purposes," the Court of Appeal says it was not. Otherwise the Court had left the matter open. On the whole, he was of opinion that there was not in the use of the closets and urinals in the present case a sufficient residential element to warrant the change from previous practice which the Water Board sought to introduce; nor was any argument strong enough to make him differ from the learned County Court Judge. The appeal therefore failed. He regretted that, in coming to this conclusion, he found himself differing from his learned brother.

Mr. Justice COLERIDGE said the defendants carried on a trade or manufacture in a building which contained lavatories and water-closets for the workmen's use, and water was required for drinking. They contended that the water was not supplied for domestic purposes; and they claimed to pay by meter. Plaintiffs contended to the contrary, and claimed to charge the defendants on the rateable value of the premises. Having referred to the sections of the Board's Charges Act bearing upon the case, his Lordship said it was now clear law that the true test of what was a "domestic" purpose was not the character of the building supplied, but the use to which the water was put. He cited the Barnard Castle swimming-bath case, and the London, Brighton, and South Coast Railway Company's case in support of this statement. It was pointed out that railway companies were bound by law to provide water, as it was necessary to properly carry on their business; and it was said that this reasoning applied with equal force to the present case, as the defendants were bound by Statute to supply certain water-closets, and therefore it was necessary to the carrying-on of their business that such conveniences should be provided. But the distinction between the two cases seemed to lie in this, that the words "railway purpose" did not necessarily import the element of domesticity. In the present case, the water was used for drinking, for lavatories, and for water-closets; and *primâ facie* it was water used for "domestic" purposes. This simple definition had been extended by the Courts, so that the question was now a complicated one. Water was not a "domestic" supply if persons used it in connection with, or ancillary to, a business. If the washing, drinking, and sanitary use of the water was for the workmen's private convenience, the fact that the water so used was supplied to a factory, even though it was without a caretaker, did not take it out of the description of "domestic" purpose where the men on the premises had regular work. This view was supported by the judgment of Mr. Justice Neville in the South Suburban Gas Company's case. In one sense, every water-closet for a workman employed on the premises for an appreciable time was in connection with the business. But in order to exclude such water from the definition of "domestic" supply, something more was necessary in the user of the water to connect it in a special manner with the business—in other words, it must be shown that the water was used for the purpose of the business, and not for the ordinary cleanliness and comfort of the people. For these reasons, he thought the appeal should be allowed.

Mr. Justice PHILLIMORE said, as the Court differed, the judgment of the Court below would stand, and the appeal be dismissed with costs; but there would be leave to appeal.

MISCELLANEOUS NEWS.

THE GAS COMPANIES' JOINT EXHIBIT AT THE JAPAN-BRITISH EXHIBITION.

We have received from Mr. F. W. Goodenough, the Hon. Secretary and Treasurer of the Committee who had charge of the arrangements connected with the Gas Companies' joint exhibit at the Japan-British Exhibition, the following report of the Committee.

OFFICE OF THE GASLIGHT AND COKE COMPANY,
Horseferry Road, London, S.W.

The Committee have pleasure in presenting herewith a statement of their receipts and expenditure in connection with the above exhibition, and a brief report concerning the exhibit made on behalf of the gas industry.

The Committee were fortunate in being able to secure space in the Decorative Arts Section, which was more easy of access, and more suitable for the purposes of such an exhibit, than the Machinery Hall, in which the gas exhibit was placed in the case of the Franco-British Exhibition. The result was that, although the exhibit was not on so large a scale, it was fully as attractive to the public and as useful as the 1908 display.

As representatives of all the subscribing companies no doubt visited the stand, no description of it is here necessary, beyond a record of the fact that it comprised an oak *salon*, a kitchen, a bath-room and a bedroom, together with a small show-room, and a space used for the display of cooking and heating stoves. The stand, which was very generally admired, was designed by Mr. Walter Tapper, F.R.I.B.A., and was very substantially built by Messrs. J. Jarvis and Sons, Limited. The specially designed fittings by Messrs. Bainbridge Reynolds, Limited, used for the lighting of the *salon*, demonstrated very clearly the applicability of gas lighting to the most expensive and artistic fittings.

That the exhibit was attractive to the public was proved in the most conclusive manner by the fact that no fewer than 4583 callers at the stand gave their names and addresses, in order that they might be furnished by their local gas undertaking or the makers with further particulars respecting fittings or apparatus in which they had become interested. This number exceeds by over 1000 the number of inquiries registered at the Franco-British Exhibition.

As a result of the inquiries recorded, 388 gas undertakings were communicated with—a strong proof of the very widespread influence of an exhibition of this character. That this influence is fully appreciated by some undertakings situated a long way from London will be seen at once by a glance down the list of subscribers. But it was a matter of regret to the Committee that the response to their appeals in the Technical Press for subscriptions was not more general, as there were many directions in which they could have increased their expenditure, to the general advantage of the industry, if funds had permitted.

The Committee desire to tender their best thanks to the following companies who furnished, at their own expense, officials to act as attendants at the stand: Brentford Gas Company, Gaslight and Coke Company, Ilford Gas Company, South Metropolitan Gas Company, South Suburban Gas Company, Tottenham and Edmonton Gaslight and Coke Company. The Committee have pleasure in reporting that the exhibit was awarded a Diploma for Grand Prize by the Jury.

The Committee are of opinion that it would be in the interests of the industry that an exhibit on similar lines be made at the Coronation Exhibition announced for next year; and they are making tentative arrangements accordingly. They hope that they may rely upon the renewed support of all this year's subscribers, and that the undoubted success of the 1910 exhibit will lead to many other undertakings giving support to such enterprises of general value in the future. It is proposed to call a meeting of the subscribers, and others interested, early in the New Year.

The Committee feel that they cannot conclude this report without expressing their cordial appreciation of the important services so unsparingly rendered by the Hon. Secretary, Mr. F. W. Goodenough, which have doubtless contributed largely to the success of the exhibition.

(Signed) D. MILNE WATSON, Chairman. A. A. JOHNSTON.
STANLEY H. JONES.
A. E. BROADBERRY. F. M'LEOD.
J. W. HELPS. S. Y. SHOUBRIDGE.
F. W. GOODENOUGH, Hon. Secretary and Treasurer.

The statement of accounts accompanying the report shows that a sum of £2586 was contributed by 47 companies. The expenditure on the exhibit—£2151—comprised £260 paid for space and £1688 for erection and furnishing. Of the latter sum, £44 was recovered for goods sold. The maintenance of the exhibit (materials and labour) came to £153. The expenditure for gas and water during the exhibition was £111; but £21 was received as a rebate from the Brentford Gas Company, and a like amount from the Gaslight and Coke Company. The services of a superintendent cost £100; and stationery, leaflets, &c., £136. There is a balance in hand of £1 1s. 2d., in addition to which the stand and a small quantity of furniture remain as assets—these being retained in view of their possible use next year.

The following are the names of the gas companies who contributed the amount named in the preceding paragraph: *London*—Gaslight and Coke, South Metropolitan, Commercial. *Suburban and Provincial*—Barking, Billericay, Brentford, Bristol, British, Chertsey, Chigwell, Cradley Heath, Croydon, Dartford, Derby, Enfield, Grimsby, Hampton Court, Harrow and Stanmore, Horley, Hornsey, Ilford, Isle of Thanet, Kenilworth, Kidderminster, Kingston-on-Thames, Lea Bridge, Leamington Priors, Mitcham and Wimbledon, North Middlesex, Ogley Hay and Brownhills, Rayleigh, Reading, Richmond, St. Margaret's, Sheffield, Southam, Southgate, South Shields, South Suburban, Staines and Egham, Tottenham and Edmonton, Uxbridge, Waltham Abbey and Cheshunt, Wandsworth and Putney, Winchester, Witney. *Continental*—Imperial Continental Gas Association.

GASLIGHT AND COKE COMPANY'S PREFERENCE STOCK.

Proposed Conversion into Ordinary Stock.

In the summary of the notice for the Bill to be promoted by the Gaslight and Coke Company next session which appeared in the "JOURNAL" for the 22nd ult. (p. 581), it was mentioned that the Company proposed to apply for authority to convert into ordinary stock all or any of the existing convertible "A" 5 per cent. preference stock (first, second, and third issues) of the Company, and to require the holders to accept in lieu thereof such amounts of ordinary stock as might be specified in the Bill. The print of the Bill is now available; and, pending the full notice of it which will appear in the course of the usual articles dealing with the gas measures for next session, we give the text of the clause (34) bearing upon the above-mentioned proposal, as this is a matter of general interest to the gas investing public.

On or at any time after the 30th day of June, 1912, the Gaslight Company may cancel all or any of their existing "A" five per centum preference stocks, first, second, and third issues, upon and subject to the terms and conditions hereinafter set forth.

(1) Not less than six months before cancelling any of such preference stocks, the Gaslight Company shall give to the respective holders thereof notice in writing, sent by post to the respective addresses of such holders as appear in the books of the Gaslight Company at the date of the giving of such notice, requiring such holders to elect whether they will (*a*) exchange or convert such amounts of the preference stocks as are held by them respectively for or into ordinary stock of the Gaslight Company in the proportion of £250 of such ordinary stock for £100 of such "A" five per centum preference stocks; or (*b*) receive at the expiration of six months after the date of such notice a sum in cash equal to the value (calculated at the maximum market price at the date on which such period of six months will expire) of the amount of ordinary stock to which they would respectively have been entitled if they had exercised the option (*a*) hereinbefore set forth.

(2) Each holder of any such amount of such preference stock who shall within the said period of six months have declared in writing to the Gaslight Company his intention to exercise either of the said options, shall at the expiration of such period be entitled, according to whether he shall have declared his intention to exercise the option (*a*) or the option (*b*), either to be registered as the holder of an amount of ordinary stock of the Gaslight Company, ascertained according to the proportion hereinbefore stated, and to receive from the Gaslight Company a certificate for the said amount of such ordinary stock, or to receive a sum in cash equal to the cash value (calculated as aforesaid) of the amount of ordinary stock to which he would have been entitled if he had exercised the option (*a*).

(3) If any holder of any such amount of such preference stock shall not within the period of six months exercise either of the options hereinbefore mentioned, the Gaslight Company shall, at or as from the expiration of the said period, pay to, or hold at the disposal of, such holder the sum in cash to which such holder would have been entitled if he had exercised the option (*b*).

(4) As from the expiration of the period of six months from the date of any such notice by the Gas Company as is referred to in this section, the amounts of preference stock referred to in such notice shall cease to rank for dividend; and the holders of such preference stock or preference stocks shall cease to have or exercise in respect thereof any of the rights or privileges of a holder of preference stock of the Gaslight Company.

(5) Every holder of "A" five per centum preference stocks, first, second, and third issues, which the Gaslight Company shall have cancelled under the provisions of this section, shall deliver up to the Gaslight Company for cancellation the certificate or certificates for the stock so cancelled held by him; and any such certificate not so delivered up shall, as from the date of cancellation of the stock represented thereby, cease to be of any effect, and shall not be deemed to be evidence of proprietorship of such stock.

(6) All payments to be made in cash by the Gaslight Company under this section may be charged to their net revenue account.

(7) There shall be, by virtue of this Act, and without any other requisite, created such an additional nominal amount (if any) of ordinary stock of the Gaslight Company as shall be necessary for giving effect to the provisions of this section.

PUBLIC LIGHTING OF PADDINGTON.

The Competing Tenders.

At the Meeting of the Paddington Borough Council last Tuesday, the question of the public lighting of the borough came up for consideration; having been adjourned from two previous meetings (see *ante*, pp. 143, 271). Tenders had been obtained from the Metropolitan Electric Supply Company, Limited; but, owing to the large amount of business on the *agenda*, the question was reached too late to be taken, and it stands adjourned until the next meeting of the Council. The General Purposes Committee and also the Finance Committee again reported in favour of the Gaslight and Coke Company's scheme.

The General Purposes Committee reported that on the 18th of October the Council referred to them the recommendation of the Works Committee for an agreement to be entered into with the Gaslight and Coke Company for lighting the borough, with instructions to examine the Company's estimate, and obtain estimates from the Metropolitan Electric Supply Company, Limited, for lighting those parts of the borough in which their mains are laid. Two tenders opened by the Council on the 15th of November and referred to the Committee had been examined by the Borough Surveyor, who had submitted the following report.

BOROUGH SURVEYOR'S REPORT.

I have considered the two attached tenders which I have received from the Town Clerk—viz., (1) The Metropolitan Electric Supply Company. (2) The Gaslight and Coke Company. Both tenders have been invited under four main headings—(*a*), (*b*), (*c*), and (*d*). Scheme (*a*) is for lighting the whole of the borough principally with 80-candle power burner lamps, as to Harrow Road with two 80-candle power burner lamps, and as to Bayswater Road, Edgware Road, and Maida Vale with three 80-candle power burner lamps; (*b*) is similar, but for lighting a portion of the borough at the contractor's option; (*c*) is for lighting the whole of the borough, but using about 1000 60-candle power burner lamps, about 2500 80-candle power burner lamps, and the remainder—viz., two 80 and three 80-candle power burner lamps as in scheme (*a*): (*d*) is like scheme (*c*), but again for a portion of the borough only, at the contractor's option.

Under each scheme, the contractor has been afforded an opportunity of quoting alternative prices respectively if the two 80 and three 80-candle power burner lamps be reduced each to one 80-candle power lamp at 1 a.m. In each scheme it was made a condition that the price quoted should include for the contractor providing and fixing complete 16 new lamps in the private roads of Westbourne Terrace. The contractor was to say whether the old fittings removed should be the property of the Council or the contractor. The specification requires the employment by the Company of the present employees of the Council, subject to good behaviour. The Company are to light the lamps free of extra cost during fog in daytime.

Electric Light Company's Tender.

The Electric Light Company's prices include all charges except the capital cost of converting and fitting up the existing lamps. They do not include the capital cost—viz., some £80—of installing the 16 lamps in Westbourne Terrace private roadways. I have added, with their concurrence, £80 to their tender. The total capital expenditure to be borne by the Council is therefore £3024, *plus* £80—viz., £3104. I have estimated at £364 per annum the charge necessary on a 3 per cent. basis; and a loan for ten years in respect of the capital charge of £3104.

The Company do not quote under schemes (*a*) or (*c*).

Taking first, therefore, scheme (*b*), their tender amounts to £4560; but they quote for 300 instead of 225 two 80-candle power burner lamps, and 144 instead of 268 three 80-candle power burner lamps. However, adopting their figures—viz., tender, £4560; 16 private lamps in Westbourne Terrace, £36 16s.; and capital charges per annum, £364, or £4960 16s., and adding to this 2367 80-candle power gas-lamps at £2 17s. 9d. (£2 12s. 6d. *plus* the 10 per cent. increase mentioned below), £6834 14s. 3d., we get a total of £11,795 10s. 3d. This includes an addition on the part of the Gas Company of 10 per cent. in their price because they have only a portion of the number of the lamps in the borough, instead of the whole. On the contrary, if the Electric Light Company's tender as above—viz., £4960 16s.—were accepted, and the 2367 lamps were lighted by the Borough Council lighters at the present cost, *plus* an allowance of 7½ per cent. increase on the maintenance (which I think is a reasonable one to be made, as with a reduced number of lamps the cost of lighting per lamp is sure to be more), making a total for the gas lighting of £6805 2s. 6d., a combined total of £11,765 18s. 6d. is arrived at. It cannot be too clearly pointed out at this juncture that the figures of £11,795 and £11,765 do not allow for the number of three-light lamps necessary for the lighting of Sutherland Avenue, part of Elgin Avenue, and various refuges and points in the borough which are at present lighted by three-light lamps, and for which the substitution of single-light lamps, as contemplated by the above scheme, is practically sure to meet with condemnation and rejection.

I do not think the Committee will wish to be troubled with a recapitulation of all the details, and so I simply give the totals of the following variations. If the three 80-candle power burner lamps are increased from the 144 quoted by the Electric Light Company to the 268 asked for by the Council—and this, as before stated, I consider to be very necessary, because otherwise there are numerous refuge lamps in the north of the borough (for instance, in Sutherland Avenue, &c.) which, if this is not done, will be lighted only by single-burner lamps, in my opinion an insufficient illuminant—the cost, instead of £11,875 10s. 3d., becomes £12,187 13s. 3d. Further, if in addition to altering the number of three 80-candle power burner lamps to that asked for in the Council's request, the 300 two 80-candle power burner lamps are reduced to the 225 asked for by the Council, the £12,187 13s. 3d. becomes £12,090 3s. 3d. If all the two and three burner lamps are reduced at 1 a.m. to one-light lamps only, the saving will be £168 per annum off the £11,795 10s. 3d., or £193 off the £12,090 3s. 3d.

Scheme (*d*).—Assuming the private Westbourne Terrace lamps at 80-candle power, this scheme involves a deduction from scheme (*b*) of £40 so far only as relates to the Electric Light Company's figures. For both schemes the Company make a condition as follows: "The contractor will make a proportionate variation in the event of coal being increased or reduced in price, based on a present rate of 11s. 6d. per ton." I have communicated with the Electric Light Company on this point, and I am informed that this price is to be regarded as their contract price for coal delivered on their wharf at Willesden. This condition involves for a 10 per cent. increase in the price of coal a 5 per cent. increase in the maintenance price per annum of the lamps. This 5 per cent., of course, is to be based upon the price exclusive of the capital charges previously alluded to.

As to the duration of the contract, the Electric Light Company require that, if the contract is terminated by the Council at the end of five years, the Council will have to repay to the Company half—viz., £1150—of their capital outlay for the new fittings, &c., not included in the £3104 previously mentioned.

Gas Company's Tender.

This is practically on the lines of the previous offer.

Scheme (*a*).—The total tender for the whole of the lighting of the borough is £11,650 15s.

Scheme (*b*).—The Company's tender under this scheme is to the effect that the prices quoted in scheme (*a*) are subject to the following

creases for a reduction in the number of lamps, in the event of the e of another illuminant for the streets, as follows:—

(a) Lamps reduced to between 3501 and 4027, price increases 5 p. ct.
(b) ,, ,, ,, 3001 ,, 3500 ,, ,, 7½ ,,
(c) ,, ,, ,, 2001 ,, 3000 ,, ,, 10 ,,
(d) ,, ,, ,, 1001 ,, 2000 ,, ,, 15 ,,
(e) ,, ,, ,, 1000 or under ,, ,, 20 ,,

Scheme (c) shows that about 1000 60-candle power burner lamps will st per annum 5s. per burner less than 80-candle power burner lamps. Scheme (d) is to be on the same basis as (b).

As to the Council's provision for the insurance of employees, the ompany point out that they maintain a special balance of £5000 to eet this as their own insurers. Further, as to the rate of wages and urs of labour, the Company say that, while there is no association employers and employees in connection with public lighting, the ompany pay their lighters 1s. per week more wages than those now id by the Council; and the Council's employees can become co-rtners and so profit-sharers.

The Company cannot offer any reduced price if the two 80-candle wer burner lamps are reduced to one 80-candle power burner lamp 1 a.m.; but if the three 80-candle power burner lamps are reduced milarly, they offer a reduction per annum of £87 2s. In all the hemes, they will make no reduction in the event of the price of gas ing reduced.

As to the length of contract, the Company say that the Council shall y to them one-tenth of the sum of £13,000 in respect of each un-pired year, if the Council tarminate the contract at or after the end the minimum period—viz., three years.

I have communicated further with the Gas Company as to the prices the use of the 60-candle power burner lamps be extended and the -candle power burner lamps be correspondingly reduced, and their ply is to the effect that the difference per annum between the two will main constant—viz., 5s.

Speaking generally, it will be seen that the use of the 60-candle power rner lamps as to 1000 lamps will result in a saving of £250 per num, which, with the saving of £87 2s. for early extinction of two t of three burners in the three 80-candle power burner lamps, amounts a total of £337 2s. per annum.

A suggestion has been made that the existing lanterns may be con-rted so as to be suitable for the use of inverted instead of upright rners, and so a saving effected. I have gone into this question; and the basis of one contractor's price for such of the existing lanterns they find capable of alteration, the cost is 12s. 3d. per lamp, which pitalized amounts to 1s. 6d. per lamp per annum for ten years. It ill be observed, however, that this is not a certain figure, as it is by means sure what number of lanterns the contractor will consider fit r conversion; and, further, undoubtedly some allowance needs to be ade for the repairs and renewals of the converted lanterns themselves ring the ten years of the contract.

Another firm of contractors think it not worth while altering the isting lanterns; but they quote a price per lamp for a new lantern, nerally of the same pattern as the existing one, using so many of its parts as they can—viz., 15s. Adding a one-light burner and fitting at 8s. 9d., I arrive at a total of 23s. 9d., which capitalized is equal to 2s. 10d. per lamp per annum. Assuming a 3½-feet burner, practically an 80-candle power lamp, and gas at 2s. 2d. per 1000 cubic feet, I estimate the running charges per annum at £2 10s. 4d., which added to the annual capital charge of 2s. 10d. amounts to £2 13s. 2d. per lamp, against £2 12s. 6d. for the 80-candle power lamps of the Gas Company. There is therefore a slight difference between the two figures in favour of the Gas Company. Further, my remarks as to renewals and repairs apply; and where we have two and three burner lamps, the existing lanterns will be quite unsuitable.

In my opinion, to re-use the existing lanterns in the manner suggested will be a bad policy. When first they approached the Council, I pointed out to the Gas Company that the form of lantern adopted would be one of the most important parts of the scheme, and that its design should be most carefully considered with the view of giving the utmost effective illumination in the highway. Lanterns of the new type will be more expensive to maintain than the existing lanterns; but the burden of this falls upon the Gas Company, for it is included in their price per annum for the lamps.

Westbourne Terrace Lighting.

In addition to the general tender for the lighting of the borough, the Electric Light Company submit a separate scheme for the lighting of Westbourne Terrace—viz., to utilize the existing 12 high columns, and add 4 others down to Stanhope Street, making a total of 16 in all; the object being to avoid the necessity of the 16 lamps in the private roadway. They do not mention in a letter the candle power of the lamps they propose to use; but they quote a price, including capital expenditure, of £160 per annum for a ten-years' contract, the Council paying the sum of £50 towards the capital expenditure if the contract is ended after five years. The Company say the lamps will be 800-candle power Hefners—say, 550 to 650 British candle power.

I have asked the Gas Company to give me a quotation for similarly utilizing the existing columns and fixing four new ones and using high candle-power lamps. They quote alternatives of—£212 for 640 and £176 for 480 candle power lamps, the cost of the 64 80-candle power lamps in the original schemes being £168.

[A schedule of the alternative prices accompanied the Surveyor's report.]

In closing their report, the Committee said the following suggestions of the Finance Committee had been embodied in the specification: "(1) The contract should provide that the quarterly payments shall be made subject to a certificate from the Borough Surveyor that the lighting is satisfactory. (2) That in the event of the Gas Company failing, in the opinion of the Borough Surveyor, to carry out the terms of the contract, and subject to an appeal by the Company to the Engineer of the London County Council, the Borough Council to be at liberty to terminate the contract without incurring any liability whatever either on revenue or capital account." As the Borough Surveyor had stated that the sum of £13,000 proposed to be spent by the Gas Company

Appendix to Borough Surveyor's Report.

Borough Surveyor's Office, Town Hall, Paddington,
Nov. 29, 1910.

UMMARY OF COSTS, &c., CONTAINED IN THE BOROUGH SURVEYOR'S REPORT TO THE GENERAL PURPOSES COMMITTEE ON THE TENDERS FOR THE LIGHTING OF THE BOROUGH.

		Metropolitan Electric Supply Company's Tender.				Gaslight and Coke Company's Tender.		
cheme.	Description of Lighting Arrangements.	For Lighting the Whole of the Borough.	For Lighting a Portion of the Borough at Contractor's Option.	Cost to Light the Remainder of the Borough.*	Total Cost to Light the Borough with Two Illuminants.	For Lighting the Whole of the Borough.	For Lighting a Portion of the Borough at Contractor's Option.	Total Cost to Light the Borough with One Illuminant.
No.			£	£	£	£		£
1	Electric Company's tender for 1216 80-c.p. burner lamps, 300 two 80-c.p., and 144 three 80-c.p. burner lamps	The Metropolitan Electric Supply Company do not quote for the lighting of the whole of the borough.	4960	..	..	..	If the total number of lamps is reduced by the substitution of another illuminant, the prices quoted would be increased:— Lamps (a) 3501 to 4027 .. Increase 5 per cent.; (b) 3001 ,, 3500 .. 7½; (c) 2001 ,, 3000 .. 10; (d) 1001 ,, 2000 .. 15; (e) 1000 or under .. 20	..
2	*Scheme* 1.—Adding the cost of lighting the remainder of the borough with 80-c.p. burner lamps under the Gas Company's tender, and increasing the three 80-c.p. burner lamps to the essential number by adding 124 three-light gas-lamps		4960	7227	12,187	..		..
3	*Scheme* 1.—Increasing the three 80-c.p. burner lamps as in Scheme 2, and reducing the 300 two 80-c.p. electric lamps to the 225 two 80-c.p. electric lamps, which are all that are asked for in the Tender Form		4863	7227	12,090	11,650		11,650†
4	*Scheme* 3.—Reducing two and three light lamps to one light for the Electric Company's scheme, and three light to one light in the Gas Company's scheme, all at 1 a.m.		4710	7187	11,897	11,563		11,563
5	*Scheme* 3, but with 1000 60-c.p. burner lamps, 80-c.p. burner lamps for the remainder of the general lighting, and two and three 80-c.p. burner lamps as before		4823	7027	11,850	11,400		11,400
6	*Scheme* 5.—Reducing the two and three light lamps as in Scheme 4		4670	6987	11,657	11,360		11,396
7	80-c.p. burner lamps on main routes of through traffic with the two and three 80-c.p. burner lamps as before, and 60-c.p. burner lamps for the remainder of the general lighting (based on 1100 80-c.p. and 2434 60-c.p. burner lamps)		..	..	..	11,042		11,042
8	*Scheme* 7, but reducing the three 80-c.p. burner lamps to one 80-c.p. burner lamp at 1 a.m.		..	..	..	10,955		10,955
9	*Scheme* 7, but altering the two and three light lamps to two and three 60-c.p. burner lamps		..	..	..	10,729		10,729
10	*Scheme* 9, but reducing the three 60-c.p burner lamps to one 60-c.p. burner lamp at 1 a.m.		..	..	..	10,689		10,689

* Corresponding column blank in Gas Company's tender.

† Practically this is the present cost of lighting per annum.

E. B. B. Newton, *Borough Surveyor.*

under the heading of capital was a reasonable one, they recommended that, subject to the consent of the London County Council being obtained to a loan of £13,000 for a period of ten years, the Council accept the tender of the Gaslight and Coke Company for lighting the borough at an annual cost of £11,650 15s. for a period of ten years, with power to determine the contract after the expiration of three years upon payment of one-tenth of the capital sum (£1300) for each year of the unexpired period.

The Finance Committee reported that they had had under consideration the report of the General Purposes Committee above referred to, and they found the two points submitted in their previous report had been embodied in the lighting specification. They concluded by recommending the Council to apply to the London County Council for sanction to the raising of a loan of £13,000 for a period of ten years, in connection with the tender of the Gaslight and Coke Company for the lighting of the borough.

THE EXPERIMENTAL ELECTRIC LIGHTING AT PICCADILLY CIRCUS.

Proposal Not Sanctioned by the Westminster City Council.

The Works Committee of the Westminster City Council have had under further consideration an offer made by the St. James's and Pall Mall Electric Light Company, Limited, to provide and maintain for five years, at their own expense, additional public lighting at Piccadilly Circus by means of electric flame arc lamps on 35-feet columns (see *ante*, p. 515).

The Committee received a letter from the Gaslight and Coke Company stating that they had been informed of the permission given by the Council to the Electric Light Company to erect the proposed arc lamps; the reason given being that the installation would secure a continuance of the "experiments" in street lighting by these lamps. They urged that this was not a fair form of experimental lighting, but was in reality giving the Electric Light Company an opportunity of advertising at the expense, in everything but money, of the Council and the Gas Company. They pointed out that there could be no experiment which did not include the cost of lighting, nor could any experiment be useful which compared a cluster of four high-power electric arcs with one high-power gas-lamp. The Gas Company went on to say that the contract for lighting certain clearly-defined thoroughfares by means of gas was allotted to them in open competition with other forms of illumination; and they felt strongly that, in the absence of default on their part, they should be given the entire lighting of the contract area. This view was supported by the wording of clause 4 of the contract, which stated that, with the exception of certain thoroughfares, of which Piccadilly Circus was not one, "the contract is intended to include the installation and maintenance of lights in place of all the lights specified in the schedule." Moreover, this point was covered by clause 10 of the general conditions of the contract, which clearly indicated that any additional lighting, if found necessary, was to be provided by the contractors, as the Council retained the power "to increase the number of lamps as and when they may deem desirable; such additional lamps being provided and maintained at the prices in the accepted tender." In conclusion, the Company offered a respectful but earnest protest against the introduction of a second system of lighting at Piccadilly Circus without reference to the existing contractors, especially seeing that the contract with them had been so recently entered into. They further expressed the hope that it might not be too late for the Council to reconsider the matter.

The Committee also received a letter from the Electric Light Company, enclosing a memorandum on the subject, in which they claimed that there was no legal ground to support the contention of the Gas Company that under their new contract they have a monopoly of any form of street lighting in the district in question; and that, in the event of the Council deciding to rescind their acceptance of the offer of the additional lighting, the only alternative for the Electric Light Company would be to dismantle their derelict apparatus, and retire altogether from a competition in which they could not expect to receive fair consideration.

Reporting upon this matter, the Committee said that since the Electric Light Company's offer was made, the new gas lighting had been installed at Piccadilly Circus. It consisted of four lamps of 3000-candle power each, and three of 1800 candle power each; being an aggregate of 17,400-candle power. Some of the members had had an opportunity of seeing the new lighting; and they were satisfied that it was ample, and a great improvement on the old lighting. The Electric Light Company's proposal was to put up, on columns 35 feet high—*i.e.*, 15 feet taller than the gas-lamps—electric lamps to have an aggregate lighting power of 36,000 candles, in three clusters, each having 12,000-candle power. Such an enormous concentration of light, whether electric or gas, would, the Committee considered, depreciate the effect of the new lighting which the Council had so recently acquired under the contract, and would, from the point of view of public lighting, be superfluous. Under all the circumstances, they recommended that the resolution of the Council of the 10th of November, accepting the offer of the Electric Light Company to provide and maintain for five years, at their own expense, certain additional public lighting at Piccadilly Circus, be revoked, and that the offer be not accepted.

The Committee's report and recommendation were brought up at the meeting of the Council last Thursday, and their adoption formally moved. Thereupon Mr. Flint objected to the motion, and called the Council's attention to the unanimity with which the Works Committee had at first decided to allow the Electric Light Company to proceed with their proposed experiment. He trusted the Council would realize that the offer was a *bonâ fide* one, as shown by their willingness to change to any other system the Committee might think better in future. He was astonished to learn that, as a result of the last Committee meeting, when he was not present, the decision come to at the first meeting, after full discussion, had been reversed; and he should like to hear from some member of the Committee what had taken place to cause them to change their minds. The only reason he could see w that they thought the experiment asked for would be depreciating t effect of the new gas lighting. This would be a very weak argume in favour of rescinding the previous motion. There seemed to some sort of idea that the Council, having made a contract wi the Gas Company, had thereby granted them a monopoly. He cc tended that there could be no such thing as a monopoly of this sor and the Council were perfectly free to "sandwich" electric lights b tween gas lights in Piccadilly if they wished to do so. They h the right to order a supply of electric light within 75 yards of a distributing main. In his opinion, Piccadilly Circus at the prese time was badly lighted for such a great place. If they had the e perimental electric lighting with the other, it would be the best light spot in the world. It was a very good ground for demonstrating i provements that were taking place in both gas and electric lightin and they wanted a place for that purpose in London. If they allow the Electric Light Company to put up their standards in Piccadil they would have a hold on the Gas Company; while the extra lig would be a boon to the public at large. In the absence of the Cha man of the Committee (Mr. Jacques Abady), Mr. Smith explained th the Committee had reversed their decision because they felt that th would be placing the Council in a false position if they allowed the el tric lighting experiment. The Gas Company had contracted to do t lighting from 30 to 80 per cent. cheaper than the Electric Light Co pany, and it would not be fair to allow opposition lighting in the sa district. The report and recommendation were then adopted.

THE LIGHTING OF LONGWOOD.

The ratepayers of Longwood have held a meeting for the purpose considering the lighting question and the price of gas; the chair bei taken by Mr. Jabez Iredale, who explained that the meeting had be called to discuss what to them was an important matter. It was cc sidered a hardship that Lindley should pay 1s. 3d. less per 1000 cul feet than Longwood. The Council had been unable to come to a terms to assist the ratepayers; and the question had been referred l consideration to the Committees of the various clubs, by whom resolution had been drawn up to submit to a public meeting of t ratepayers.

Mr. STEPHENS advised the exercise of great care and thought, that the ratepayers of the borough of Longwood would not suffer consequence of any rash act. He had, since his election to t Council, constantly endeavoured to bring prominently before the G Committee the importance of the lighting of Longwood. In Nove ber, 1908, a letter was sent from the Huddersfield Gas Committee the Longwood Gas Company with respect to their charges, and aski for a reduction in the price of gas to consumers. In March, 1910, t Town Clerk read a reply from the Longwood Gas Company, stati their inability to reduce the price of gas. The matter was furt referred to a Sub-Committee to consider the purchase of the und taking. Negotiations were entered upon; and a strong deputation the Gas Committee consulted with the Directors of the Longwood G Company at their offices, and viewed the works. But the Compa would only sell under arbitration held under the Lands Clauses A Consequently, the matter had dropped through for the present, as t Gas Committee could see no advantage in pursuing it further.

Mr. EASTWOOD urged the adoption of electric lighting in the hom of the working classes.

Alderman CHATTERTON remarked that there were some people w said that Longwood would have been better off if it had not been the Huddersfield Corporation; but this remained to be seen. A member of that body, he could not be a party to the purchase of t gas-works under the Lands Clauses Act. There was one thing would promise, and that was that the Corporation would do all th possibly could to assist the Longwood people in their endeavours secure better lighting.

Mr. MOUNTAIN (Electrical Engineer) went minutely into the questi of lighting, and showed how an installation could be fixed for 8s. p house, including the slot-meter, providing the house was wit 20 yards of the main. He detailed at length experiments which h been made in property in Huddersfield, and said the cost of lighti worked out at 18s. per year, including meter-rent, which was cheaper than gas.

There were several other speakers, one of whom feared that the G Company, in the event of the installation of electric light, would reco themselves by charging more for gas used for cooking purposes. T reply was that there need be no fear on this point. In the course of short time, the Electric Light Committee would be holding a demonst tion showing the advantage of cooking by electricity instead of gas.

Mr. J. I. SWALLOW moved the following resolution: "That, in t opinion of this meeting, the time has now arrived when the lor outstanding anomaly (*re* gas charges) should be abolished, and furth that this meeting of Longwood ratepayers pledges itself to take necessary action to bring this about."

Mr. J. LEES seconded the resolution, and contended that if meetin like this one had been held years ago, the ratepayers would now be possession of privileges they had to fight for.

Mr. J. D. BUCKLEY moved as an amendment: "Having heard t testimony of the Electricity Committee of the great advantage of ele tric light, this meeting urges on property owners and tenants the des ability of installing the electric light for the purpose of lighting in t district, and pledges itself to do all in its power to carry this out."

Mr. W. DAWSON seconded; and on a vote being taken, the amen ment was carried by a large majority.

Portishead Gas-Works Flooded.—Owing to the flooding of t works of the Portishead Gas Company last Friday week, the supply gas was entirely cut off from the district. A notice was promptly issu by the Secretary (Mr. Charles Bartlett), expressing the Directo regret, and explaining that the works were flooded with over 4 feet tidal water, but that every effort was being made to renew the supp

MAIDSTONE ELECTRIC LIGHTING.

Opposition to a Loan.

An inquiry was held at Maidstone some days ago by Mr. H. R. Hooper, of the Local Government Board, relative to an application by the Town Council for permission to borrow £4000 in respect of the electricity undertaking. Mr. Robert Hoar opposed the application, on behalf of the Maidstone Gas Company and several other large ratepayers; and some interesting facts were elicited in the course of the hearing.

The Town Clerk (Mr. Monckton) explained that most of the money would be expended in extensions of mains. It was impossible for them to carry on their trade without from time to time increasing the capital for the purpose of extending the business.

The Borough Accountant (Mr. Lowe) added that £80,595 in loans had been sanctioned; and the total capital expended was £80,010.

Mr. Hoar questioned Mr. Lowe as to the accounts of the electricity undertaking from its commencement. For the first two years, he said, the loss according to the figures in his possession was £4054.

Mr. Lowe said he made it £3162.

Mr. Hoar: In 1903-4, there was another loss of £1275. But there were profits in 1904-5 of £456; in 1905-6, £679; in 1906-7, £1176; in 1907-8, £933; and in 1908-9, £1072. Last year there was a loss of £111. I should also like to call attention to the profit and loss on the subsidiary undertaking—the tramways. In 1903-4, there was a loss on the tramways of £48; in 1904-5, a profit of £1531; in 1905-6, a profit of £474; in 1906-7, a profit of £374; in 1907-8, a profit of £123; in 1908-9, a loss of £2454; and last year, a loss of £2499. These figures are, I believe, correct.

A reply was given in the affirmative; and it was further stated that the cost of public lighting by electricity last year was £2460, and by gas £820—making a total of £3280.

Mr. Hoar: Does this £2460 include anything apart from the supply?

The Electrical Engineer (Mr. Hoadley) explained that this was the amount paid by the Highways Committee for street lighting, and was at exactly the same rate as that paid by the ordinary consumers. The Corporation provided everything, including mains, renewals, carbons, and labour for a certain sum per annum. The principal and interest on the loan was, of course, included in the sum of £2460.

Mr. Hoar (to Mr. Hoadley): Can you tell me the cost of laying the main per yard?

Mr. Hoadley: About 3s.

Then may I ask how many customers have been obtained in the fifteen or sixteen streets in which mains were laid under the last loan. Would there be a hundred?—Oh, no.

Would there be ten?—There might be.

Can you tell me the name of one single customer in these streets?—There are applications from residents in these streets at the present time. I cannot say definitely whether there are any consumers.

That is not a very satisfactory answer. How many applications are there?—There are two that I know of.

In these streets were not the mains laid chiefly for the purposes of public lighting?—You can take it that was a factor.

What were the other factors?—Another was the private consumer. But I should like to point out that these mains have only just been laid; and this explains the small number of applications.

Now with reference to the comparative cost of gas and electric lighting. Our charge is £3 1s. 6d. per annum, whereas you charge £3?—Yes.

In addition to this, you charge something for laying the cable?—Yes.

You have said that the cost amounts to 3s. per yard, so that for the mile-and-a-half of mains laid in these streets the cost would be between £300 and £400. Therefore, taking this into consideration as well, you will agree that the cost is increased somewhat?—I am sorry I cannot agree. The £3 covers the principal and interest on the work.

And do you make a profit on the £3?—Yes.

Then how do you account for your loss this year?—You know as well as I of the introduction recently of the filament lamp; and last year we suffered from the complaint like a good many other undertakings, though not so badly as some. Mr. Hoadley added that the cost of producing electricity last year was 0·876d. per unit.

Mr. Hoar said that, speaking on behalf of some very large ratepayers, he much regretted having to oppose the application, because he need hardly assure the Council that the work done by them generally was greatly appreciated by the ratepayers of the town. They did feel, however, that the electricity and tramway concerns had been the least successful of the various undertakings carried on by the Council, and that they were bound to oppose any further loan being granted in respect of them. The indebtedness of the borough had increased from £106,000 in 1901 to £306,000 in 1910. The average rate of interest on the loans was 3¾ per cent.; and taking an average period of repayment of 35 years, the amount which the Council paid in principal and interest yearly on the whole of their loans was about £16,000. They had been told that a 1d. rate produced £730; so this meant that nearly a 2s. rate was each year devoted to the repayment of the loans. Considering this, and the losses on the undertaking, he thought the time had come when a halt should be called in the lavish expenditure. The Electric Lighting Act, 1909, he contended, created a new anxiety, inasmuch as the limit placed on the borrowing powers, of twice the assessable value by the Public Health Act of 1875, had been removed. It was more necessary than ever, therefore, to sift every proposal to borrow for electric light purposes. The price of electricity had been lowered again and again. The policy of the Corporation seemed to have been to lay cables in certain streets, not with a view of obtaining customers, but for the purpose of public lighting; and to replace gas-lamps, which were quite sufficient for the lighting of some of the streets, by electric light was not good business. It might be very enterprising; but it was extravagant. He then called attention to the increase in the cost of public lighting; explaining that during the two years it was done by the Gas Company prior to the commencement of the electricity undertaking, the average cost was £2330, while the average for the past two years was £3396.

The Town Clerk then briefly addressed the Inspector. The Council had, he said, to carry on their commercial undertaking at a tremendous disadvantage as compared with the Gas Company, because they had to repay principal and interest. The Company did not have to do this, and were consequently able to form a depreciation fund. Despite the large payments that had been made in respect of the electricity undertaking, the loss only amounted to £1014; and he thought it was not fair to compare them with an undertaking such as the Gas Company.

SOUTH METROPOLITAN CO-PARTNERSHIP SCHEME.

The Chairman on the Year's Work.

The "Co-Partnership Journal" of the South Metropolitan Gas Company for next month opens with the following address by the Chairman, Mr. Charles Carpenter, on the year's work in connection with the co-partnership scheme.

Stocktaking at regular intervals is a necessary feature in the conduct of industrial undertakings; and the co-partnership which is entrusted with the duty of supplying gas in South London is no exception to the rule. The closing of the year provides a fitting opportunity to reckon up our gains and losses, and by striking a balance to let us see how we stand compared with our position at its commencement. To the question "Is all well with our co-partnership?" three satisfactory answers are required, one from each of the three bodies which constitute it—viz., consumers, shareholders, and employees. Let us deal with them in this order, and take the users of gas first, for without them neither Company nor workpeople would be required.

I cannot, of course, speak for our consumers; but fortunately they very frequently speak for themselves, and often in very gratifying terms. They write and say how well the work has been done, how attentive the men have been, and how pleased they are with the result. Such satisfactory conduct on the part of the large proportion of the employees who come into contact with the consumers is absolutely essential to the welfare of our business by making the use of gas increasingly popular. An engineer who came over from India to study public lighting said the streets of South London were the best example he had seen. This was a high compliment, coming from one who had made a special investigation into the matter; and praise is due to the men who have achieved so notable a result by their care and painstaking in maintaining such a fine advertisement for the Company's staple manufacture.

The satisfaction of which the above particulars are an example is, I believe, given by all our departments, and it arises no doubt because, in the vast majority of cases, pride is felt and interest is taken in the work. Workmen could not represent the Company so worthily if they did not feel it an honour to be in its service; and this must be the secret of the good feeling which undoubtedly exists between those who buy our gas and those who form the many links between its manufacture and its use.

Touching now upon the light in which the second party to our co-partnership views its operations, there is no doubt as to its deep-rooted belief in the well-being of the system. Not only do the proceedings at every half-yearly meeting testify to this, but individual shareholders constantly express their belief in the additional security given to their investments by reason of the mutuality of interest upon which the Company's operations are based. If further evidence be required, it is furnished by the price which the Company's stock fetches in the open market. Government stock (Consols) has certainly not maintained its value in the same degree; and this may well afford us food for reflection. Would it not be for the general weal if the business of the nation could be so organized that all worked together for its prosperity and to the maintenance of its eminence, instead of, as now, pulling in different directions, wasting time and energy in a strife of words?

The third party in our co-partnership is the employees; and we have had perhaps a fuller opportunity than usual of gauging what their feelings are concerning it. The recent election of Mr. Newbold as an Employee-Director was taken advantage of to hold a series of meetings at which those co-partners who might not have personally known the representative for whom they voted could have an occasion of meeting him. It is pleasing to record that from first to last no uncertainty was shown as to this result. The well-chosen words used by Mr. Newbold in enunciating what he conceived to be his duties as a Director, and the unanimous manner in which they were adopted by the thousands of workmen who applauded them, were an all-sufficient proof that the rock of our co-partnership is as firmly and solidly fixed as ever.

I feel, then, that I am right in saying that the balance of working in our co-partnership during the past year is on the right side, and that we have made substantial progress in the realization of our ideals. Shakespeare tells us in one of his plays that the sleep of the toiler is in Elysium. Perhaps it is too high an ideal to hope that each day of toil may be anticipated as happily as the night of rest it earns. But co-partnership has done so much to give us cheerful and contented workers, that we may not unreasonably look forward to the realization of such a dream.

In the hope that the close of 1911 will witness a tighter drawing together of the bonds which unite the South Metropolitan co-partners, I heartily wish all

A Happy New Year.

Water Supply in Italy.—According to the "Bollettino Finanze" of Rome, as quoted in the "Board of Trade Journal," a Bill will shortly be laid before Parliament with the object of providing drinking water for all the places in Italy at present without an adequate supply. For this purpose it is proposed to open credits amounting to 250,000,000 lire (£10,000,000), which will be spread over fifteen years—viz., from 1911 to 1925 inclusive.

THE PRESENT POSITION OF ACETYLENE.

The Twelfth General Meeting of the German Acetylene Association was held at Eisenach on the 7th and 8th ult., under the Presidency of Professor Dr. J. H. Vogel, of Berlin. The inaugural address of Dr. Vogel was mainly devoted to a review of the present position of the carbide and acetylene industries; and the following particulars of general interest have been abstracted from the reprint of the address in "Carbid und Acetylen," the official organ of the German Acetylene Association.

After expressing satisfaction at the presence at the meeting of Chief-Councillor Jäger, as representative of the Prussian Minister of Commerce, Dr. Vogel said that the carbide and acetylene industries had fared even worse last year than in the preceding twelve months. The year had proved full of disappointments; but there seemed now some prospect of improvement. The chief evil in the carbide industry was over-production. Existing carbide factories, if they utilized all their power, were capable of producing twice as much carbide as was now being consumed. The low prices which prevailed as a consequence of over-production were compelling factories to close down; and lately only two of the seven carbide works in Germany had remained at work. A few weeks ago, however, all the more important European carbide works—to the number of 58 in seven countries, and representing a make of about 120,000 tons per annum—had come to an understanding to restrict the output in order to effect a raising of prices to a remunerative level for manufacturers. There appeared to be no intention, however, to force up the price of carbide to such an unreasonable extent that acetylene would cease to be cheaper than other gases. The speaker hoped that the new Syndicate would direct their attention also to furthering the consumption of carbide, especially for lighting and welding purposes, by energetic advertisement, and would also endeavour to find new applications for carbide.

The consumption of carbide in Germany in 1909 was about 32,322 metric tons, of which 25,988 tons were imported and the remainder produced in the country. This consumption was about 6000 tons less than the speaker had forecast a year ago—partly due to acetylene being no longer used in the preparation of a mixed gas for railway carriage lighting by the Prussian-Hessian State Railway Administration, but partly owing to an undoubted reduction in the consumption of carbide for lighting purposes generally. In 1908, the State Railways used no less than 8850 tons of carbide; but the adoption of incandescent gas lighting for the trains abolished this use of acetylene. The reduction in the consumption of carbide for lighting indicated by the figures quoted was confirmed by the speaker's own observations that the number of fresh acetylene lighting plants was not equal to the number of plants discarded for one reason or another. It would appear that the present consumption of carbide for welding purposes in Germany was at the rate of about 5000 tons per annum. The speaker estimated that the German requirements in carbide for lighting and welding in the year 1910 would amount to some 30,000 metric tons. One gratifying feature was the high quality, both in respect of yield and quality of the gas produced, of the carbide supplied at the present time. One cause of the over-supply of carbide was that less had been used than was anticipated for the making of lime nitride for manurial purposes, and, consequently, the surplus had come on to the market for lighting and welding. The production of lime nitride was indeed increasing, but not so rapidly as had been expected; and a fall in the price had tended to restrict it. About 8000 tons of carbide would probably be used in Germany in the twelve months ending March 31 next for the manufacture of nitride. As things stood, it was incomprehensible that schemes for the erection of new carbide and nitride works should continue to be promulgated, since only in quite exceptionally favourable conditions could such works be expected to pay.

The acetylene industry had done very badly in the past year, owing largely to the regulations existing in Germany respecting the erection and working of acetylene apparatus being too irksome. Since 1906, the output of acetylene lighting plants had been continually falling off, and no firm of makers of them would have survived had it not been for the growing demand for apparatus for welding. Now, however, a new set of regulations had been drawn up by the Prussian Government, in which the representations made by the German Acetylene Association had been regarded; and these regulations, it was hoped, would shortly be passed by the House of Representatives and become law. The following essential points of a satisfactory code of regulations for the erection and working of acetylene plant would then be secured, viz.: (1) The introduction of prescriptions in the interest of safety, which, though strict, would be such as could technically and industrially be observed; (2) the abolition of all superfluous and technically and industrially impracticable prescriptions; (3) the suppression of apparatus which did not comply with the official prescriptions, and by its defects was liable to bring the whole acetylene industry into ill-repute. If no unforeseen obstacle cropped up, the new regulations should be passed in December. In the ordinary course, however, they would not come into force until twelve months later; but having regard to the fact that firms might desire to take advantage of them at an earlier date, it was proposed to insert a special clause sanctioning their adoption forthwith by any such firms.

The number of fixed acetylene lighting plants (in Germany) was no greater than in the previous year—viz., about 34,000. There were 143 local acetylene central supply works, of which 14 were new ones. But five such works had gone out of use in the past year, owing to coal-gas supplies having been obtained from the works of some large town in the district or otherwise. The speaker thought that it was unsatisfactory that only 14 new local acetylene central stations had been equipped in the past year; and he advocated the pursuance of vigorous measures to promulgate their advantages at the present time—when the numerous failures of cross-country electricity supplies from central works made the prospects of the adoption of acetylene schemes better than hitherto. Small acetylene lighting apparatus had made great progress during the year, especially in the case of miner's lamps and other hand lamps, and lanterns for signalling purposes. The military and railway authorities were now availing themselves largely of small acetylene apparatus.

It was gratifying to observe that the number of explosions with acetylene apparatus had been extremely low in the past year relatively to the number of installations in use, and represented only that proportion of accidents to apparatus installed which even with the most perfect equipment it had been impossible to exclude entirely with any system of lighting, whether acetylene, coal gas, air gas, oil, or electricity. The use of dissolved acetylene was now beginning to spread in Germany, despite many obstacles, for the lighting of motor cars, and marine and railway signals, and for welding. The production of acetylene tetrachloride from chlorine and acetylene in the presence of a suitable catalytic agent was becoming an important industry. The tetrachloride was uninflammable, and was a valuable solvent for fats, oils, tarry bodies, sulphur, and many organic substances; while it was the raw material for the preparation of a number of other chlorine compounds, some of which had already acquired considerable technical importance. Acetylene was also used for the production, by its simple dissociation, of lampblack and hydrogen. Last spring a factory started work on a large scale at Friedrichshafen for the manufacture in this manner of lampblack and hydrogen, and the Zeppelin Company took the hydrogen, after a simple purification, for filling air-ships. After four weeks' working, however, a disastrous explosion destroyed part of the plant, which was now under reconstruction.

The spread of acetylene welding might be demonstrated by reference to the quantity of oxygen used in connection therewith. The oxygen consumption in Germany at the present time was at the rate of 70 million cubic feet per annum, of which one quarter at most was used for autogenous soldering, &c., with hydrogen. The remaining three-fourths corresponded with a consumption of acetylene equivalent to about 4000 tons of carbide, to which should be added a further 1000 tons for acetylene used for welding on works having their own oxygen-making plant. The cutting of metals by means of acetylene was quite suppressed for the time being in Germany, owing to patent litigation. The Association endeavoured, by holding two courses of instruction, and by other means, to further the use of acetylene for welding, &c., as it was recognized that this application of acetylene should involve in the future a greatly enhanced consumption of carbide.

The Association's testing laboratory had been at work for about a year, and was engaged in testing acetylene plant in action. Seventeen specimens of acetylene plant, chiefly intended for welding, had been examined. Of the plants examined, five were of the drawer type, eight of the carbide-to-water or shoot type, two worked on the contact or flooded-compartment system, one according to the dip, and one according to the rising water system. Of the apparatus examined, fourteen were purely automatic. Seven plants had been passed by the Minister of Commerce as permissible for use indoors. The speaker then proceeded to discuss at very considerable length the necessary precautions for insuring safety in the working of acetylene welding plant. Some of the experiments carried out in the testing of samples of carbide for yield of gas, demonstrated the immense importance of proper sampling.

Various acetylene cooking burners were examined and tests were also made of a number of them in comparison with coal-gas burners. A certain quantity of water of the same initial temperature was taken in enamelled kettles and saucepans of various shapes and sizes, and raised to the boil with acetylene at a pressure of 40-10ths, and with coal gas at 24-10ths. The experiment confirmed the long-established fact that acetylene could not compete as a heating gas with coal gas, either in respect of price or of time occupied. The adoption of gas cooking in households was as much a question of the time occupied as of the cost. It must be possible, for instance, to bring water to the boil in a short time. Experiments were made of the time taken to raise 3 litres (about 5·3 pints) of water to the boil in a kettle with the lid on. With coal gas at a consumption of 10·6 cubic feet per hour the time required was 18 to 20 minutes, and with a consumption of 24·7 cubic feet per hour the time required was 10 to 11 minutes. With acetylene, with a consumption of 3·7 cubic feet per hour, the time required was 21 minutes; and in unfavourable conditions—with a consumption of 1·9 cubic feet per hour—60 minutes. Taking the price of acetylene at £2 5s. 4d., or £1 5s. 6d. per 1000 cubic feet, according to whether it was obtained from a central supply or from private plant, and the price of coal gas at 5s. 8d. per 1000 cubic feet, the cost of raising 3 litres of water to the boil became, with coal gas at 10·6 cubic feet per hour 0·223d., at 24·7 cubic feet per hour, 0·278d.; and with acetylene at 3·7 cubic feet per hour, 0·691d. (central supply) and 0·389d. (private plant), and at 1·9 cubic feet per hour 1·037d. (central supply), and 0·583d. (private plant). The lowest cost of boiling with acetylene was secured with a circular burner, which boiled 3 litres of water in 37 minutes, with a consumption of 1·15 cubic feet. The cost in this case was 0·352d. (private plant), or 0·624d. (central supply) for acetylene, as compared with 0·278d. for the coal-gas burner at 24·7 cubic feet per hour. It would, therefore, be seen that, even in the most favourable conditions, the cost was higher than that of coal gas. The other types of boiling burners left much to be desired. It would appear as though acetylene, apart from its price, was less suitable for boiling purposes because the acetylene bunsen flame was too short. While the flame of a coal-gas boiling burner lapped round the bottom of the kettle, the acetylene flame could not be said to do so, more especially if it came from a slit burner. Only comparatively narrow strips were warmed or heated by it. Consequently, the heating took place very slowly.

The speaker next referred to the relative advantages of stationary and portable acetylene generating plant for welding purposes, and laid stress on the importance of properly training men to carry out welds with acetylene. In regard to the consumption of carbide, he predicted that the 5000 tons or so of carbide at present consumed per annum for welding purposes would, in the course of four or five years, be increased tenfold at least; and this increase would keep all the existing carbide works busy.

After inviting the assistance of those present to help in a settlement of a number of important technical questions which would be raised at the meeting, and especially pointing out that an exhaustive discussion of the projected ordinance relating to acetylene was desirable, Dr. Vogel concluded his address.

THE ELECTROLYSIS QUESTION IN AMERICA.

First Judicial Decision.

We learn from "Engineering Record" that a judicial decision in the action of the Peoria Water-Works Company against the Peoria Railway Company has lately been rendered by Judge A. L. Sanborn, of the United States Circuit Court for the Northern District of Illinois. The case has been before the Courts for more than ten years. The testimony was taken by Mr. Frank L. Wean, Special Master in Chancery, who made two reports on the subject. In his first report to the Judges of the Court, in 1901, he stated that as the defendants could prevent the injury to the pipes of the plaintiffs by the installation of a double overhead trolley system, an injunction should be issued against the operation of the system as it was then being worked. The highly technical features of the case, and the importance of the interests involved, led to the matter being referred back to the same Master, who was directed to hear further evidence and also report particularly upon the remedies which could be applied to minimize or prevent the injury complained of; the relative merits of the single and the double overhead trolley system; the means then employed to prevent injury to the water-pipes; the extent to which the mains had been injured since the close of the proofs of the original case; and the improvements which had been made by the defendants since the close of their evidence. Mr. Wean's second report appeared in July last year. Briefly, he stated therein that the evidence offered on the re-reference had failed to disclose any sufficient ground for changing the conclusions set forth in the first report to which objection was made. The following is our contemporary's summary of the judgment.

In his decision, Judge Sanborn summarized the claims of the complainants, which were, briefly, that their water-mains and service-pipes were being used as part of the negative return system of defendants, thereby inducing electrolysis or chemical decomposition. This took place largely at the joints of the pipes where the current passed through the wet earth round the joints, and also at other places on the pipes where the current left them to pass to other underground structures or back to the railroad track, and also on the lead service-pipes. It was further claimed that the smallest fraction of a volt difference in potential on the pipes would cause their gradual decomposition and destruction. Finally, it was claimed that the complainants could do nothing to lessen the injury; while the defendants, by putting in an insulated metallic circuit by means of a double trolley or otherwise, could entirely prevent the damage.

The defendants claimed that, by ordinance, they were required to operate by the single-trolley system, and that they had done everything possible, in the present state of the art, for the safe return of the current. Their acts were authorized by legislative authority; and if any incidental injury had been done to the water system, it was *damnum absque injuriâ*. If there had been any serious injury, the remedy called for the exercise of the police power to be authorized only by the Legislature or the City Council, and not by the Court. Some 1600 single-trolley systems were in operation in the United States, and only one or two double-trolley systems. The injury in Peoria was not done generally to the whole of the pipe system, but was localized in the region near the power station, and was continually being made less by better methods of negative return. There was not such great or irreparable injury as to justify the installation of a double-trolley or other insulated system. Moreover, this system was unreasonably expensive, its use was dangerous, and it would not entirely prevent the escape of electric current to the ground and on the water-pipes so as to cause injury.

Judge Sanborn then made it clear that the Court had no power to prescribe by an injunction the use of any particular system of circuit or negative return. The utmost possible relief was to restrain the defendants from continuing the injury—assuming, as a premise, that sufficient damage had been shown—and to punish them and their officers for contempt in case of disobedience—leaving the means of curing the injury entirely to their discretion. The whole duty of the defendants was to make the damage as little as possible by using the best means reasonable within their power.

The Judge declared his conclusions as follows: It is indeed stated by some of the expert witnesses that wherever the current leaves a pipe electrolysis occurs, stripping off small particles of the pipe metal, and gradually destroying it in direct proportion to the amperage or volume of current flowing on the pipe. But, under all the testimony and from common observation, it is clear that the mere passage of electricity from one substance to another is not electrolysis—the metals being conductors, without decomposition—and is not necessarily attended with injury at the point of escape. Mr. Waterman, an experienced electrical and railway engineer, testified that the water round a pipe will carry electricity either conductively, without damage or decomposition, or electrolytically, with injury to the pipe and decomposition of the solution; also that there may be electrolysis of the solution without injury to the pipe. Professor D. C. Jackson, who has for many years made a thorough study of the practical side of electrolysis to water-mains and is a most accomplished electrical engineer, says that if the anode is crude copper, containing also iron and silver, only the copper may be carried to the cathode, while the iron and silver may go to the bottom of the tank. This illustrates the position sustained by the evidence as a whole—that electrolysis is a question of surrounding conditions, and that current leaving a pipe may or may not be attended with injury to the pipe. Professor Jackson's experiments tend to show that cast-iron and lead plates embedded in moist earth will suffer electrolysis when a current is applied; but he did not cover the plates with silica, asphalt, or other insulator, nor does he state the current, volume, or voltage. He did not make tests with pieces of pipe covered with iron rust, which is an insulating protector.

It is to be inferred from the evidence as a whole that wet earth surrounding a water-pipe may, by containing some solution not described—possibly iron, iron rust, common salt, sulphate of zinc, nitrate of soda, or carbonate of lime—become an electrolyte, decomposable by having an electric current pass through it; and also, under some

conditions not described and apparently unknown, particles of the iron pipe, or anode, may be stripped off, and pass into the electrolyte solution, or possibly be carried over to some unknown cathode, as in the process of silver plating. Analysis of samples of soil taken from two places above a water-main showed from $2\frac{1}{2}$ to $3\frac{1}{3}$ per cent. of iron, and $\frac{1}{2}$ to 1 per cent. of soluble salts composed of sodium chloride, potassium nitrate, lime, and a small amount of sulphates. The testimony shows that 1 ampere constantly leaving a pipe for 18 hours a day under electrolytic conditions will take away 15 lbs. of iron per annum. Yet in $8\frac{1}{2}$ years not a single break in a water-main occurred, though the rails were at that time very poorly bonded. During this period, Professor Jackson found a voltage of 75 amperes on some of the mains.

Injury to the ends of water-pipes, near the joint, may also result from the current flowing from one pipe to another. The pieces of pipe are 12 feet long, and are covered with a non-conducting coating. It is not convenient so to join the pipe sections as to obtain complete metallic contact between them, on account of the coating and the oakum and lead used in the joints. Oakum is not a good conductor; and the lead, while a good conductor, is not put into electrical contact with the cast iron of the pipe, though preventing leakage of water. As a result, there is a break in the conductivity of the pipe every 12 feet. However, the joint resistance is very much less than the soil resistance round the main, as well as of the water in it; pure water being nearly a non-conductor, though absolutely pure water has probably never been produced. It follows, therefore, that the current will take the path of least resistance through the joints, rather than the path of much higher resistance round them, unless an electrolyte is found near the joint, or in the water in the pipes, of such a character as to divert the current from its natural path.

Many of the witnesses say that the joint resistance becomes so great that the current will shunt round the joint through the outside earth or the water in the pipe, and that when it leaves the pipe it causes injury. It appears that most of the joints must make a high resistance. If the current were shunted round these joints, and invariably resulted in injury to the pipe, it would not take long to destroy the whole water system. In many years there was not a single break in a water-main from electrolysis. During the same period, only 88 out of 5000 service-pipes were destroyed by it. Out of 9000 service-pipes, there were twelve breaks in 1905, eight in 1906, five in 1907, and two in the first four months of 1908. During the same four months, there were two joint leaks, four in 1907, twelve in 1906, seven in 1905, nine in 1904, and fourteen in 1903. As a result of three tests at different places of a large number of pipes made in 1903, 1904, and 1906, the pipe damage in 1903 was found to be 20 per cent., 15 per cent. in 1904, and 10 per cent. in 1906. The same tests showed the average current on the pipes in 1903 to be $5\frac{1}{2}$ amperes, 4 amperes in 1904, 6 amperes in 1906, and a test in 1908 gave an average of 24 amperes. These tests were by no means universal in the system, and any undue weight should not be attached to them. But they tend to show a progressively lessening average damage. In particular places, especially near the power station, steadily increasing damage by electrolysis appears; but on the average the evidence shows it is lessening. One reason for improvement is the better bonding of the rails and more attention to negative return feeders. Another seems to be that, as electrolysis proceeds and the pipes become rusted, the oxide formed increases the electrical resistance of the pipe coating, and thus prevents further electrolysis except under unusual conditions.

Mr. Herrick, who testified at great length on both references, and whose testimony will be again referred to in connection with different systems of return, testified that while in the case of lead pipes electrolysis carries sulphate or carbonate of lead into adjacent soil, and thus lessens the electrical resistance, in the case of iron pipes the resistance is increased by the iron decomposition in the soil. The oxide surface formed on water-pipes by current flow diminishes subsequent chemical action by current leaving such surface. This is corroborated by some other witnesses. Tests made by Mr. Herrick in Peoria showed a constant rise in resistance as current continues to flow from the pipes, with some variation depending on moisture. A thin surface is formed, protecting the pipe from further action, because the current is prevented from passing through the adjacent electrolyte. It seems also that the decomposition of the water in the electrolyte sets up a great resistance to further electrolysis, and tends to stop it.

The proof as a whole conclusively shows that no dependence whatever is to be placed upon the numerous general statements of the expert witnesses to the effect that wherever current leaves a pipe injury occurs. With an increasing current there is found diminishing damage. These experts have entirely failed to harmonize the undisputed facts shown by actual inspection of pipes and actual tests of current flow with their theories of decomposition of metallic substances in the earth by electrolysis attended by decomposition of the pipes themselves. Especially unsatisfactory is the theory of complainant's witnesses adopted by the Master that the smallest amount of current may cause injury—that "a difference in potential of a fraction of a volt may cause electrolysis." As a laboratory theory, this is sometimes true and sometimes not; but as applied to a general system of water-pipes, it is utterly untrustworthy. The inference is drawn by certain of the witnesses because a small pressure is sometimes found on a pipe showing small damage, made at some other time and by some other pressure, both absolutely unknown. One witness made a laboratory test by passing 0·01 ampere under pressure of $\frac{1}{3}$ volt through an electrolyte of sulphate of zinc, similar to solutions in the earth, and with zinc electrodes, and obtained electrolysis of the zinc anode. Whether cast-iron electrodes covered with insulating material like that used on water-pipes or pieces of oxidized iron would have given a like result, he does not state.

Again, it is not explained how or why the weak current on the pipe does not pass through the joint rather than seek a path through a weak electrolyte near. While this theory finds some little support in the evidence, it is so inconsistent with established facts as to leave the finding without any sufficient foundation. Mr. Waterman says that an iron anode is not always corroded by the escaping current, even when the electrolyte is itself split up, and that the silicon found on the water-

pipes will prevent corrosion; and he concludes that it is impossible to tell what amount of current it is safe to draw per square foot from the surface of a pipe. Defendants' experts generally agree that a small amount of current is not injurious, but complainants' witnesses are convinced to the contrary, and the Master has followed them. The finding, however, is quite unsatisfactory and so inconsistent with the nature of electrolytic action, and with the facts clearly established by undisputed evidence as to actual damage, that it cannot be sustained. It is also inconsistent with the theory of increased resistance due to water decomposition in electrolysis.

Lead service-pipes have also to some extent been injured by electrolysis, especially near the power station. Altogether there are about 9000 of them. During the nineteen years from 1890 to 1909, there have been 217 breaks in service-pipes attributed to electrolysis, and many more from other causes. From electrolysis there were twelve breaks of service-pipes in 1905, eight in 1906, five in 1907, and two in the first five months of 1908. These service-pipes are many of them under the street railroad tracks; and the theory of damage is that when the iron pipes are positive to the rails the current flows from the mains through the lead pipes, and then through some electrolyte in the earth to the rails, decomposing the service-pipe as it goes. This injury, like that to the mains, is shown to be lessening; and the percentage of damage is not enough to show danger of the ultimate destruction of these lead pipes, even of those in the region of the power station, where almost all the breaks have occurred. Repairs to service-pipes are paid for by the water consumers. It may be that the use of galvanized-iron instead of lead service-pipes near the power station might be an improvement; but this will be left to the judgment of the complainants.

Complainants' water-works system is being damaged by electrolysis caused by electricity generated by the defendants, but not so seriously as reported by the Master. This injury should be stopped. The complainants cannot, in the present state of development, find any reasonably practical way to cure it. Both parties insist that the injury is curable; but they differ as to means. The subject has been most seriously studied by many engineers; and there is a difference of opinion among them whether anything short of a metallic circuit will be a complete remedy. Many other plans have been tried. The effort has been so to perfect the rail-return as to prevent escape of current into the earth. No claim is made that this can be fully done; but some eleven witnesses testified, on the second reference, that the rails can be so bonded and cross-bonded as practically to stop electrolysis of the water-pipes with the assistance of other means of negative return. Nearly as many other witnesses are of opinion that no such thing is possible. The Master agrees with them, and has recommended the compulsory installation of a metallic non-rail return circuit.

Four plans of improving the rail-return are explained by the defendants' witnesses, which they think practically efficient. They have been used more or less since 1899. All of them contemplate the use of the brazed rail bond, of which the defendants had installed about six miles at the time the testimony was closed on the second reference. This bond consists of a number of leaves of thin copper folded backwards and forwards on themselves, with a piece of brass wound round the end, and applied to the side of the ball of the rail near the end. The rail is first ground with an emery wheel to make it clean and bright. Then the end of the bond is clamped between a carbon plug and the rail, and subjected to a current of 2000 amperes passed through the bond and joint until the brass melts and flows upon the clean rail surface; thus making a perfect and permanent electrical contact. Each bond is equivalent in conductivity to 3 feet of rail—that is, to one-fourth as great a conductivity as that of a continuous rail; and each has a greater conductivity than the trolley wire.

The first plan consists in the use of some efficient form of rail return, as the brazed bond, welded joint, &c., with cross wires between the rails, and assisting the return by feeder wires from the rail to the negative side of the dynamo at regular distances from the power station. This is the system in use in Peoria.

The second plan is called the quadrilateral or constant potential system, and is simply a modification of the first, with additional bonding at the crossings and switches. This system is recommended for Peoria by the defendants' witnesses, with a possible addition suggested by Mr. Winters. It was installed in Richmond (Va.) by Mr. Waterman; and he claimed to have reduced the amperage on the water-pipes from a varying current of considerable size to a maximum of less than 1 ampere. The underlying idea is that the tendency to leakage of current from the rails varies as the square of the distance between the feeders, so that the putting in of an additional feeder divides the distance by two and the leakage by four. In Richmond, four copper wires ¾-inch diameter were attached at one end to the negative busbar at the station, and at the other each to an extended network of smaller wires attached to the rails. Each system of wires extended in a different direction.

The third plan is called the drainage system, often used to protect the sheaths of telephone cables. In this the rails and pipes are regarded as a parallel conductor system of return feeders; the pipes and rails being connected by copper wire. This can only be put in when the owners of both systems are working in harmony. It is in use in Rochester (N.Y.), where it is claimed to have avoided trouble from complaint of electrolysis. Testimony as to its efficiency is, however, conflicting.

The last plan is not fully described in the proofs. By this it is sought constantly to keep the whole piping system negative to the rails, so that no current can flow from pipe to rail. This may be done by copper wire, or by a "negative booster"—*i.e.*, an additional dynamo so connected with the pipes as to produce upon them a lower potential than upon the rails.

The quadrilateral or constant-potential system is recommended for Peoria by defendants' witnesses; and Mr. Winters also suggests a limited use of the drainage system in addition to the other, but thinks it would not be necessary for the protection of the pipes.

Defendants' expert witnesses agree in testifying that no system will prevent all leakage of current, but think that the quadrilateral plan

will be a substantial success. Complainants' witnesses believe it to be necessary to keep all the current from the rails by the double-trolley or other insulated system; and they think that if any current whatever gets upon the pipes they will be destroyed. This conclusion s not established by the evidence. Certain findings of the Master on the first reference are not sustained by the proofs; and the findings on the second reference need modification according to this opinion.

The defendants should be enjoined from continuing the injury to the complainants' water-mains and service-pipes, and should be given a reasonable time to take such measures or put in such improvements to its negative return as will substantially prevent injury. This should be upon condition that the complainants co-operate with the defendants, so far as is reasonable and proper, in aiding them to prevent or lessen the escape of current from their rails, or from the water-pipes in such manner as to cause injury thereto.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In my last weekly contribution to the "JOURNAL" for the year 1910, I will begin by making a brief review of the more striking events of the year, so far as these have been within my own domain. As in many former years, when discharging this task, I feel that I have not matter at my disposal which would justify me in making any one item the object of more than passing notice, because of stirring events there have been none, and of outstanding events there cannot be said to be any that are peculiar to Scotland.

The occurrence of probably most importance was the parliamentary struggle which the Corporation of Glasgow had over a Bill for the consolidation of their Gas Acts, and other objects. Though there were disappointments connected with the treatment accorded to the measure by the Committee of the House of Commons, the Corporation gained their point in the matter of consolidation of Statutes; and they also obtained authority to charge differential rates for gas, which was a new power conferred upon them. This new provision was at once taken advantage of, and is now in operation, with beneficial results.

Next in interest may perhaps be mentioned the holding of the Smoke Abatement Exhibition in Glasgow in September and October. It was a most satisfactory show of appliances for the mitigation of the smoke nuisance, and has resulted in greatly increased sales of gas appliances—these being the readiest and most effective methods of doing away with the smoke which is attendant upon open fire or furnace combustion. But the exhibition was intended by its promoters to have a more lasting effect than even the general adoption of gas-fires would produce, in the permanent purification of the atmosphere. This object is not being lost sight of now that the exhibition is a thing of the past. The campaign against smoke is being waged with vigour in Glasgow, by means of lectures upon air purification; and, as regards other places, there is talk already of an exhibition on similar line being held in Manchester next year.

Honour was done to Scotland in the election, last June, of Mr. A Wilson, of Glasgow, to the office of President of the Institution of Ga Engineers.

Any review of events arising out of gas-works administration in Scotland would be sadly incomplete were notice not to be taken of the retirement of Mr. W. R. Herring from the post of Chief Engineer and Manager to the Edinburgh and Leith Gas Commission. Mr. Herring did a great work during his sojourn in Scotland. He has left his impress upon Scotch gas affairs, which is quite remarkable when it is considered that he had only the short space of thirteen years in which to make himself felt. The Granton Gas-Works will probably to the general throng be the outward symbol which will most forcibly keep the memory of Mr. Herring alive; but to those who were acquainted with his work, there are other mementoes which may be recalled—such as his great superannuation scheme, and the adaptation of the gas supply to modern needs. Just before he left Edinburgh, Mr. Herring was engaged in the consideration of how to supply gas for trade purposes at a cheaper rate than for lighting and for general heating. Now that he holds the position of Consulting Engineer to the Gas Commissioners he may be able to carry his proposals into effect.

Vertical retorts have been in use, experimentally, in the Granton Gas-Works, Edinburgh, and in the Dawsholm Gas-Works, Glasgow. In Helensburgh, an installation of the Glover-West system is at present in course of erection.

Extensions to works, including the introduction of stoking machinery, were inaugurated at Kilmarnock; and at Alloa, coke-handling plant was brought into use. Stoking plant for the Perth Corporation Gas-Works was proposed; but it was not gone on with. New gas-works were opened at Cardenden, Fifeshire.

The gas-works at Carnoustie were transferred to the Corporation in May. About the same time, the ratepayers of Barrhead, by plebiscite, decided, by a majority, in favour of a transfer. A transfer was proposed at Inverkeithing, but was not adopted. The Gas Company have issued additional capital, and are renewing their works. Gas transfers are in progress at Kirkcaldy and Fraserburgh; and in Inverurie, the Corporation have opened negotiations for a transfer.

During the year, coal fell in price by about 1s. per ton; but within the last three months, it has begun to rise again. Contracts for the supply of coal to gas-works were, in most cases, entered into at slightly higher rates. There were, in consequence, only trifling changes in the prices charged for gas. There were reductions at the rate of 1d. per 1000 cubic feet in Glasgow and Greenock, of 2d. in Edinburgh, and of 3d. in Falkirk.

Of changes in the *personnel* of the body of gas managers there were a few. As stated already, Mr. W. R. Herring retired from the position of Chief Engineer to the Edinburgh and Leith Gas Commission, and his Assistant, Mr. A. Masterton, received the appointment. Mr. W. Galbraith left Ardrossan; and his place was taken by Mr. J. D. Keillor, of Lochgelly, who, in turn, was succeeded by Mr. W. Ewing.

Mr. J. Dunlop Smith, of Stirling, was appointed Gas Engineer to the Corporation of Belfast, and was succeeded at Stirling by his brother, Mr. J. M. Smith, from Dumfries. Mr. A. Morton Fyffe, Assistant to Mr. A. Yuill at Dundee, was appointed Manager at Nelson, Lancashire. Mr. A. Kelloch, Assistant to Mr. J. W. Napier at Alloa, was made Manager at Pontefract. Mr. J. Dickson, of Kelty, was appointed to the Corporation gas-works at Forfar, and was succeeded at Kelty by Mr. H. Rule, who had been Assistant to Mr. W. Wilson at Falkirk. Mr. Walter C. Scott, of Bonnybridge, was selected as Manager at Markinch.

The obituary list includes the names of Mr. T. Whimster, late of Perth; Mr. John Marshall, of Largs; Mr. A. Bell, sen., late of Dalkeith, who died at Peebles; Mr. J. Manwell, formerly Manager of the Dalmarnock Gas-Works, in Glasgow, who died in December, 1909; Mr. John Learmont, of Milngavie; Mr. James Baxter, of Forfar; and Mr. John Ireland, of Newport.

The year, though not brilliant, was quite satisfactory; the output of gas being, in nearly every instance, increased. The meeting of the North British Association at Dunfermline in July was a quiet one. The same cannot be said of the Informal Meeting in Glasgow in April, which was a most interesting gathering. The two Districts of the Scottish Junior Gas Association continue to show much activity, and to do a great deal of good to the members.

It was reported to the Edinburgh and Leith Gas Commissioners on Monday that they had let Granton House and grounds on a lease for nine years, with possession on Feb. 1, at a yearly rent of £140.

In the Forfar Town Council on Wednesday, ex-Provost M'Dougall moved that the Gas Committee be empowered to get plans and estimates for the introduction of sulphate of ammonia plant at the gas-works. The estimated cost of the undertaking, he said, was about £600; and he was sanguine that there would be an annual profit from it of not less than £100. They had plenty of accommodation at the gas-works for the plant; and, under the capable supervision of Mr. Dickson, he had little fear as to the scheme proving successful. After a discussion, the motion was adopted.

On Tuesday evening, two papers by Mr. Norman M. Henderson, Manager of the Broxburn Oil Company, Limited, were read by Mr. J. N. Cuthbertson before the Scottish Section of the Society of Chemical Industry in Edinburgh. In the second paper, Mr. Henderson dealt with the recovery of waste gases from mineral-oil stills, and described the methods of recovering and utilizing the gases, which were formerly allowed to escape into the atmosphere. The gases are very rich, and require to be diluted with air. They are used for heating purposes in the works at Broxburn, and for lighting both in the works and in the town.

It was stated at the last meeting of the Ashton Joint Water-Works Board that £90,429 had been spent on the new reservoir, and that the Engineer's commission now amounted to £4100.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Dec.* 22.

Since the commencement of this week the market has assumed quite a different complexion, and a good business has been done at hardening prices. Less than a week ago buyers in all quarters were very apathetic; but they are now willing to operate at higher figures. To-day's quotations are £12 12s. 6d. to £12 13s. 9d. per ton f.o.b. Hull; £12 15s. to £12 16s. 3d. per ton f.o.b. Liverpool; and £12 16s. 3d. to £12 17s. 6d. per ton f.o.b. Leith. The firmer tone in the near position has had the natural effect of stiffening makers in their views as regards selling ahead, and they mostly decline to contract for delivery over next year unless they can realize current values. Buyers, however, are somewhat shy of conceding these prices for the distant months.

Nitrate of Soda.

The market for this article is also distinctly better, and quotations have been raised to 9s. 6d. per cwt. for ordinary and 9s. 9d. for refined quality, on spot.

COAL TRADE REPORTS.

Northern Coal Trade.

There is considerable activity in the coal trade of the north-east. The production is heavy, and it is well taken up; so that the deliveries are full. Prices, too, are generally kept firm by the knowledge that there will be a short output for a fortnight or so. In the steam coal trade, best Northumbrians are scarce for early delivery, and the price is about 10s. per ton f.o.b. For second-class steams, from 8s. 6d. to 8s. 9d. per ton is quoted; and for steam smalls, from 5s. to 6s. 6d. There is naturally a very strong demand for gas coals, as the great users wish to add to their stocks, with the knowledge that the consumption will be at its heaviest in the next three weeks or so. Durham gas coals vary in price, according to quality. Best Durhams are about 9s. 3d. per ton f.o.b., and second-class from 8s. 3d. to 8s. 9d.; while for "Wear" specials, up to 10s. 3d. and 10s. 6d. is quoted. There is little doing in contracts at present. The large sales that have been made in the last few weeks have made the collieries less disposed to accept the current prices for additional quantities, as the surplus is not now large in some instances; and thus they ask higher forward prices. In the coke trade, the market is firmer. For good gas coke there is a steady demand, and the price is from 14s. to 14s. 6d. per ton f.o.b.

Scotch Coal Trade.

Trade is unstable; the sorts in most demand being ell and splint for shipment. Steam coal is quiet. The prices now quoted are: Ell, 9s. 3d. to 10s. per ton f.o.b. Glasgow; splint, 10s. 6d. to 10s. 9d.; and

steam, 9s. to 9s. 3d. The shipments for the week amounted to 326,584 tons—an increase of 11,031 tons upon the preceding week, and of 15,364 tons upon the corresponding week last year. For the year to date, the total shipments have been 15,608,223 tons—an increase of 747,436 tons.

Mid-Oxfordshire Gaslight and Coke Company, Limited.

Last Tuesday, the action of *Beirnstein v. Mid-Oxfordshire Gaslight and Coke Company, Limited,* came before Mr. Justice Neville as a short cause upon a motion for judgment in default of defence. Mr. Galbraith said the Company was formed on Oct. 10, 1905, for the purpose of carrying on the business of manufacturers of gas. In pursuance of their powers, they bought various businesses in Mid-Oxfordshire, and issued three series of debentures; charging the separate businesses, which were situate at Chipping Norton. The debentures became due, and actions were commenced in respect of each series. On May 14, 1910, a Receiver was appointed. The three actions were afterwards consolidated; and, the Company having gone into liquidation, the present action came on, in default of defence, for the usual order in a debenture-holders' action. His Lordship asked whether all interested parties were before the Court. Mr. Galbraith said they were. His Lordship made a declaration for carrying into effect the trusts of the three deeds, and an order for the usual accounts and inquiries.

Water Filtration and Typhoid Fever.

In a report on the purification of the Montreal water supply, noticed in a recent number of "Engineering Record," Messrs. Hering and Fuller, of Yew York, made the following comments on the presence of typhoid fever germs in natural and filtered water sent into the city: Occasionally typhoid fever in scattering cases is found on the watershed of the Ouarean; and the infection of water is likely to be more frequent than was formerly supposed. In the soil and ordinary natural waters, typhoid germs die quite rapidly as a rule. Some, however, will live for months. So far as present knowledge goes, the investigations of the most experienced workers in bacteriology indicate that this germ rarely, if ever, multiplies in water and soil as found in Nature. At the Paris Exhibition in 1900, the German Government showed charts presenting a comparison of the typhoid statistics in various German cities, grouped so as to make the different cities generally comparable with respect to conditions other than the water supply. Attention may be called to the following statement of the average typhoid fever death-rate per 100,000 of population in German cities for the years 1896, 1897, and 1898, which is illustrative of the sanitary quality of filtered surface waters (A) in comparison with ground water (B): (A) Stuttgart, 4; Chemnitz, 4; Berlin, 4·6; Altona, 6; Magdeburg, 6; Hamburg, 6; Bremen, 6; Brunswick, 8·3; Breslau, 8·6; Königsberg, 17·6; Stettin, 20·6. (B) Munich, 3·6; Dresden, 4; Charlottenburg, 4·3; Nuremberg, 4·6; Hanover, 5·3; Crefeld, 6·3; Elberfeld, 6·3; Aix-la-Chapelle, 7·3; Barmen, 8; Leipzig, 8·3; Cologne, 9; Mannheim, 9·3; Cassel, 10·3; Flensburg, 11·3; Strassburg, 12; Dantzig, 12·3; Halle, 13; Essen, 13·6. In America, the experience of the past fifteen years or more allows statistics to be prepared and presented which show, as did the hygienic exhibit at the Paris Exhibition in 1900, that, with other sanitary conditions the same, it is possible, by means of filtration, to purify surface waters so that they will be substantially equal in purity to ground waters of the best quality. Such statistics are afforded from cities provided with sand filter plants, as set forth in the accompanying table, showing the death rates from typhoid fever per 100,000 of population.

City.	Plant Completed.	Years Averaged. Before Filtration.	Years Averaged. After Filtration.	Typhoid Death-Rate. Before Filtration.	Typhoid Death-Rate. After Filtration.
Sand Filters.					
*Albany (N.Y.)	1899	10	9	90	22
Lawrence (Mass.)	1893	7	15	114	25
*Pittsburg (Pa.)	1907	8	1	133	47
Mechanical Filters.					
Binghampton (N.Y.)	1907	5	5	47	15
Cincinnati (O.)	1908	4	1	50	16
Columbus (O.)	1908	11	1	78	20
Paterson (N.J.)	1902	5	7	32	10
Watertown (N.Y.)	1904	5	5	100	38
York (Pa.)	1899	2	8	76	22
Hoboken (N.J.)	1905	7	4	19	14

* Including Allegheny, supplied with unfiltered water.

About ten years ago, mechanical filters had their standing predicated to a large extent on results of laboratory investigations of an exhaustive nature. To-day, modern mechanical filter plants which are well built and well operated show that communities adopting them have experienced as marked reduction in water-borne diseases—notably typhoid fever—as was the case when sand filters were introduced at Lawrence, Albany, and Pittsburg. Representative results are given in the foregoing table.

Bursting of a Storage Tank.—The heavy rains resulted last Saturday week in a landslide which damaged a small service tank employed by the Rhymney and Aber Valleys Gas and Water Company to serve the Deri Newydd on which it is situated halfway up the mountain side. In the course of an interview with the correspondent of a local paper, the Company's Manager (Mr. A. W. Branson) stated that the landslide occurred above the tank, and it pushed the tank out of position, and broke the pipes. No consumers will be affected, as even Deri will be supplied from the other reservoirs. It will not be a long task to repair the tank, which is sunk in the ground, and consists of stone and brick, with a concrete bottom.

Tax on Automatic Lighters in France.—On Monday last week, the Chamber of Deputies adopted, by 445 votes against 65, a Bill regulating the French Customs laws with regard, among other things, to gas or acetylene lighters, caps, and other fittings connected with these articles.

Bilston Gas Company.—At the annual general meeting of the Company to be held next Monday, the Directors will present their 65th annual report, accompanied by the statement of accounts for the year ended the 30th of September. The profit and loss account, after paying the usual interim dividends, shows a credit balance of £8814. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares, and 4s. per share on the "B" shares (making with the interim dividends paid in July 11s. and 8s. per share respectively for the year); leaving a balance of £6129. The Directors state that, in pursuance of the policy foreshadowed in the Directors' reports for 1907 and 1908, considerable expenditure has been incurred in the renewal of the first half of the retort-bench. A portion of this cost is included in the item for the repair and maintenance of works, &c., in the revenue account.

Newcastle and Automatic Lighting.—It is reported that the Lighting Committee of the Newcastle Corporation have decided to recommend the Council to adopt automatic extinguishing and lighting apparatus for street-lamps over the whole of the city, in sections. It is proposed to make 1000 installations at a time. It was stated that the Committee had already experimented with apparatus for twelve months in the west end of the city, and that it had been found very satisfactory. It was further intimated that as little labour as possible would be dispensed with on the full installation of the new system. The experiments carried out in Newcastle have demonstrated clearly the great possibilities underlying a pressure-wave system. The scheduled burning hours for hand-lighted lamps in Newcastle is 3776 hours 35 minutes per annum; and with mechanical lighting, this has been reduced to 2855 hours 34 minutes.

Wandsworth Public Lighting.—The Highways Committee of the Wandsworth Borough Council have under consideration proposals from the Gas Companies supplying the borough for the revision of the charges for street lighting and the improvement of the arrangements in their respective districts. The Borough Engineer prepared a report on the comparative cost of the public lighting in the various districts; and the Committee drew up a series of recommendations, which it was stated would, if adopted, effect a saving to the borough of 500 guineas per annum. At the last meeting of the Council, the matter was, however, referred back to the Committee for further consideration. On that occasion, a member asked the Committee to take note of the high-pressure system of gas lighting which had recently been adopted in tradesmen's premises in Streatham High Road; and on behalf of the Committee, it was stated that the subject had already been before them, and would not be lost sight of.

APPLICATIONS FOR LETTERS PATENT.

28,676.—Sugg, W., and Co., Limited, and Mattock, W. G. H., "Inverted lamps." Dec. 9.

28,697.—Pausinger, F. von, "Preventing explosions and poisoning by gases." Dec. 9.

28,703.—Ewart, J. W., "Water-heaters." Dec. 9.

28 711.—White, M. & J. H., "Gas-generating plant." Dec. 9.

28,763.—Carroll, L. D., "Manufacture of carburetted water gas." Dec. 10.

28,769.—Vanlaer, M., "Gas-purifier." Dec. 10.

28,818.—Cox, F. J., and Machine Gas, Ltd., "Air-gas apparatus." Dec. 12.

28,855.—Glasgow, A. G., "Manufacture of water gas." Dec. 12.

28,922.—Senior, H. V., and Livens, F. H., "Gas producing and cleaning apparatus." Dec. 13.

28,929.—Wainwright, G. E., and Cooke, F., "Fuel." Dec. 13.

28,941-2.—Bolz, C., "Upright retorts." Dec. 13.

28,943.—Cohn, S., "Tying gas-mantles." Dec. 13.

28,948.—Weber, A., and Co., "Acetylene burner." Dec. 13.

28,959.—Koerner, C., "Gas-burners." Dec. 13.

28,982.—Bernhardt, F., "Regenerative furnaces." Dec. 13.

29,009.—Wibberley, R., "Gas-meters." Dec. 14.

29,019.—Moore, W. G., "Retort." Dec. 14.

29,037.—Clayton, Son, and Co., Ltd., and Pickering, J. R., "Spirally-guided gasholders." Dec. 14.

29,047.—Salsbury, H., and Whitaker, T., "Gas-generators." Dec. 14.

29,081.—Kühn, W., and Pokorny and Wittekind Maschinenbau Akt.-Ges., "Pipe-union." Dec. 14.

29,097.—Foster, C. E., "Radiation pyrometers." Dec. 15.

29,125.—Scheidemann, B., "Controlling gas-cocks." Dec. 15.

29,163.—Tooth, L. F., "Regenerative burners." Dec. 15.

29,174.—Bird, H., and Simplex Scoop Syndicate, Ltd., "Charging retorts." Dec. 15.

29,189.—Allen, E., and Gibson, R. E., "Manufacture or treatment of coke or like carbonaceous fuel." Dec. 15.

29,194.—Johnston, A. A., and Clark, F. W., "Gas manufacture." Dec. 15.

29,196.—Brassert, H. A., and Witting, A. G., "Cleaning gas." Dec. 15.

29,204.—Monk, C. F., and Chivers, J. H., "Fixing rubber tube to metal tube." Dec. 16.

29,323.—Tetlow, C. E., Brentnall, J., and Schute, H. G. & A. W., "Joints for gas or water pipes." Dec. 17.

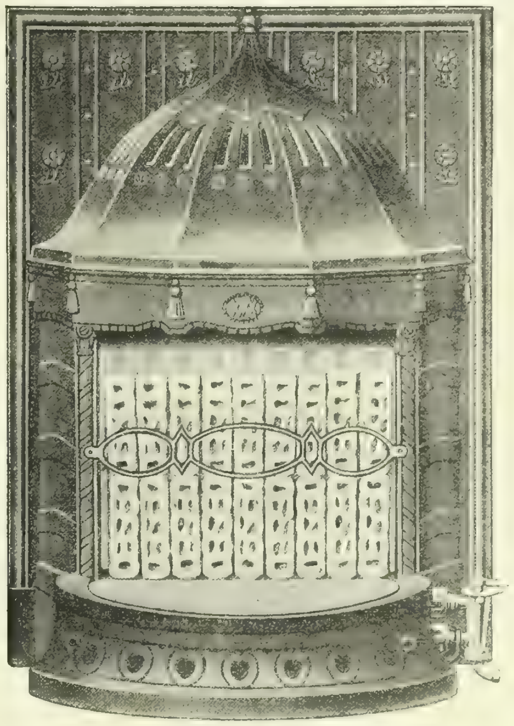
29.353.—Breeden, J., and Co., Ltd., and Breeden, F., "Casings or bodies of incandescent gas-lamps." Dec. 17.

29,357.—Rees, E. S. G., "Rotary pumps or compressors." Dec. 17.

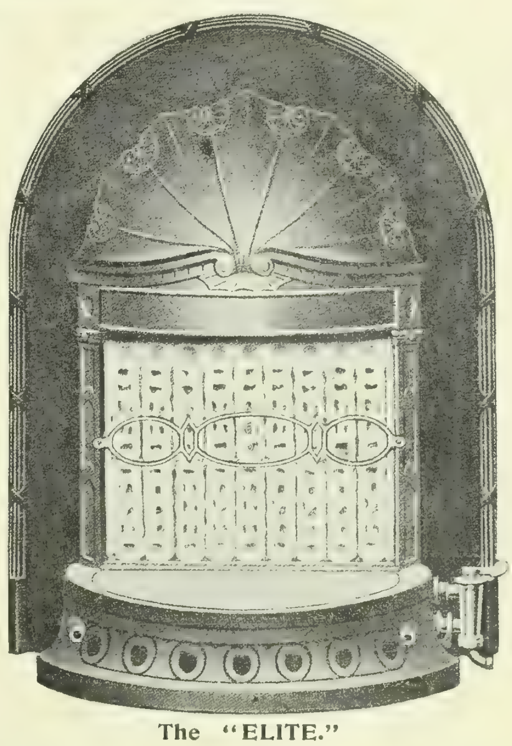
29,363.—Julius Pintsch Akt.-Ges., "Gas lighting and extinguishing devices." Dec. 17.

29,367.—Reynolds, A., "Production of gaseous fuel." Dec. 17.

29,400.—Hair, J., "Lighting and extinguishing gas lights." Dec. 17.



The "IDOL."



The "ELITE."

Fatal Explosion of Pintsch Gas in New York.

One of the worst disasters recorded in New York during recent years occurred on Monday morning last week, when an explosion wrecked the power-house of the New York Central Railroad near the Grand Central Station, killing 14 persons, and injuring some 70 others. It was at first attributed both to gas and dynamite. But the officials of the Railway Company have issued a statement that apparently the explosion was the result of an electric train overrunning the buffer stops in the storage yard, and breaking an oil-gas pipe. The gas penetrated into the lower part of the sub-station of the power-house and became ignited. Another report states that the Company's officials have explained that ignition was caused by an electric spark from a short-circuit. Reading these statements, the following extract from the "Electrical Review" does not appear to convey the whole truth: "*Apropos* of gas, the danger of employing this means for lighting trains is again exemplified by the disaster at New York, which, it is reported, originated with a leak from a gas-tank on a train."

Reduction in Price at South Shields.—The Directors of the South Shields Gas Company have decided to reduce the price of gas by 2d. per 1000 cubic feet from the 1st prox. This makes three reductions, aggregating 6d. per 1000 cubic feet, in ten years.

Nantwich Water Supply.—Two schemes for a new water supply to the Nantwich urban area have been submitted by Mr. Baldwin Latham to the Nantwich Urban District Council. The estimated cost is £19,000 and £22,000 respectively. The source of the proposed new supply is at Madeley, Staffordshire, where sinking operations will be necessary. The cost of the mains will be upwards of £8000. It has been decided to apply to the Local Government Board for sanction to borrow £3000 for preliminary works. The Nantwich Rural District Council have asked for a supply from the Urban District Council; and they will support the application for a loan.

Inquest on a Gas Company's Watchman.—Mr. W. Wynn Westcott, the Coroner for the North-East Division, held an inquiry last Wednesday relative to the death of Thomas Norley (61), a watchman in the employ of the Gaslight and Coke Company at their Kingsland Road station. Deceased complained on Sunday, the 11th inst., of being unwell, but went to work that day, and also on the Monday and Tuesday following. The latter day he was taken home, suffering from severe internal pains. He said he had been vomiting after having eaten some fish. He was seen by his club doctor at the works on the 14th; and as he was in great pain, he was sent home. On Friday, the 16th, his condition was so serious that he was ordered to be removed to the hospital; but death ensued before this could be done. During his illness, deceased said he might have ricked his back in starting a gas-engine at the works; but the medical evidence and the post-mortem examination went to show that the pain complained of was caused by eating the fish. There was no sign of any twisting or strain; and it was stated that the gas-engine was a 14 H.P. one, and could be started by a youth. The Jury returned a unanimous verdict in accordance with the medical evidence.

Private Bills in Parliament.—Private Bills for next session had to be delivered at the Private Bill Office by eight o'clock on the 17th inst.; and the total number deposited up to that hour was 128, which compares with 112 last year.

Korean Water-Works, Limited.—Meetings of the proprietors of this Company were held at the London Offices on the 13th inst., in connection with the proposed sale of the undertaking. A circular of particulars had been sent out, and resolutions sanctioning the sale were passed by the holders of prior lien debentures and mortgage debentures. These were afterwards confirmed at an extraordinary general meeting of the Company. Each debenture holder will receive £102 10s. in respect of each £100 of stock held by him.

New Joint-Stock Companies Registered.—The Adamson Water Main Cleaning Company, Limited, has been registered with a capital of £1000, in £1 shares, to take up the pipe-cleaning arrangement designed by Mr. R. A. Adamson, the Engineer-in-Charge of the Rivington works of the Liverpool Corporation, which was described in the "JOURNAL" for the 11th of October last (p. 138). "Scientific Illumination" is the title of a Company formed with a capital of £5000, in £1 shares, to carry on the business of electricians, mechanical engineers, suppliers of electricity, &c.

A Gas Worker's Fraud.—On a charge of obtaining £2 7s. 6d. by false pretences from the Borough Treasurer's Department of the Stockport Corporation, a former employee in the gas-works, named Thomas Davenport, was last week sent to prison for a month with hard labour. Davenport left the service of the Corporation on Nov. 10. On Friday, the 16th inst., he went to the pay-office window, and, giving the name and number of another workman, received the above-named amount, which represented the other man's wages. A few minutes later the fraud was discovered and information given to the police. Prisoner was arrested the same night; and on him was found 19s. 6½d. and a new silver watch. He was intoxicated. On being charged, he said he was sorry he took the money; but he did it for the sake of his six children. He was going to buy some toys for Christmas.

The District Councils of Yeadon, Rawdon, and Guiseley arranged a conference for further discussing the advisability of acquiring the undertakings of the Yeadon and Guiseley Water Companies; but the majority in favour of municipalization, on a vote being taken, was so small that the gathering broke up without any steps to purchase being determined upon. At a previous conference a resolution had been passed to the effect that the water supply of the district should be the property of the ratepayers.

At the first statutory meeting of the shareholders of the newly formed Chapel-en-le-Frith and Chinley Gas Company, it was stated that all the 20,000 shares were promptly taken up and the works paid for. The mains are being extended to Chinley; and there is a prospect of the connection being highly prosperous. A Bill is being promoted incorporating the Company as a parliamentary concern, with a capital of £40,000 and a standard dividend of 6 per cent. Mr. J. W. Brown, formerly Assistant Engineer and Manager at the Matlock and District Gas-Works, is Manager of the new Company.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 914.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct 14	5	Alliance & Dublin Ord. .	80–83	+1	6 0 6
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96–98	..	4 1 8
200,000	5	Oct. 28	7	Bombay, Ltd. . . .	6⅝–6⅞	..	5 1 10
40,000	5	,,	7	Do. New, £4 paid .	5–5¼	..	5 6 8
50,000	10	Aug. 31	15	Bournemouth Gas and Water 10 p.c. . .	28½–29½	..	5 1 8
311,810	10	,,	7	Do. B 7 p.c. .	16¼–16¾	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	14¾–15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	250–253	+2	4 18 10
330,000	,,	,,	9½	Do. New . . .	192–195	+3½	4 17 5
50,000	,,	,,	5	Do. 5 p.c. Pref. .	120–122	..	4 2 0
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb. .	97–99*	..	4 0 10
220,000	Stk	Aug. 31	11	Brighton & Hove Orig.	215–218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk. .	158–161	..	4 19 5
460,000	20	Sept. 29	10⅜	British	44–45	..	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c. . .	117–119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c. . .	88–90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c. . .	107–109	..	5 0 11
55,000	,,	June 29	3½	Do. 3½ p.c. Deb. .	85–87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97–99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	4½–5½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	90–92	..	4 17 10
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. . .	109½–111½	..	4 9 8
1,513,280	Stk.	,,	5 2/10	Commercial 4 p.c. Stk. .	106–109	..	4 15 5
560,000	,,	,,	5	Do. 3½ p.c. do. .	101–103	..	4 17 1
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77–79*	..	3 15 11
800 000	Stk.	,,	4	Continental Union, Ltd.	86–91	..	4 7 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	134–136*	..	5 2 11
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122–124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk. . . .	104–105	..	3 16 2
148,995	,,	Oct. 14	5	East Hull 5 p.c. Ord. .	103–105	..	4 15 3
486,090	10	July 14	12	European, Ltd. . . .	23¼–24¼	..	4 19 0
354,060	10	,,	12	Do. £7 10s. paid.	17¾–18¼	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅔	Gas light and Coke 4 p.c. Ord. . .	105¼–106¼	−½	4 7 10
2,600,000	,,	,,	3½	Do. 3½ p.c. max. . .	87–89	..	3 18 8
4,002,235	,,	,,	4	Do. 4 p.c. Con. Pref.	103–105	..	3 16 2
4,531,705	,,	Dec. 15	3	Do. 3 p.c. Con. Deb.	78–80*	..	3 15 0
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	93–95	+1	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	114–116	..	5 12 1
70,000	10	Oct. 14	11	Hongkong & China, Ltd.	17–17½	..	6 5 8
131,000	Stk.	Sept. 15	7⅛	Ilford A and C . . .	146–149	+1	4 19 0
65,780	,,	,,	5⅞	Do. B	115–117	+1	5 0 5
65,500	,,	June 29	4	Do. 4 p.c. Deb. . .	98–100	..	4 0 0

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental .	185–187	..	4 16 3
1,235,000	Stk.	Aug 12	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	121–123	+1	4 17 7
561,000	Stk.	,,	10	Liverpool United A .	220–222	..	4 10 1
718,100	,,	,,	7	Do. B . .	164–165	..	4 4 10
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	Dec. 15	6	Malta & Mediterranean.	4⅝–4⅞*	..	6 3 1
560,000	100	Oct. 1	5	Met. of Melbourne 5 p.c. Deb	99–101	..	4 19 0
250,000	100	,,	4½	Do. 4½ p.c. Deb.	99–101	..	5 9 10
541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	12¼–12¾	..	5 9 10
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102–103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90–91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	13½–14½	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	137–139	..	5 15 1
60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6¼–6¾	..	5 18 6
31,800	53	Aug. 31	13	Portsea Island A. . .	132–134	+1	5 2 4
60,000	50	,,	13	Do. B. . .	125–127	+1	5 2 4
100,000	50	,,	12	Do. C. . .	118–120	+1	5 0 0
114,800	50	,,	10	Do. D and E.	103–105	+1	4 15 3
398,490	5	Oct. 28	7	Primitiva Ord. . . .	7¼–7½	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref. .	5¼–5½	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	95–97	..	4 2 6
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb. .	97–99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd. . . .	15¼–15¾	..	5 14 3
115,000	10	,,	6	Do. 6 p.c. Pref. .	11¼–11¾	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb. .	51–52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229–231	..	4 6 7
209,984	,,	,,	10	Do. B	229–231	..	4 6 7
523,500	,,	,,	10	Do. C	229–231	..	4 6 7
70,000	10	Oct. 14	6	South African	10¾–11¼	..	5 6 8
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121–123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80–82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 12	5⅝	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120–122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122–124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	110–112	+1	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham and Edmonton A 5 p.c. .	141–143	..	4 17 11
483,940	,,	,,	5½	Do. B 3½ p.c. .	113–115	+1	4 15 8
149,470	,,	Dec. 15	4	Do. 4 p.c. Deb.	95–97	..	4 2 6
182,380	10	June 10	8	Tuscan, Ltd. . . .	9–9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	98–100	..	5 0 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	113–115	..	4 6 11
255,636	Stk.	Aug. 31	6¾	Wandsworth B 3½ p.c. . .	142–144	+2	4 15 7
85,766	,,	June 29	3	Do. 3 p.c. Deb. Stk.	74–76	..	3 18 11

Prices marked * are "Ex div."

The Stoke Newington Borough Council intend to convert the single-burner street-lamps to double-burner ones, at an estimated cost of £53 12s. per annum additional for gas and maintenance.

Readers of the daily papers are aware that several "slate clubs" have been in trouble lately on account of the disappearance of the parties entrusted with the money. At the East Ham Police Court last Tuesday, Thomas John Ambrose (36), a labourer, of Macaulay Road, East Ham, was charged on his own confession with converting to his own use £44 16s. 7d., moneys of the Equitable Slate Club at the Beckton Gas-Works, of which he was Secretary and Treasurer. He was remanded.

In the course of a Local Government Board inquiry conducted at East Ham last Wednesday, by Mr. H. R. Hooper, in respect of an application by the East Ham Corporation for power to borrow £17,430 for the electricity undertaking, the Treasurer (Mr. G. L. B. Davis) said the total indebtedness of the borough amounted to £956,953, of which £98,482 had been borrowed under the Electric Lighting Act. In answer to a question by the Inspector, Mr. Davis said the total indebtedness did not include loans sanctioned and not taken up; and the rates were 9s. 10d. in the pound. The Inspector expressed the opinion that, instead of increasing their capital charges, they should pay for unremunerative works out of revenue.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

Chief Distributing Engineer. Oriental Gas Company. Applications by Jan. 9.

Works Foreman. Oriental Gas Company. Applications by Jan. 9.

Works Chemist. No. 5332.

Manager (Gas Engineering Firm). No. 5335.

Plant, &c. (Second-Hand), for Sale.

Main Drilling Apparatus, &c. No. 5333.

TENDERS FOR

Hydrants, Valves, Stopcocks, Cast-Iron Work, Lead, and Lead Pipe, &c.

Plymouth Water Department. Tenders by Jan. 12.

Tar and Liquor.

Harwich Gas Company. Tenders by Jan. 6.

Sheppy Gas Company. Tenders by Jan. 2.

Waggons.

Leek Lighting Committee. Tenders by Dec. 30.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1911, are reminded that this can only be done during January.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

TAR WANTED.

THE BURNDEN TAR COMPANY (BOLTON), LIMITED.
Hulton Chemical Works, BOLTON.

D. ANDERSON AND COMPANY, GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "Dacolight London." Telephone: 2836 Holborn.

LUX'S GAS PURIFYING MASS.
See Advertisement on First White Page.
Friedrich Lux, Ludwigshafen-am-Rhein.

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SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: Oldbury, Wednesbury, and Stafford.
Address Correspondence and Inquiries to Oldbury, Worcs.
Telegrams: "Chemicals, Oldbury."

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J. W. & C. J. PHILLIPS, 23, College Hill, Cannon Street, London, E.C.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
John Radcliffe, Chemical Engineer, East Barnet.

SULPHATE OF AMMONIA SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works, Bolton.
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MEADE-KING, ROBINSON, & CO. Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, Exchange Street, Manchester, and Tower Building, 22, Water Street, Liverpool.

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TENDERS are invited for the Surplus TAR produced at this Company's Works for the Year ending Dec. 31, 1911.
The Tar will be delivered free into Railway Tank Waggons or Tank Barges at this Works.
Probable quantity, 120 Tons.
The Directors do not bind themselves to accept the highest or any Tender.
Sealed Tenders to be delivered addressed to me, not later than the 6th day of January, 1911.

Geo. Baines,
Secretary.

THE Directors of the Sheppy Gas Com- pany invite TENDERS for the Purchase of the Surplus TAR produced at their Works from the 1st of January to the 31st of December, 1911.
Approximate Quantity, 40,000 to 50,000 Gallons.
May be removed by Water or Rail. If the latter, the Contractor must provide his own Casks and accept Delivery at Sheerness Dockyard Station.
Tenders to be sent to the undersigned not later than the 2nd of January, 1911.
The Directors do not bind themselves to accept the highest or any Tender.

By order,
H. Barber,
Secretary and General Manager.
Gas Offices, Sheerness,
Dec. 15, 1910.

LEEK URBAN DISTRICT COUNCIL.

COAL WAGGONS.

THE Lighting Committee of the above Council invite TENDERS for the Supply of Eight new 12-TON COAL WAGGONS for the Gas Department.
Specification and Form of Tender can be obtained from the undersigned.
Sealed Tenders, addressed to the Chairman of the Lighting Committee, to be delivered at the Town Hall, Leek, not later than the 30th of December, 1910.
The lowest or any Tender will not necessarily be accepted.

S. Trow Smith,
Engineer and Manager.
Gas-Works, Leek,
Dec. 10, 1910.

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The lowest or any Tender will not necessarily be accepted.
Tenders, enclosed in envelopes provided, to be delivered at this Office by Twelve o'clock Noon on Thursday, Jan 12, 1911.

Frank Howarth, M.Inst.C.E.,
Water Engineer.
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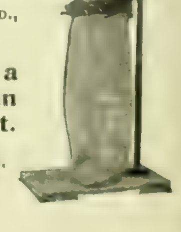

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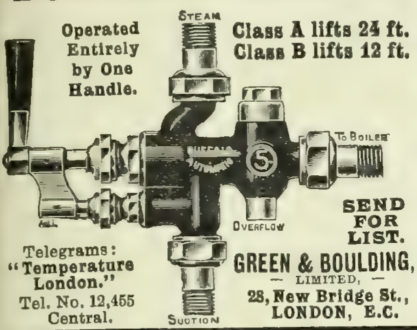

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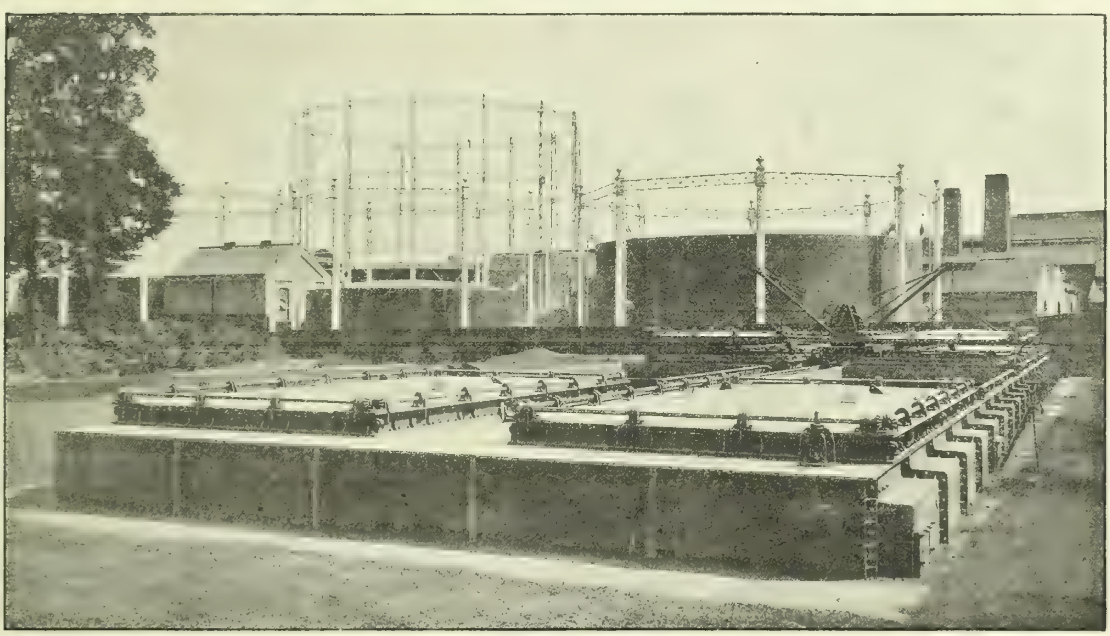

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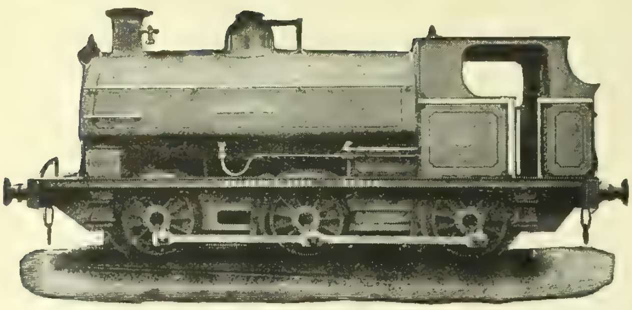

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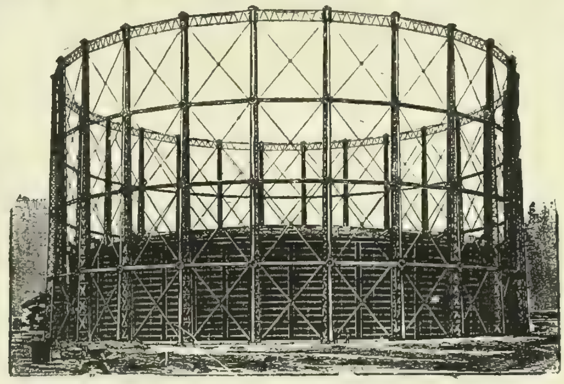

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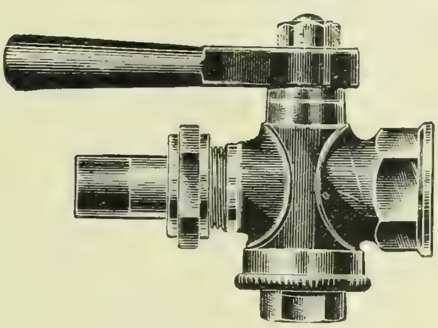

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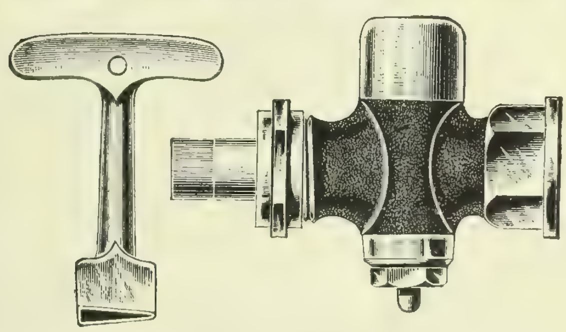

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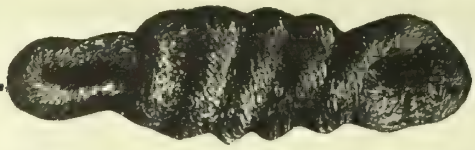

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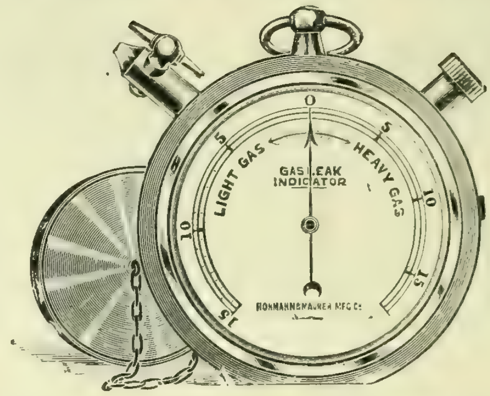

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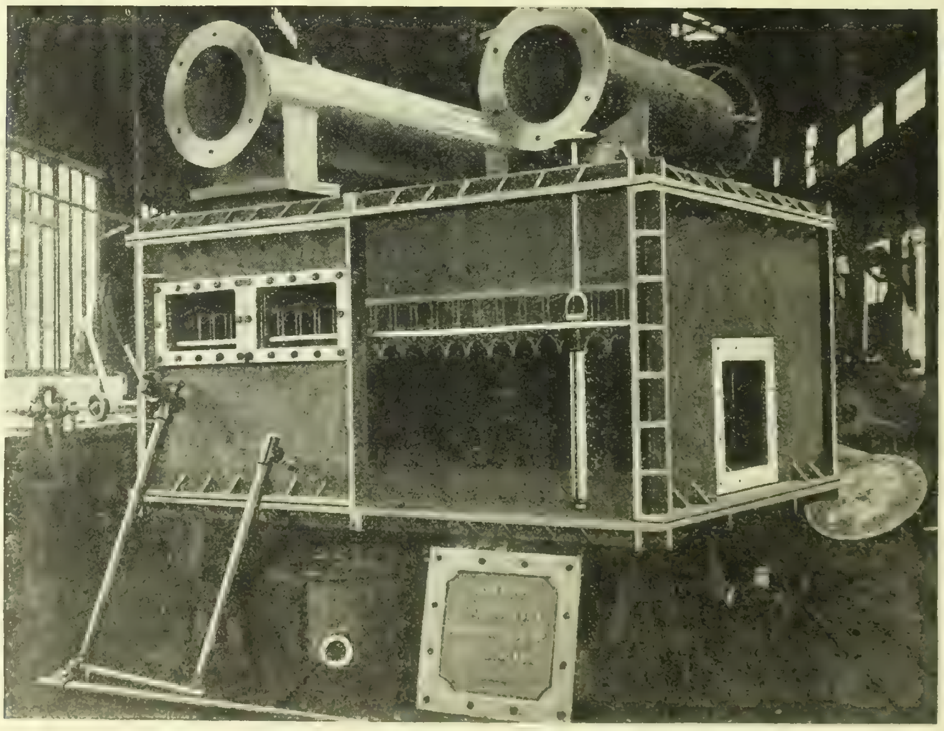

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